ENGG*3180 Air Quality

Fall 2018
Section(s): C01

School of Engineering
Credit Weight: 0.50
Version 1.00 - September 05, 2018

---

1 Course Details

1.1 Calendar Description

The study of the transport, transformation and deposition processes associated with air pollutants. The chemical and biological nature, impacts, and sources of air pollutants. The physical aspects of the atmospheric boundary layer. The mathematical treatment of diffusion in a homogeneous field in a boundary layer. Regulatory approaches worldwide and their use of air quality modeling. The use of models for the design of stacks and monitoring networks.

Pre-Requisite(s): ENGG*2230, (ENGG*2560 or ENGG*2660)
Co-Requisite(s): ENGG*3260

1.2 Timetable

Lectures:

Tuesday	11:30 – 12:50	MCKN 116
Thursday	11:30 – 12:50	MCKN 116

Tutorials/Lab:

Monday	Sec 01	08:30 – 10:20	THRN 1313/1006
Friday	Sec 02	08:30 – 10:20	THRN 1313/1006

1.3 Final Exam

Friday, December 14, 2018, 19:00 - 21:00, room TBA

---

2 Instructional Support

2.1 Instructor(s)

Bill Van Heyst
Email: bvanheys@uoguelph.ca
Telephone: +1-519-824-4120 x53665
Office: THRN 1333
Office Hours: TBA on Courselink or by appointment

2.2 Instructional Support Team

Lab Technician: Joanne Ryks
Email: jryks@uoguelph.ca
Telephone: +1-519-824-4120 x54087
Office: THRN 1114

2.3 Teaching Assistant(s)

Teaching Assistant: Patrick McGrath
Email: mcgrathp@uoguelph.ca

Teaching Assistant: Amir Nazem
Email: anazem@uoguelph.ca
(0.5 GTA allocation)

---

3 Learning Resources

3.1 Required Resource(s)

Course Website (Website)
http://courselink.uoguelph.ca
Course material, news, announcements, and grades will be regularly posted to the ENGG*3180 CourseLink site. You are responsible for checking the site regularly.

ENGG*3180 Air Quality Course Notes (Van Heyst, 2018) (Textbook)
This set of notes is provided electronically on the CourseLink web site free of charge. No other textbook is required.

3.2 Additional Resource(s)

Lab and Project Information (Notes)
The handouts for the lab and projects will be distributed via CourseLink and discussed in class.

Assignments (Notes)
Assignments are posted on the CourseLink web site. The teaching assistants will take up the solutions in the weekly tutorials. Assignments will not be graded.

Exams (Notes)
A copy of a previous year's midterm and final exams will be posted on Courselink as samples with the solutions either taken up in class or tutorial.

3.3 Communication & E-mail 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 <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its student.

---

4 Learning Outcomes

The course covers the fundamentals associated with air quality. The course will provide an overview of historic air pollution events as well as current air quality issues and concerns. The focus of the course will be on the thermodynamics and fluid mechanics of the planetary boundary layer (PBL), the behaviour of plumes released into the PBL, and the computer modelling of air pollution sources. In addition, emission inventory preparation and air quality measurements will be addressed. This is a core course for Environmental Engineering students and will provide practical knowledge applicable to work placements.

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Explain air pollution events from chemical, physical and meteorological perspectives as well as explain the importance of historical air pollution events in society and the development of the air quality field of study.
2. Construct the various levels of the planetary boundary layer using fundamental thermodynamic and fluid mechanic equations and apply assumptions regarding the dominant forces.
3. Predict the dispersion of contaminants downwind using mass transfer relationships and the Gaussian plume model.
4. Generate downwind point of impingement concentrations using the Ontario Regulation 419 as well as AERMOD.
5. Assemble air emission inventories for sources using a variety of methods.
6. Differentiate and explain the required analytical methods required to measure pollutants in the atmosphere and the role of the Air Quality Heath Index (AQHI).
7. Defend and justify the use of EPA Method 5 for measuring particulate matter from point sources.

4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome Set Name	Course Learning Outcome
1	Knowledge Base	1, 2, 3, 5, 6
1.3	Recall, describe and apply fundamental engineering principles and concepts	1, 2, 3, 5, 6
1.4	Recall, describe and apply program-specific engineering principles and concepts	1, 2, 3, 5, 6
2	Problem Analysis	2, 3, 4, 5
2.2	Identify, organize and justify appropriate information, including assumptions	2, 3, 4, 5

#	Outcome Set Name	Course Learning Outcome
2.3	Construct a conceptual framework and select an appropriate solution approach	2, 3, 4, 5
2.4	Execute an engineering solution	2, 3, 4, 5
2.5	Critique and appraise solution approach and results	2, 3, 4, 5
3	Investigation	2, 3, 4, 5, 7
3.2	Design and apply an experimental plan/investigative approach (for example, to characterize, test or troubleshoot a system)	7
3.3	Analyze and interpret experimental data	4, 5, 7
3.4	Assess validity of conclusions within limitations of data and methodologies	2, 3, 4, 5, 7
5	Use of Engineering Tools	4, 5, 7
5.1	Select appropriate engineering tools from various alternatives	4, 5
5.2	Demonstrate proficiency in the application of selected engineering tools	4, 5, 7
5.3	Recognize limitations of selected engineering tools	4, 5, 7
6	Individual & Teamwork	4, 7
6.2	Understand all members' roles and responsibilities within a team	4, 7
6.3	Execute and adapt individual role to promote team success through, for example, timeliness, respect, positive attitude	4, 7
6.4	Apply strategies to mitigate and/or resolve conflicts	4, 7
6.5	Demonstrate leadership through, for example, influencing team vision and process, promoting a positive team culture, and inspiring team members to excel	4, 7
7	Communication Skills	4
7.1	Identify key message(s) and intended audience in verbal or written communication as both sender and receiver	4
7.2	Interpret technical documentation such as device specification sheets, drawings, diagrams, flowcharts, and pseudocode	4
7.3	Construct the finished elements using accepted norms in English, graphical standards, and engineering conventions, as appropriate for the message and audience	4
7.4	Substantiate claims by building evidence-based arguments and integrating effective figures, tables, equations, and/or references	4

