

Western University - Faculty of Engineering
Department of Civil and Environmental Engineering

CEE 4405a - AIR POLLUTION
Course Outline 2017-2018

This course is an introduction to the diverse nature of the air pollution problem, and atmospheric dispersion of air pollutants. It introduces the student to aspects of physics, epidemiology, legislation, chemistry, technology, meteorology, and dispersion modeling relevant to air pollution, and develops the basic skills required to evaluate air pollution problems. The general objectives of the course are to:

- identify, formulate, analyse and solve air pollution and design problems while working individually or functioning on a team.
- apply knowledge of chemistry and mathematics to the analysis of fate and transport of air pollutants.
- develop an awareness of contemporary air pollution problem and appreciate professional responsibility issues;
- recognize the need for life-long learning to keep abreast of new designs and pollution control methods, enhance one's abilities as a designer, and maintain one's professional competence.

Calendar Copy:

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Contact Hours:

2 lecture hours; 2 tutorial hours each week; Attendance at the tutorial session is **mandatory**

Prerequisites:

Completion of second year of the Engineering Science or Science Program
or permission of the Department

Note: It is the student's responsibility to ensure that all Prerequisite and Corequisite conditions are met or that special permission to waive these requirements has been granted by the Faculty. It is also the student's responsibility to ensure that they have not taken a course listed as an Antirequisite. The student may be dropped from the course or not given credit for the course towards their degree if they violate the Prerequisite, Corequisite or Antirequisite conditions.

Corequisites:

None

Antirequisites:

None

Contact Hours:**2 lecture hours; 2 tutorial hours each week**

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Instructor:

Dr. M. Ray (TEB 443); Tel. 661-2111 ext. 81273; email: mray@eng.uwo.ca

Dr. G. Nakhla (SEB 3037); Tel. 661-2111 ext. 85470; email: gnakhla@eng.uwo.ca

Textbook:

Air Pollution Control Engineering; Third Edition, Noel de Nevers, Waveland Press, Inc., 2017.

Other References:

Course Notes: To be provided; posted at the WEBCT

Laboratory Notes:

None

Units:

SI units will be used in lectures and examinations

Specific Learning Objectives:**Introduction**

At the end of this topic, students should be able to:

- perform basic chemistry calculations and unit interconversions

Air Pollution Effects

At the end of this topic, students should be able to:

- relate to the common indoor and outdoor problems.

Air Quality Standards and Regulation

At the end of this topic, students should be able to:

- perform simple health risk calculations using given risk factors
- appreciate the interplay of various factors in the regulation of air pollution
- understand the principal aspects of air pollution regulation

Air Pollution Sources

At the end of this topic, students should be able to:

- identify the sectoral origins of major air pollutants in North America
- calculate air pollutant emission rates, given emission factors

Atmospheric Chemistry of Sulfur and Nitrogen

At the end of this topic, students should be able to:

- describe the atmospheric chemistry of sulfur and nitrogen compounds relevant to acidic deposition

Particulate Air Pollution

At the end of this topic, students should be able to:

- appreciate the origin, nature, fate and impact of atmospheric particulates
- use design techniques to remove particulates

Combustion as a Source of Air Pollutants

At the end of this topic, students should be able to:

- calculate the volume and composition of gases evolved by fuel combustion
- identify the major variables affecting formation of nitrogen oxides in combustion processes
- describe the principal pollutants emitted by internal combustion engines, and factors affecting their formation

Photochemical Air Pollution

At the end of this topic, students should be able to:

- describe the formation of secondary pollutant due to photochemical reactions

Atmospheric Dispersion

At the end of this topic, students should be able to:

- calculate dispersion of pollutants in atmosphere based on meteorology
- calculate stack height for pollutant release

Source Reduction

At the end of this topic, students should be able to:

- identify strategies and technologies for reducing emissions of particulates and gases

Indoor air pollution

At the end of this topic, students should be able to:

- identify indoor air pollutants and predict the concentration of pollutant using systems approach

Particulate Pollutants Control

At the end of this topic, students will be able to:

- understand various forces governing particulate movement
- design gravity settlers and cyclones

Incineration & Thermal Oxidation

At the end of this topic, students will be able to:

