Western University - Faculty of Engineering

Department of Chemical and Biochemical Engineering

CBE 4405- AIR POLLUTION CONTROL
Course Outline, Winter 2026

Description

This course is an introduction to air pollution control science and engineering. General definitions about the atmosphere, atmospheric reactions, air quality index (AQI), source of pollutants and ongoing challenges in chemical and physical control methods of air pollution are presented. Indoor and outdoor pollution are reviewed. Atmospheric dispersion models and their applications in determination of concentration profile of pollutant in the atmosphere are discussed. Particulate matters and gaseous pollutant control strategies are introduced. Design methodologies for cyclones, cloth filters, wet scrubbers, absorption, adsorption, incineration as well as biofilters are covered.

Learning Objectives

• To develop an awareness of contemporary air pollution problem and appreciate professional responsibility issues.

• Become familiar with the basics of different air pollutants, learn the sources and estimate emission from different processes (**Note: this learning objective aligns with the assessment of Graduate Attribute of Knowledge Base, Level: Applied**)

• To analyse the fate and transport of air pollutants in indoor air and atmosphere (**Note: this learning objective aligns with the assessment of Graduate Attribute of Problem Analysis, Level: Applied**).

• To critically evaluate different pollution control technologies for particulate, VOC and inorganic air pollutants (**Note: this learning objective aligns with the assessment of Graduate Attribute of Problem Analysis, Level: Developed, and Design (Intermediate)**).

• Become familiar with advanced technologies and design approaches for air pollution mitigation.

Contact Hours:

2 lecture hours; 1 tutorial hour, 2 help hours each week.

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 Anti-requisite. 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 Anti-requisite conditions.

Corequisites: None

Antirequisites: None

Instructor:

Dr. S. Barghi (TEB 447); Tel. 661-2111 ext. 81275; email: sbarghi2@uwo.ca

Textbooks:

Air Pollution: Science, Engineering and Management Fundamentals Mukesh Khare, Prateek Sharma, Sri Harsha Kota, Sumanth Chinthala, CRC Press Copyright 2025.

Air Pollution Control Engineering for Environmental Engineers, Jeff Kuo, CRC Press, 2019.

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

Fundamentals of Air Pollution, 5th Edition Daniel A. Vallero, Academic Press, 2014

Other References:

Course Notes: To be provided; posted at the Owl BrightSpace

Laboratory Notes: None

Units:

SI units will be used in lectures and examinations

Specific Learning Objectives:

Topic #	Description	Learning Activities	Tentative timeline
Introduction	1: general review of air pollution with main focus on chemical industry. 2: Review of the course outline, expectations, assessments, etc.	In class discussion	Week 1
Air pollution quality	Air pollution effects, standards and regulations, indoors, outdoors	Indoors/outdoors air quality assessment, development of regulations	Week 2

Sources of air pollution	Determination of pollutant sources indoors/outdoors	Pollutant sources review (indoors outdoors) mainly in chemical industries and formation of secondary pollutants in the atmosphere	Week 3
Atmospheric chemistry	Review of chemical reactions between pollutants and atmosphere constituents	Different mechanism of reaction in the atmosphere and the effects of environment on these reactions	Week 4
Atmospheric dispersions	Dispersion models (puff and plume), and effects of wind. Steady state and unsteady state behaviors in dispersion models. Pollutant release mitigation methods.	Review of puff and plume models, calculation of pollutants' concentration at different times and locations under different atmospheric conditions	Week 5 & 6
Particulate Pollutants Control	Review of particulate movement dynamics, Understanding mitigation methods and design of units such as cyclones, filters, gravity precipitators, etc.	Review of governing equations for particulate move in the atmosphere, understanding design of units particulate concentration control	Week 7 & 8
Scrubbers/Absorption	Review of principles of operation, and design methodologies	Application of scrubbers in air pollution control and design of commercial units.	Week 8
Adsorption Systems	Adsorption theory and principles of operation, and design methodologies	Application of scrubbers in air pollution control and design of commercial units.	Week 9

Incineration & Thermal Oxidation	Principles of incineration, design of incinerators	Operating condition, design constraint, design equations	Week 10
Biological Control Systems	Review of biofilters bio-trickling beds, and bio-scrubbers	Design of units considering design and operating limitations	Week 11
Brief review of the course contents	Review of the assignments, quizzes and exams	Questions and answers	Week 12

SPECIFC LEARNING OUTCOMES

Degree Level Expectation	**Weight**	**Assessment Tools**	**Outcomes**
Depth and breadth of knowledge	30%	Assignments and Quizzes	Understanding of air pollution principles and its impacts on the people and environment
Research & scholarship	10%	Understanding new technologies in air pollution control	Becoming familiar with principles and new technologies in air pollution control
Application of knowledge	35%	Assignments, Quizzes and examinations	Ability to apply knowledge in a rational way to analyze air pollution problems and finding practical solutions
Professional capacity / autonomy	10%	Descriptive questions as short examination	Awareness of academic integrity, implementation of mitigation processes following the stablished rules by authorities

Communication skills	5%	Reports/Essays	Ability to communicate ideas, issues, results and conclusions

Evaluation (CBE 4405):

The final course mark will be determined as follows:

Assignments and quizzes:	25%
Midterm Examination	25% (one A4 two sided Cheat sheet for equations)
Final Exam:	50% (two A4 two sided Cheat sheet for equations)

(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. (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 Chemical and Biochemical 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 = 35%; Engineering design = 25%; Complementary Studies = 15%; Mathematics = 10%.

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:
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 Student with Disabilities (SSD) at 661-2111 x82147 for any specific question regarding an accommodation.

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:
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 required to wait outside until being invited in by the Instructor. Please turn off your cell phone before coming to a class, tutorial, 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 and notices posted on Instructors' doors.

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:

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

January 19, 2026