ENGG*4330 Air Pollution Control
Fall 2014

School of Engineering

(Revision 0: September 4, 2014)

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1 Instructional Support

1.1 Instructor

Instructor: William David Lubitz, Ph.D., P.Eng.
Office: THRN 2407, ext. 54387
Email: wlubitz@uoguelph.ca
Office hour: Friday 2:30 pm or by appointment

1.2 Lab Technician

Technician: Joanne Ryks
Office: THRN 1114, ext. 54087
Email: jryks@uoguelph.ca

1.3 Teaching Assistants

GTA	Email
Arefeh Rezaee	arezaee@uoguelph.ca
Joespeh McIntyre	Jmcint03@uoguelph.ca

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2 Learning Resources

2.1 Course Website

Course material, news, announcements, and grades will be regularly posted to the ENGG*4330 Courselink site. You are responsible for checking the site regularly.

2.2 Required Resources

Required resources will be distributed via Courselink

2.3 Recommended Resources

Cooper, C. D., Alley, F. C. **2011.** *Air Pollution Control: A Design Approach.* 4th Ed. Waveland Press, Prospect Heights, IL, USA.

2.4 Additional Resources

Lecture Information: Some lecture notes will be posted on Courselink, generally before the specific lecture. Note that posted notes will be incomplete, prepared with the intention that students will take additional notes during lectures.

Lab Information: Requirements will be posted on Courselink.

Project Information: Requirements will be posted on Courselink

Assignments: Posted on Courselink.

Tests: Example questions drawn from past tests will be posted on Courselink.

Miscellaneous Information: Other information will be posted on Courselink.

2.5 Communication & Email Policy

Please use lectures and lab 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 students.

3 ASSESSMENT

3.1 Dates and Distribution

Energy and Emissions	Lab Report 1	15%	Sat. Sept. 27 at noon. Submit via Courselink Dropbox.
	Lab Report 2	25%	Sat. Oct. 25 at noon. Submit via Courselink Dropbox
Particulate Design	Phase 1 Report	15%	In lab, Nov. 10-12
	Phase 2 Report	25%	Thurs. Dec. 11 at noon (during exam period). Submit via Courselink Dropbox.
Tests	Test 1	10%	Fri. Oct. 17 during lecture
	Test 2	10%	Fri. Nov. 21 during lecture

Tests will be in class. An 8½" by 11" student generated aid sheet will be permitted. The sheet is to be submitted with the test (and will be returned with the marked test).

The reports for Lab 1, Lab 2 and Design Phase 2 will be completed in teams from your section. The Energy & Emissions teams will consist of 3 students. The size of Phase 2 teams will be your choice, up to a maximum of five students.

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. Please see below for specific details and consult 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 instructor within 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

Passing grade: The passing grade for this course is 50%. Students must also achieve a 50% or greater mark on the individual components of the course (Test 1, Test 2 and Design Phase 1) to pass the course. If the mark for the individual components, weighted as above, is less than 50%, this mark

will be recorded as the student's course mark, even if the course mark including group components is greater than 50%.

Missed tests: If you miss a test due to grounds for granting academic consideration or religious accommodation, a makeup will be scheduled at a time suitable for all individuals involved.

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. If you do not complete the pre-lab safety quiz, you will not be permitted to complete the lab.

Late Lab Reports: Late (> 4 hours) submissions will be penalized if there are not acceptable compassionate or medical grounds. A 30% penalty will be applied for reports submitted between 4 and 72 hours late. Reports received more than 72 hours late will be assigned a grade of zero. Students not ready to present in their scheduled presentation time will be assigned a grade of zero for that component.

Team Work: Team work is required for the Lab 1, Lab 2 and Design Phase 2 reports. If there is some observation or evidence that you have not been an approximately equal contributor to the work then you will be asked to provide evidence of <u>your individual</u> efforts, contributions and results. Keeping a log book may be one effective means to help demonstrate your contributions.

4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

4.1 Calendar Description

Analysis and design of atmospheric pollution control techniques. Techniques considered include both in-process solutions as well as conventional end-of-pipe treatments. Pollutants covered include gaseous, particulate, metals and trace organics.

Prerequisite(s): ENGG*3180 (Air Quality), ENGG*3260 (Thermodynamics)
Corequisite(s): - None

4.2 Course Aims

This course aims to have students think deeply about energy systems and their corresponding atmospheric emissions and to critique particulate control technologies and identify opportunities for improvement.

In pursuing these aims, the course will do so through both investigation and design; using and advancing fundamental process engineering, fluid mechanics and thermodynamics principles; and building computer programs and using CAE tools. Thus, the course also aims to enhance student's foundational skills which have value well beyond the atmospheric pollution domain.

