

Chemical and Biological Engineering 485 Air Pollution Prevention and Control

Instructor: Anthony Lau Email: anthony.lau@ubc.ca
Lectures: Mon Wed Fri 12-1 pm
Tutorials: Wed 2-4 pm Sept 9, Sept 23, Oct 7, Oct 21, Nov 18
Website: <http://canvas.ubc.ca>

Course notes: Lecture notes and additional materials will be provided through Canvas.

Optional textbooks:

Cooper, C.D. and F.C. Alley. 2011. Air pollution control: A design approach, 4th edition, Waveland Press Inc., Prospect Heights, IL
Sternberg, S.P.K. 2015. Air pollution: engineering, science, and policy, College Publishing, Glen Allen, VA (eBook: <http://www.vitalsource.com>)

Evaluation:

Assignments	25%
Homework assignments (4)	
Tutorial assignments (2)	
Midterm Test (November 4 , Open book)	35%
Term Paper (3 students per group)	40%

Assignment submission deadlines:

Homework assignments are to be submitted via Canvas on the date they are due.

Tutorial assignments are to be submitted via Canvas two days after each of the following tutorial sessions: Sept 23, Oct 21.

Late assignments: 10% of the maximum possible mark will be deducted per day. Assignments submitted after the solutions have been posted will not be marked.

Learning outcomes:

Upon successful completion of this course, students should be able to:

- Identify different categories and sources of air pollutants and explain their impact on human health, welfare and the environment
- Develop a conceptual understanding of pollution control vs. pollution prevention technologies, and discuss measures for air pollution prevention
- Gain a basic understanding of the legal requirements for air pollution control
- Use the mass balance and the emission factor methods to estimate source emissions
- Apply atmospheric dispersion modeling for predicting the concentrations of pollutants downwind from the source and their impact on ambient air quality
- Describe, discuss and analyze the physical/thermal, chemical and biological technologies that are used for the control of air pollution emissions from different sources
- Demonstrate the ability to organize and communicate their ideas in written form

Course Outline

Chapter 1. Introduction to air pollution control and prevention (Weeks 1-2)

1. Definition and categories of air pollutants
2. Sources and causes of air pollution
3. Historic air pollution events
4. Air pollution and air quality
5. Examples of air pollution control technologies

Chapter 2. Air pollution regulations and estimation of emissions (Weeks 2-4)

1. Ambient air quality criteria and standards
2. Source emission standards
3. Air pollutants audit and inventories

Chapter 3. Meteorology of air pollution (Week 4)

1. The physics of the atmosphere
2. Atmospheric stability
3. Plume profiles for various atmospheric conditions

Chapter 4. Dispersion of pollutants in the atmosphere (Weeks 5-6)

1. Atmospheric dispersion modeling – gaseous pollutants and particulates
2. Plume models and puff models
3. Dispersion modeling systems - screening models and refined models

Chapter 5. Prevention and control of particulate matter (Weeks 7-9)

1. Characteristics and particle distribution
2. Collection mechanisms
3. Control equipment - theory and design considerations

Chapter 6. Prevention and control of gaseous pollutants (Weeks 10-12)

Control equipment – theory and design considerations for:

1. Nitrogen oxides
2. Sulfur oxides
3. Volatile organic compounds and Odors
4. Greenhouse gases (carbon dioxide and methane)

Chapter 7. Effects of air pollution on human health and the environment (Week 13)

1. Human health and living systems
2. Global warming and climate change
3. Ground-level smog formation
4. Acid rain formation
5. Stratosphere ozone depletion
6. Visibility impairment

Summary (Week 13)

Reference books

- Bakshi, B.R. 2019. Sustainable engineering – principles and practice. Cambridge University Press, UK.
- Vallero, D. 2014. Fundamentals of air pollution, 5th edition, Elsevier, Boston, MA (UBC eBook)
- Kreith, F. and J.F. Kreider. 2011. Principles of Sustainable Energy. CRC Press. Boca Raton, FL.
- Heck, R.M., R.J. Farrauto and S.T. Gulati. 2009. Catalytic air pollution control – commercial technology. John Wiley & Sons Inc., Hoboken, NJ (UBC eBook)
- Shareefdeen, Z. and A. Singh (eds.) 2005. Biotechnology for odor and air pollution control. Springer-Verlag, Berlin. (UBC eBook)
- Marsh, W.M. and J. Grossa, Jr. 2002. Environmental geography – science, land use, and earth systems. John Wiley & Sons Inc., New York.
- Cheremisinoff, N.P. (ed.) 2002. Handbook of air pollution prevention and control. Butterworth-Heinemann, Amsterdam. (UBC eBook)
- Schiffner, K.C. (ed.) 2002. Air pollution control equipment selection guide. Lewis Publishers, Boca Raton, FL. (UBC eBook)
- De Nevers, N. 2000. Air pollution control engineering, 2nd edition, McGraw Hill, New York.
- Wark, K. C.F. Warner and W.T. Davis. 1998. Air Pollution: its origin and control, 3rd edition, Prentice Hall, NJ

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During this pandemic, the shift to online learning has greatly altered teaching and studying at UBC, including changes to health and safety considerations. Keep in mind that some UBC courses might cover topics that are censored or considered illegal by non-Canadian governments. This may include, but is not limited to, human rights, representative government, defamation, obscenity, gender or sexuality, and historical or current geopolitical controversies.

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