



## University of Manitoba Department of Biosystems Engineering

### Course Details

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<b>Course Title &amp; Number:</b>	BIOE 4460 Air Pollution Assessment and Management
<b>Number of Credit Hours:</b>	4
<b>Class Times &amp; Days of Week:</b>	Lectures: MWF 11:30-12:20 Labs: R 2:30-5:15
<b>Location for classes/labs/tutorials:</b>	Lectures: E2-304 EITC; Labs: E2-304 EITC
<b>Pre- or Co-Requisites:</b>	BIOE 2790 or CIVL 2790 or MECH 2262 or the former MECH 2260

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### Course Description:

Air pollutant sources and characteristics, their impact on the environment, their behaviour in the atmosphere. Methods of sampling and measurement and the basic technological alternatives available for separation/removal and control. Particular problems of regional interest are discussed.

### Instructor Information

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<b>Instructor(s) Name:</b>	Dr. Qiang (Chong) Zhang, P.Eng., Professor I prefer to be addressed as Dr. Zhang
<b>Office Location:</b>	E1-339 EITC
<b>Office Hours or Availability:</b>	Open door
<b>Office Phone No.</b>	204-474-9819
<b>Email:</b>	Qiang.Zhang@umanitoba.ca
<b>Contact:</b>	You may contact me by phone, by email, or in person. Emails sent after business hours will not likely be answered until the next day.
<b>Teaching Assistant:</b>	Miss Xiaojie (Emily) Yan
<b>Office Location:</b>	E1-345 EITC
<b>Office Hours</b>	Open door
<b>Email:</b>	Xiaojie Yan <yanx34@myumanitoba.ca>

### General Course Information

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Environmental engineering is a program specialization in the Biosystems Engineering undergraduate program, and air pollution is one of the most important areas in environmental engineering. This course will prepare students in dealing with various air pollution issues, including the transport of pollutants in the atmosphere, and design of systems for controlling particulate and gaseous pollutants.

### How does this course fit into the curriculum?

This course is a design elective that students take in their final year. It is one of the courses in the design elective package for the environmental engineering specialization within the Biosystems Engineering program.

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## Course Goals

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The intent of this course is to provide students with an understanding of the engineering principles of air pollution control and the process of designing/selecting air pollution control systems.

## Intended Learning Outcomes

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At the conclusion of the course, the student will:

- gain knowledge of effects of air pollution on environment and human health;
- be able to interpret air pollution related regulations (local, national, and international);
- understand the mechanisms of pollutant transport/dispersion in the atmosphere;
- be able to use air dispersion models to predict and assess pollution impact;
- be able use air sampling methods for pollution assessment;
- be able to design/select systems for controlling particulate pollutants; and
- be able design/select systems for controlling gaseous pollutants

## Textbook, Readings, Materials

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**Required textbook** – None

### References

- De Nevers, N. 2000. Air Pollution Control Engineering, 2nd ed., McGraw-Hill.
- Wark, K., C.F. Warner and W.T. Davis. 1998. Air Pollution, Its Origin and Control. Addison Wesley Longman Publishing Company.
- Sternberg, S.P.K. 2015. Air Pollution: Engineering, Science, and Policy. College Publishing ([www.vitalsource.com](http://www.vitalsource.com)).
- Kuo, J. 2018. Air Pollution Control Engineering for Environmental Engineers, 1st ed. CRC Press.

### Additional Materials

Lecture notes (pdf files) will be posted on UM Learn for download.

## Using Copyrighted Material

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Please respect copyright. We will use copyrighted content in this course. The content used is appropriately acknowledged and is copied in accordance with copyright laws and University guidelines. Copyrighted works, including those created by us, are made available for private study and must not be distributed in any format without permission.

## Recording Class Lectures

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Dr. Qiang Zhang and the University of Manitoba hold copyright over the course materials, presentations and lectures that form part of this course. No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission from Dr. Qiang Zhang. Course materials (both paper and digital) are for the participant's private study and research.

## Course Technology

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As a courtesy to both the instructors and your classmates, use of cell phones is not permitted during class time. Please remember to switch your cell phone to vibrate mode to avoid interruptions. Computers may be used during lectures only for the purpose of taking notes. Course materials will be available through UM Learn.

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## **Class Communication**

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All communication between you as a student and your instructors/TAs must comply with the electronic communication with student policy. You are required to obtain and use your U of M email account for all communication between yourself and the university. For full details of the Electronic Communication with Students please visit:

([http://umanitoba.ca/admin/governance/governing\\_documents/community/electronic\\_communication\\_with\\_students\\_policy.html](http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html)).