4.3 Learning Objectives

At the successful completion of this course, the student will have demonstrated the ability to:

1. **Analyze (5)** thermodynamic models of combustion systems for the estimation of emissions and performance
2. **Develop (5)** computer programs to execute thermodynamic models
3. **Critique (6)** models of combustion systems for the estimation of emissions and performance
4. **Analyze (4)** conventional particulate control technologies
5. **Create (5)** ideas for incremental innovations within particulate control technologies
6. **Construct (3)** simple CFD models to explore ideas
7. **Summarize (2)** fugitive emission issues, estimation and control options

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	1,3,4	Tests, Projects
2. Problem Analysis	1,3,4,7	Tests, Energy & Emission Project
3. Investigation	3	Energy & Emissions
4. Design	5, 6	Particulate Project
5. Use of Engineering Tools	2, 6	Projects
6. Communication	3, 5	Projects
7. Individual and Teamwork	1,2,3,6	Projects
8. Professionalism	-	-
9. Impact of Engineering on Society and the Environment	-	-
10. Ethics and Equity	-	-
11. Business & Project Management	-	-
12. Life-Long Learning	5	Phase I Particulates

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/D2L 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 and tutorials. 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*1100 & ENGG*2100: Core design process skills are essential for the particulate design project. Team and project management skills are equally important.

ENGG*2560: Mass balances around reactor systems including reaction kinetics and equilibrium

ENGG*2230: Particulate Control dominantly builds on fluid mechanic principles

ENGG*3260: Energy & Emissions dominantly builds on thermodynamic principles

ENGG*3180: Air quality sets the context for the atmospheric control challenges that 4330 addresses

Before (Regular) and After (Coop) Courses:

ENGG*3100: Continuing to advance your design skills is essential for air pollution control

ENGG*3430 & ENGG*3470: Heat and Mass transfer limitations can play a significant role in the effectiveness of many air pollution control solutions

ENGG*3410: Automated control systems play an integral role in the operation and success of a very large fraction of emission control technology.

Follow-on Courses:

ENGG*4130: Many final design teams and projects will draw on 4330 skills. Directly benefitting teams addressing air pollution challenges in their design work. Indirectly benefitting teams that require thermodynamics, fluid mechanics, programming and/or CFD skills.

5 TEACHING AND LEARNING ACTIVITIES

5.1 Timetable

Lectures:

Mon, Wed, Fri		11:30 – 12:20	MACKN 120
Labs/Tutorials:			
Section 01	Wed	3:30 – 5:20	THRN 1002, 1012, 2336
Section 02	Wed	12:30 – 2:20	THRN 1002, 1012, 2336
Section 04	Wed	8:30 – 10:20	THRN 1002, 1012, 2336
Section 05	Mon	12:30 – 2:20	THRN 1002, 1012, 2336

- most weeks the labs/tutorials will be in THRN1002.

5.2 Lecture Schedule (approximate)

Lectures	Lecture Topics	References	Learning Objectives
1	Introduction and Atmospheric Challenges		
2-17	Energy & Emissions	Ch 11, 16, 18; Supp. Notes	1, 2, 3
18	TEST		
19-30	Particulate Matter Control	Ch 3-7; USEPA docs	4, 5, 6
32	TEST		
31, 33-35	Fugitive Emissions	Supp. Notes	7
36	Closure		

5.3 Lab / Tutorial Schedule (approximate)

Week & Dates	Topics	Locations
1 Sept 8 – 10	Background recapture (Problem Set 0) Energy & Emissions	THRN 1002
2 Sept 15 – 17	Energy & Emissions; Programming	THRN 1002, THRN 2336
3 Sept 22 – 24	Energy & Emissions; Programming	THRN 1002, THRN 2336
4 Sept 29 – Oct 1	Energy & Emissions; Experimental design	THRN 1002, THRN 2336
5 Oct 6 – 8	Energy & Emissions	THRN 1002
6 Oct 13 – 15	Energy & Emissions; Simulation	THRN 1002, THRN 2336
7 Oct 20 – 22	Energy & Emissions	THRN 1002
8 Oct 27 – 29	Particulates; Fluent Introduction	THRN 2336
9 Nov 3 – 5	Particulates; Fluent	THRN 2336
10 Nov 10 – 12	Idea Presentations	THRN 1002
11 Nov 17 – 19	Particulate Design Support	THRN 2336
12 Nov 24 – 26	Particulate Design Support	THRN 2336

Note: the experiments will be conducted outside of the scheduled lab/tutorial contact hours

5.4 Other Important Dates

Friday, September 5, 2014: First day of class
Monday, 13 October 2014: Thanksgiving holiday – no classes scheduled. No lab section.
Tuesday, October 14, 2014: Fall Study Break Day – no classes scheduled
Friday, 31 October 2014: 40th class day – last day to drop one-semester courses
Friday, 28 November 2014: Last class (Monday Schedule in effect as make up for Thanksgiving)

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.

If the laboratory rules are not followed, consequences will include removing student's access to the lab. If this results in lab work not being completed, the student will receive a grade of 0.

A pre-lab safety quiz must be passed before students may complete labs. A group will not be permitted to complete a lab until all members of the group have individually passed the quiz. Students may be asked equivalent lab safety questions while in the laboratory. Students who cannot demonstrate a working knowledge of laboratory safety will be removed from the lab.

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.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, 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