#	Outcome Set Name	Course Learning Outcome
7.5	Demonstrate ability to process oral and written communication by following instructions, actively listening, incorporating feedback, and formulating meaningful questions	4
9	Impact of Engineering on Society and the Environment	1, 6
9.1	Analyze the safety, social, environmental, and legal aspects of engineering activity	1, 6

5 Teaching and Learning Activities

5.1 Lecture Schedule

Lectures	Lecture Topics	References	Learning Objectives
Week1	Introduction & Air Quality Issues	Chapter 1	1
Week 2	Planetary Boundary Layer (PBL)	Chapter 2	1, 2
Week 3	PBL	Chapter 2	1, 2
Week 4	PBL	Chapter 2	1, 2
Week 5	PBL / Plume Behaviour	Chapter 2,3	1, 2, 3
Week 6	Plume Behaviour	Chapter 3	1, 3
Week 7	Plume Behaviour	Chapter 3	1, 3
Week 8	Plume Dispersion Modelling	Chapter 4	4
Week 9	Plume Dispersion Modelling	Chapter 4	4
Week 10	Emission Inventories	Chapter 5	5
Week 11	Ambient Air Quality	Chapter 6	6
Week 12	Industrial Source Testing	Chapter 6	7

5.2 Lab Schedule

The lab is scheduled for the weeks of Sept. 24 – Sept. 28, 2018 and Oct. 1 to Oct. 5, 2018. Further details will be announced in class.

5.3 Other Important Dates

Thursday, September 06, 2018: First class

Monday, October 08, 2018: Thanksgiving holiday – no classes

Tuesday, October 09, 2018: Fall Study Break – no classes

Friday, November 02, 2018: drop date – 40th class

Thursday, November 29, 2018: Tuesday Schedule in effect (make-up for Tuesday of Fall Study Break)

Friday, November 30, 2018: last class (Monday Schedule in effect)

---

6 Assessments

6.1 Marking Schemes & Distributions

The marking distribution for the various course assessments is given in the table below.

If you fail (< 50%) both the midterm and the final, you will receive a failing grade in the course equal to the highest of your midterm or final assessment.

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 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

Name	Scheme A (%)
Method 5 Lab	10
Chemical Survey	5

Name	Scheme A (%)
Air Emission Summary and Dispersion Modelling (ESDM) project	20
Midterm Exam	20
Final Exam	45
Total	100

6.2 Assessment Details

Method 5 Lab (10%)

Date: Mon, Sep 24 - Fri, Oct 5, Environmental Engineering Lab (THRN 1313) and Roof Top of Adams Atrium

The course has one lab that entails the measurement of particulate matter from a smoke stack using the US EPA Method 5. The lab will be performed during the weeks of Sept. 24 – Sept. 28 and Oct. 1 to Oct. 5. More details on scheduling, the lab methodology and due date will be provided in class.

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

An electronic copy of the lab report is to be submitted via a drop box on CourseLink on Tuesday October 16, 2018.

Chemical Survey (5%)

Due: Thu, Sep 20, Drop Box on CourseLink

This project involves the investigation of the historic usage, environmental and health concerns and personal exposure to a selected chemical. More details will be provided in class.

An electronic copy of your report is to be submitted via a drop box on CourseLink.

Air Emission Summary and Dispersion Modelling (ESDM) project (20%)

Due: Wed, Nov 28, Drop Box on CourseLink

This project, to be conducted in groups of two, will investigate an Air Emissions Summary and Dispersion Modelling report for a facility in Ontario. The project will involve the verification of the emission summaries as well as conducting air dispersion modelling runs in accordance to Ontario's regulatory requirements.

An electronic copy of your report is to be submitted via a drop box on CourseLink.

Midterm Exam (20%)

Date: Tue, Oct 23, 11:30 AM - 12:50 PM, In Class (MCKN 116)

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

Final Exam (40%)

Date: Fri, Dec 14, 7:00 PM - 9:00 PM, TBA

6.3 Additional Notes

1. Late submissions of lab and project reports will not be accepted.
2. The midterm and final exams will be closed book tests. Necessary equations and information will be provided or announced prior to each exam. Calculators are permitted, but they must be non-communicating devices.

---

7 Course Statements

7.1 Lab Safety

Details of the lab safety specific for the course will be discussed in class prior to conducting the lab.

---

8 School of Engineering Statements

8.1 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. Some written lecture notes will be presented only in class. 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 labs.

8.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. 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.

8.3 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.

---

9 University Statements

9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-

mail is the official route of communication between the University and its students.

9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The regulations and procedures for Academic Consideration are detailed in the Undergraduate Calendar.

9.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for Dropping Courses are available in the Undergraduate Calendar.

9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance, and not later than the 40th Class Day.

More information: www.uoguelph.ca/sas

9.6 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 or faculty advisor.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar.

9.7 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.

9.8 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.
