ENGG*3250 Energy Management and Utilization
Winter 2017

School of Engineering

(Revision 0: January 5th 2017)

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1 INSTRUCTIONAL SUPPORT

1.1 Instructor

Instructor: Jhantu Kumar Saha, PhD, EIT
Office: Room 2361, Ext. 58262
Email: jsaha@uoguelph.ca
Office hours: TBA on Courselink or by appointment

1.2 Lab Technician

Technician: Mike Speagle
Office: THRN 3502, ext. 56803
Email: mspeagle@uoguelph.ca

1.3 Teaching Assistants

GTA	Email	Office Hours
Hesham Ibrahim	<hesham@uoguelph.ca>	TBA on Courselink

2 LEARNING RESOURCES

2.1 Course Website

Course material, news, announcements, and grades will be regularly posted to the ENGG*3250 Courselink site. You are responsible for checking the course website regularly.

2.2 Resources

In addition to some lecture notes and handouts, the following references will be used partially in this course

1. B.L. Capehart, W.C. Turner, and W.J. Kennedy, Guide to Energy Management, 7th Edition, Fairmont Press, 2012.
2. F. Kreith and D.Y. Goswami, Energy Management and Conservation Handbook, CRC Press,2008.
3. Principles of Heating, Ventilating and Air Conditioning, 7th Edition, by American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE), 2013.
4. W.T. Grondzik, and A.G. Kwok, B. Stein and J. S. Reynolds, Mechanical and Electrical Equipment for Buildings, 11th Edition, Wiley, 2009.
5. Fundamentals of Heat and Mass Transfer by F. Incropera and D. DeWitt, John Wiley, 7thEdition, 2011.
6. Yunus A. Çengel and Michael A. Boles. Thermodynamics–An Engineering Approach, 8thEdition, McGraw Hill Higher Education, 2014.

2.3 Additional Resources

Lecture Information: Lecture presentations will be posted on the courselink.

Lab Information:

The handouts for all the lab sessions will be available during the lab sections. All types of resources regarding tutorials, links to web pages can be found in this section.

Miscellaneous Information:

Other information related to Energy Management and Utilization materials may be posted on the courselink

2.4 Communication & Email Policy

Please use lectures and lab/tutorial help sessions as your main opportunity to ask questions about the course. Major announcements will be posted to the course website. **It is your responsibility to check the course website regularly**. As per university regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its student.

3 ASSESSMENT

3.1 Dates and Distribution

Labs: 10%
See section 5.4 below for due dates

Midterm test 1: 15%
Friday Feb.10th 2017,10:30-11:15 AM, CRSC, Room 117

Midterm test 2: 15%
Friday Mar.10th 2017,10:30-11:15 AM, CRSC, Room 117

Project 1: 20%

Due date: Friday, March 18th,2017, in class (Both papers and electronic copies need to be submitted)

Progress and presentations and project details (TBA)

Project 2: 10%

Due date: Friday, March 31st ,2017, in class (Both papers and electronic copies need to be submitted)

Final Exam: 30%
Wed., Apr. 12th 2017, 2:30PM - 4:30AM, Room TBA on Web advisor

3.2 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructorwithin two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Missed midterm tests: If you miss a test due to grounds for granting academic consideration or religious accommodation, **the weight of the missed test will be added to the final exam**. There will be no makeup midterm tests.

Lab Work: You must attend and complete all laboratories. If you miss a laboratory due to grounds for granting academic consideration or religious accommodation, arrangements must be made with the teaching assistant to complete a makeup lab.

Late Lab Reports: Late submissions of lab reports will not be accepted.

Passing Grades: The passing grade is 50%.

4 AIMS, OBJECTIVES& GRADUATE ATTRIBUTES

4.1 Calendar Description

This course introduces notions of energy conservation and efficiency, an integrated approach to energy auditing and examples of typical applications (examples include: steam generation and distribution, process or comfort cooling, pumping and compressed air, human needs for modern living, energy consumption in buildings and industry). It also covers pinch technology and its application for energy recovery in industry, and methods to achieve low energy buildings.

