UNIVERSITY OF GUELPH

SCHOOL OF ENGINEERING

ENGG*3030 – ENERGY DISTRIBUTION
FALL 2012

I. **Course Description:** The purpose of this course is to introduce the concepts and techniques of energy management and conservation. The subjects that will be discussed are energy distribution, supply, and demand, energy pricing, scope of the energy problem and approaches to provide solutions; energy auditing; improving energy utilization in space conditioning, and steam, hot water and compressed air systems; energy saving opportunities in refrigeration and cooling systems; insulation; and electrical energy conservation. An interdisciplinary approach will be employed in this course to provide a wider understanding of the subject.

II. **Instructor:** Merih Aydinalp Koksal
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III. **Schedule:**
Lectures: Monday, Wednesday & Friday 09:30– 10:20 @ CRCS 403
Lab: Wednesday 03:30 – 05:20 @ ROZH Room 108
Office Hours: Monday and Wednesday 10:30 – 11:15 @ THRN 1432 or by appointment

IV. Text Books:

1. *Guide to Energy Management*, 7th Edition, B. L. Capehart, W. C. Turner, W. J. Kennedy, 2012, The Fairmont Press. (TJ163.3 C37 2012)
2. *Handbook of Energy Audits*, A. Thumann, W. J. Younger, 2008, The Fairmont Press. (TJ 163.245 T48 2008)
3. Reference Materials*:*
   a. *Source Book for Energy Auditors*, M.D. Lyberg, Editor, International Energy Agency (IEA), 1987.
      http://www.ecbcs.org/docs/annex_11_source_book_vol1.pdf
      http://www.ecbcs.org/docs/annex_11_source_book_vol2.pdf
   b. *Energy Efficiency Guide for Industry in Asia*, Klaus Topfer, Editor, UNEP, 2006.
      www.energyefficiencyasia.org

V. **Course Content:**

Week 1: Overview

1.1 Review of course content and objective
1.2 Energy distribution, management, and conservation
1.3 Scope of the energy problem and approaches to provide solutions
- Inefficiencies in energy systems and their components
- Approaches to improve efficiency

Week 2: Characterizing energy use - Energy Auditing

2.1 Purpose of energy auditing
2.2 Design and implementation of a comprehensive energy audit
2.3 Review of sample energy audit questionnaires for different applications

Week 3: Steam distribution systems

3.1 Steam distribution network design, insulation, leaks
3.2 Steam traps
- Purpose and importance
- Types and operating principles
- Testing

Week 4: Hot water and compressed air systems

Week 5: Energy saving opportunities for fired heaters and boilers

5.1 Improved combustion
- Incomplete combustion
- Control of excess air
- Using oxygen-enriched air

5.2 Waste heat recovery
- Stack gasses
- Blowdown water
- Product cooling

Week 6: Heat recovery

6.1 Heat recovery options
- Direct utilization
- Transfer of heat using heat exchangers
- Upgrading of heat using heat pumps

6.2 Types, characteristics and selection of heat exchangers

Week 7&8: Energy conservation in space conditioning

7.1 Comfort standards, process requirements
7.2 Temperature and equipment scheduling
7.3 Efficient HVAC systems
- Radiant heating/spot cooling
- De-stratification

- VAV, VVVT systems

7.4 Variable speed fans and pumps
7.5 Building energy simulation
7.6 Energy management systems and direct digital control

Week 9: Insulation

9.1 Classification of insulation and selecting the "right" insulation for an application
9.2 Critical insulation radius for pipe insulation
9.3 Economic insulation thickness

Week 10: Energy saving opportunities in refrigeration and cooling

10.1 System evaluation - need, temperature levels, central or distributed, etc.
10.2 Energy recovery
10.3 Cooling towers
- Operating principles and types
- Improving performance

Week 11: Conservation of electrical power

11.1 Consumption and demand
11.2 High efficiency and variable speed motors
11.3 Efficient lighting
11.4 Load and power factor improvement
11.5 Inefficiencies Power factor improvement

Weeks 12: Review and project presentations

VI. **Marking:**

Assignments	20%
Project and presentation	30%
Midterm exam	20%
Final Exam	30%

VII. **Student Responsibilities:**

- Attend lectures in order to obtain all the course material that you are responsible for.
- Submit assignments on time.
- Check announcements page on a regular basis.
- Regularly, check your marks on the course web page and make sure that are up to date.
- Submission of assignments for re-marking must be done within a week of being returned

VIII. **Important Notes**

- The midterm test is scheduled for Monday October 22nd, 2012; time: 9:30; location: CRCS 403
- The final exam is scheduled for Wednesday December 12th, 2012; time: 08:30 – 10:30; location: TBA
- The lab dates will be determined later.
- Communications regarding this course will frequently involve the course the course web page and e-mail. Students are responsible for checking the course website and the university email account for all instructions and announcements. This must be done at least once every week.

IX. **Late assignment/Missed Test Policy**

If you find yourself unable to meet a course requirement such as an assignment or a test as a result of compassionate, illness, or physiological reasons; a formal explanation must be made in writing to the instructor and (where possible) proper documentation must be provided. This should be done prior to an exam or assignment (if possible) or as soon as possible but definitely within a week after the exam or assignment due date.

If no explanations are provided; exams receive a grade of zero and assignments are subject to the following deductions:

- 25% will be deducted if the assignment is up to 24 hours late,
- 50% will be deducted if the assignment is up to 48 hours late,
- No assignments will be accepted after that.

X. **University Policy on Academic Misconduct**

Academic misconduct, such as plagiarism is a serious offence at the University of Guelph. Please consult the Undergraduate Calendar 2012-2013 and School of Engineering programs guide, for offences, penalties and procedures relating to academic misconduct:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

XI. **Disclaimer**

The instructor reserves the right to change any or all of the above in the event of appropriate circumstances, subject to the University of Guelph Academic Regulations.