## **Expectations: You Can Expect Us To**

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Learning is most effective when both the teacher and the student are engaged in the subject material. The role of the teacher, therefore, is to create an environment that facilitates student engagement and learning. In this course, dissemination of fundamental knowledge will occur using the traditional lecture format. However, students will be exposed to the real-world air pollution issues through site visits and guest speakers. They will also learn sampling and measurement methods through conducting physical lab tests. Your attendance of labs is mandatory.

## **Expectations: We Expect You To**

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We expect you to be in attendance, and on time, for all scheduled lectures and labs. If you must be absent, please show us the courtesy of sending an e-mail notifying us of your absence. Deadlines are a reality in the world of engineering; we expect assignments to be completed on time. Finally, please respect both us as instructors and your classmates by turning off your cell phone during class time. Laptops may be used during lectures only if you are taking notes on the laptop.

## **Academic Integrity:**

Plagiarism or any other form of cheating in examinations, term tests or academic work is subject to serious academic penalty. Cheating in examinations or tests may take the form of copying from another student or bringing unauthorized materials into the exam room. Exam cheating can also include exam impersonation. A student found guilty of contributing to cheating in examinations or assignments is also subject to serious academic penalty. Students should acquaint themselves with the University's policy on plagiarism, cheating, exam impersonation and duplicate submission.

## **Students Accessibility Services**

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### **Student Accessibility Services (SAS)**

If you are a student with a disability, please contact SAS for academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

*Student Accessibility Services*

520 University Centre

204 474 7423

<http://umanitoba.ca/student-supports/accessibility>

## **Class & Lab Schedule**

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A preliminary schedule is provided below. The schedule is subject to change at the discretion of the instructors and/or based on the learning needs of the students but such changes are subject to Section 2.8 of the ROASS Procedure.

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1. Air pollutants and their effects (3 h)
  - 1.1. definitions and types of air pollution
  - 1.2. sources of air pollution
  - 1.3. effects of air pollution
  - 1.4. air quality standards, legislations, and regulations
  - 1.5. approach of addressing air pollution problems
2. Dispersion of pollutants in atmosphere (10 h)
  - 2.1. atmospheric motions and stability
  - 2.2. Gaussian plume dispersion models
  - 2.3. other dispersion models
3. Particulate pollutants (10 h)
  - 3.1. PM definition and description
  - 3.2. behavior of particulate pollutants
  - 3.3. sampling of particulate pollutants
  - 3.4. design of control systems for particulate pollutants
4. Gaseous pollutants (gases and vapors) (10 h)
  - 4.1. typical gaseous pollutants and their properties
    - 4.1.1. sulfur oxides
    - 4.1.2. nitrogen oxides
    - 4.1.3. VOCs (volatile organic compounds)
    - 4.1.4. environmental odours
  - 4.2. sampling methods
  - 4.3. design of control systems for gaseous pollutants
5. GHG and climate change (6 h)

**Laboratory:** two hours per week for one term

Topics:

- Facility tours
- Guest speakers
- Stack plume measurement
- Air sampling
- Olfactometer for odour measurement
- Dispersion modelling
- Design project

**Important Dates:**

Midterm examination	March 6, 2020
Project presentation	April 3, 2020
Voluntary withdrawal date	March 18, 2020

**Course Evaluation Methods**

The basis for evaluation is established by agreement at the beginning of each term. Typical weights assigned to various components of the work are:

Final examination	50%			_____ %
Midterm examination	20%			_____ %
Lab reports and assignments	10%			_____ %
Design project	20%			_____ %

## Grading

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The grading scale used for this course is shown below.

Letter Grade	Percentage out of 100
A+	92-100
A	85-91
B+	78-84
B	72-77
C+	66-71
C	60-65
D	50-59
F	Less than 50

## Assignment Descriptions

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There will be assignments to help you digest the content of important topics. A report will be required for each lab (including site visits). A project report will be submitted as part of your design project. The project report will include the following elements: defining the system; design data; system design; economics; and limitations and recommendations.

### Assignment Guidelines:

1. Late submission of assignments will be accepted up to **5 days** (including weekends and holidays) following the due date. Each late day after the due date will result in 10% reduction of the mark for each individual assignment. Assignments submitted after 5 days will have no credit.
2. Marked assignments will be handed back approximately two weeks after they were submitted.

## Examination Description

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There will one (1) midterm examination and one (1) final examination in this course. The midterm examination will be scheduled during a regular lab period before the VW deadline. The 3-hour final examination will be based on 80% of the materials covered after the midterm and 20% before the midterm. The examinations will be closed book, and a formula sheet will be provided to you. The Student Records Office will determine the date of final examination.

### Missed Examinations

If the midterm examination is missed and the student has a valid medical certificate or compassionate reason (i.e., death of an immediate family member), there are two options for the student: 1) a make-up midterm examination will be scheduled by the course instructor, or 2) the weight of midterm will be added to the final examination. Students who miss the examination without a valid reason will receive a grade of zero for the examination.

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