- perform mass and energy calculations
- design vapor/gas incinerators with afterburners

Scrubbers/Absorption Systems

At the end of this topic, students will be able to:

- design packed beds, bubble plates and tray absorbers
- select scrubbing liquid and determine flows
- calculate pressure drops across beds

Adsorption Systems

At the end of this topic, students will be able to:

- understand the adsorption process and adsorption equilibrium models
- design fixed-bed adsorbers and estimate service life

Biological Control Systems

At the end of this topic, students will be able to:

- understand various systems including biofilters, biotrickling filters, and bioscrubbers
- perform design calculations for biological systems
- understand impact of design and operational parameters on system performance

General Learning Objectives

E=Evaluate, T=Teach, I=Introduce

Problem Analysis	T	Team Work	I	Ethics and Equity	I
Investigation	I	Communication	T	Economics and Project Management	I
Design	T	Professionalism	T	Life-Long Learning	T
Engineering Tools	T	Impact on Society	I		

Evaluation:

The final course mark will be determined as follows:

Weekly Assignments:	20%
Midterm Examination	30% (open book) (to be decided by the end of September)
Final Exam:	50% (open book)

(Notes: (1) Students must pass the final examination to pass this course. Students who fail the final examination will be assigned the aggregate mark, as determined above, or the examination mark, whichever is less. Assignments are to be handed in the CEE 4405 locker (#61) on the specified due date provided by the Instructor. **(2)** Students who have failed this course previously must repeat all components of the course. No special permissions will be granted enabling a student to retain assignment or test marks from previous years. Previously completed assignments cannot be resubmitted.

Plagiarism Checking:

The University of Western Ontario uses software for plagiarism checking. Students are required to submit their Laboratory Reports in electronic form to Turnitin.com for plagiarism checking.

Cheating:

University policy states that cheating is a scholastic offence. The commission of a scholastic offence is attended by academic penalties that might include expulsion from the program. If you are caught cheating, there will be no second warning.

For more information on scholastic offenses, please see:

http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf

Attendance:

Any student who, in the opinion of the instructor, is absent too frequently from class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the

Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

Accessibility:

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

Conduct:

Students are expected to arrive at lectures on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others. Late comers may be asked to wait outside the classroom until being invited in by the Instructor. Please turn off your cell phone before coming to a class, tutorial, quiz or exam.

On the premises of the University or at a University-sponsored program, students must abide by the Student Code of Conduct: <http://www.uwo.ca/univsec/board/code.pdf>

Sickness and Other Problems:

Students should immediately consult with the Instructor or Department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see attached). The student should seek advice from the Instructor or Department Chair regarding how best to deal with the problem. Failure to notify the Instructor or Department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

For more information concerning medical accommodations, please see:
http://www.uwo.ca/univsec/handbook/appeals/accommodation_medical.pdf

Notice:

Students are responsible for regularly checking their email, course website (<https://owl.uwo.ca>) and notices posted outside the Civil and Environmental Engineering Department Office

Consultation:

Students are encouraged to discuss problems with their teaching assistant and/or instructor in tutorial sessions. Office hours will be arranged for the students to see the instructor and teaching assistants. Other individual consultation can be arranged by appointment with the appropriate instructor.

Course breakdown:

Natural Science = 25%; Engineering Science = 30%; Engineering design = 20%; Complementary Studies = 10%; Mathematics = 15%.

Use of English:

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for the improper use of English. Additionally, poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

Attendance

Any student, who, in the opinion of the instructor, is absent too frequently from class or laboratory or tutorial periods in any course, will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular examination in the course.

Accessibility:

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Cheating

University policy states that cheating is a scholastic offense. The commission of a scholastic offense is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage of text from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence

The University of Western Ontario has software for plagiarism checking. Students may be required to submit their work in electronic form for plagiarism checking.

For further information on plagiarism, consult the Scholastic Offence Policy in the Western Academic Calendar, the course instructor, or access the following website:

http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergraduate.pdf

Conduct:

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Course Breakdown:

Basic Science	=	11 AU's
Engineering Science	=	14 AU's
Engineering Design	=	11.8 AU's

September 8, 2017