Co-requisite(s): ENGG*3430 Heat and Mass Transfer

4.2 Course Aims

This course aims at introducing the basic concepts and techniques for energy management andutilization. Multiple subjects will be discussed in the course to strengthen these concepts includingenergy distribution, supply and demand, energy pricing, scope of the energy problem and approaches to provide solutions, energy auditing, improving energy utilization in space, mechanical and electrical equipment in buildings such asair conditioning, heating, steam, hot water and compressed air systems, energy saving opportunities in refrigeration and cooling systems, insulation, and finally energy conservation. Both practical and analytical approaches integrated with basic analysis of thermo-fluids and heat transfer systems will be employed in this course to provide a deep understanding of the energy subject.

4.3 Learning Objectives

After a successful completion of this course, the student should demonstrate the ability to:

1. Identify inefficiencies in energy systems and their components
2. Evaluate energy use and Energy Auditing
3. Perform energy conservation analysis and characterize simple energy systems
4. Analyze and design waste heat recovery systems
5. Evaluate energy conservation in space conditioning, refrigeration, and cooling
6. Conduct laboratory tests through collecting and analyzing data using the appropriate sensors and instruments and write clear, concise and professional laboratory reports

4.4 Graduate Attributes

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

Graduate Attribute	Learning Objectives	Assessment
1. Knowledge Base for Engineering	1, 2, 3,4,5	Exam, project
2. Problem Analysis	1, 2, 3,4,5	Exam, project
3. Investigation	6	Labs
4. Design	4	Project
5. Use of Engineering Tools	4, 6	Labs, Project

6. Communication	6	Labs
7. Individual and Teamwork	6	Labs
8. Professionalism	6	Labs
9. Impact of Engineering on Society and the Environment	-	-
10. Ethics and Equity	-	-
11. Environment, Society, Business, & Project Management	4,5,6	Project
12. Life-Long Learning	-	-

4.5 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink **but these are not intended to be stand-alone course notes.** During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and project.

4.6 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures, tutorials and labs. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

4.7 Relationships with other Courses & Labs

Previous Courses:

ENGG*2230: Steady and unsteady state; 1st law and Bernoulli equation; fluid flow rate and friction; laminar and turbulent flows; non-dimensional parameters (e.g., Reynolds number)

ENGG*2400: Modeling of engineering systems

MATH*2270: Solving differential equations

ENGG*3260: System and control volume; work and heat and their interaction with the boundary and direction; energy efficiency and effectiveness of systems; thermodynamic losses.

Current Courses:

ENGG*3430: Foundation for application of heat transfer in various types of systems

Follow-on Courses:

ENGG*3370: Foundation for analysis of thermo-fluid systems

ENGG*3470: Foundations of energy balances, thermal flow, thermal properties; Mass transfer through fluid flows (convection), thermal fluid properties

ENGG*3830: Foundations of heat and mass balance and bioreactor design

ENGG*4230: Foundations for design of energy conversion processes

ENGG*4300: Foundations for design of food engineering process

ENGG*4330: Foundation for performance analysis of combustion systems

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5 TEACHING AND LEARNING ACTIVITIES

5.1 Timetable

Lectures:

Monday	10:30 AM –11:20 AM	CRSC, Room 117
Wednesday	10:30 AM –11:20 AM	CRSC, Room 117
Friday	10:30 AM –11:20 AM	CRSC, Room 117

Laboratory & Tutorials:

Monday	Sec 01	08:30 AM - 10:20 AM	THRN 3404
Tuesday	Sec 02	09:30 AM- 11:20 AM	THRN 3404

Laboratory for week 5:

Monday	Sec 01	08:30 AM - 10:20 AM	THRN 1004
Tuesday	Sec 02	09:30 AM - 11:20 AM	THRN 1004

5.2 Lecture Schedule

Lectures	Lecture Topics	References	Learning Objectives
Week 1	Review of thermo-fluid subjects and course overview	Lecture notes	2,3
Week 2,3	Energy conservation in buildings	Lecture notes	1,2,4,5
	Insulation	Lecture notes	3,4,5,6
Week 4	Energy use and energy auditing	Lecture notes	2,3,4,5
Week 5	Insulation	Lecture notes	3,4,5,6
Week 6	Hot water and compressed air systems	Lecture notes	1,2,3
Week 7	Energy saving opportunities for heaters and boilers	Lecture notes	1,2,3,4
Week 8	Heat recovery systems	Lecture notes	3,4,5
Week 9	Steam distribution system	Lecture notes	1,2,3
Week 10	Energy saving opportunities for refrigeration and cooling systems	Lecture notes	2,3,4,5,6
Week 11	Industrial energy efficiency and energy management	Lecture notes	1,2,3,4,5,6
Week 12	Review		

5.3 Tutorial and Lab Schedule

All labs and tutorials are scheduled at THRN 3404, THRN 1004 (as listed above). This is a two hour lab session. Lab hours will be distributed between solving selected problems and/or conducting lab experiments.

Week	Activity
1	Introduction on lab equipment's and lab safety
2	Lab experiments 1 & 2 and Problem solving
3	Lab experiments 2 & 2 and Problem solving
4	Problem solving
5	Lab experiment 3
6	Lab experiment 4
7	Lab experiment 5
8	Problem solving
9	Problem solving and project help
10	Problem solving and project help
11	Problem solving and project help
12	Review

5.4 Lab Schedule

Week	Topic	*Due
1	Introduction to Lab Equipment and Safety Training	
2,3	Infrared scanning to detect thermal defects and air leakage In building envelopes (Expt. 1)	Week after lab session
2, 3	Blower door testing to measure the air tightness of buildings (Expt.2)	Week after lab session
5	Desigo Building Energy Automation (Expt. 3)	Week after lab session
6	Thermal conductivity measurements of glass and insulating materials (Expt. 4)	Week after lab session
7	Comparison of energy flow measurements between single and double pane windows (Expt. 5)	Week after lab session

*Lab reports will be submitted to the TA in the tutorial session one week after experiments is conducted (THRN 3404/THRN 1004)

5.5 Other Important Dates

Monday, 9 January 2017: First class

Monday, 9 January 2017: First Lab

Monday, 20 February 2017: Winter Break begins. **No classes scheduled this week**

Friday, 10 March 2017: Last day to drop

Friday, 14 April 2017: Holiday. **No classes scheduled**

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6 LAB SAFETY

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

6.1 Sustainable Energy Lab Safety

This section outlines some of the safety related procedures and information for use in the Sustainable Energy Lab in THRN 3404. Safety in the laboratory is critical. **You will not be allowed to do the project or the labs unless you attend the safety session and sign a form indicating that you have done so.** You must have **WHMIS** (Workplace Hazardous Materials Information System) training before the first lab experiment session. Visit Environmental Health and Safety website (https://www.uoguelph.ca/ehs/node/975) for registration and additional information. Your GTA and Lab Technician may ask you to show them a copy of the WHMIS completion certificate anytime during your lab session.If you have any concerns or comments related to safety in this laboratory you can reach Mr. Mike Speagle, at ext. 56803, in THRN 3502.

1. Be prepared. You should download and print a copy of the ENGG*3250 Lab Manual from Courselink. Be sure to carefully read the specific manual section before you go to perform each of the laboratory exercises.
2. You must do as instructed by the laboratory demonstrator. If you are not sure about something ask the demonstrator. Inform the demonstrator if you become aware of a potential hazard.
3. Food and beverages cannot be stored or consumed in this laboratory
4. Safety glasses are mandatory for all experiments. You will not be allowed to perform an experiment without them.
5. Proper footwear is mandatory for all the experiments. This means no open toed shoes or sandals.
6. The fire extinguisher, first aid kit, and phone are located at the front of the lab (THRN 3404). Dial ext. 52000 in case of emergencies.
7. All accidents should be reported to the demonstrator.

7 ACADEMIC MISCONDUCT

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member.

7.1 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:
http://www.academicintegrity.uoguelph.ca/

Please also review the section on Academic Misconduct in your Engineering Program Guide.

The School of Engineering has adopted a Code of Ethics that can be found at:
http://www.uoguelph.ca/engineering/undergrad-counselling-ethics

8 ACCESSIBILITY

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability for a short-term disability should contact the Centre for Students with Disabilities as soon as possible

For more information, contact CSD at 519-824-4120 ext. 56208 or email csd@uoguelph.ca or see the website: http://www.csd.uoguelph.ca/csd/

9 Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

10 RESOURCES

The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.HTTP://WWW.UOGUELPH.CA/REGISTRAR/CALENDARS/INDEX.CFM?INDEX