ACKNOWLEDGEMENT

UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xwməθkwəy̓əm (Musqueam) people. The land it is situated on has always been a place of learning for the Musqueam people, who for millennia have passed on their culture, history, and traditions from one generation to the next on this site.

COURSE INFORMATION

Course Title & Time	Course Code Number	Credit Value
Air Pollution, Technology & Society *Mon-Wed 1-2PM + asynchronous content & debates on Fridays*	MECH 410U	3

PREREQUISITES

None.

COREQUISITES

None.

CONTACTS

Course Instructor	Contact Details	Office Location	Office Hours
Prof. Naomi Zimmerman, Ph.D. Pronouns: She/Her/Hers	**Email:** nzimmerman@mech.ubc.ca **Note:** I encourage you to send me messages using the Canvas inbox as you are likely to get a faster reply. I aim to reply within 24 hours during weekdays	CEME 2066	My drop-in office hours will be determined after an in-class poll of students' availability and will be posted on Canvas

ABOUT PROF. ZIMMERMAN

I'm an Assistant Professor in the Department of Mechanical Engineering, and Canada Research Chair in Sustainability. Before joining UBC in 2018, I did my Bachelor's degree in Chemical Engineering at Waterloo, my Ph.D jointly in Chemical Engineering and Mechanical Engineering at the University of Toronto, and was a postdoctoral fellow in Mechanical Engineering at Carnegie Mellon University's Center for Atmospheric Particle Studies. My research focuses on understanding air quality and climate impacts of technology and policy, particularly in the transporatation and energy sectors. You might find my grad students deploying air quality sensors around town, or doing international field work (well, not in 2020!). I created MECH 410U when I joined UBC, and also teach MECH 431 (Engineering Economics). When I'm not researching or teaching, you can likely find me enjoying some tea and hanging out with my cat named Mouse.

OTHER INSTRUCTIONAL STAFF

Teaching Assistant: Sarah Crosby [email: sarah.crosby@mech.ubc.ca]

Sarah will moderate our online UBC Blogs page, track participation, assist with grading, and run the weekly office hour.

COURSE STRUCTURE

MECH410U consists of lectures and discussion. We will have two hours of "synchronous" lecture every week (Mondays and Wednesdays at 1 PM PT), as well as one hour of "asynchronous" content (videos, discussion prompts etc.) or a Friday debate. Synchronous lectures will take place on Zoom. Asychronous content will be posted on Canvas under the appropriate module.

All Zoom synchronous content will be recorded and uploaded to Canvas for later viewing. The videos will be embedded into the appropriate course module. All videos related to the Grand Challenges presentations (initial uploads and the debate itself) will be posted on UBC CLAS.

Discussion posts will be posted on our course UBC Blogs page: https://blogs.ubc.ca/airenergy2021/. This is a shared space with ENVR410 and where you will post your response to all discussion prompts. There are a number of "MECH410U-only" posts and two cross-course posts, where you will engage with students in ENVR410 (Energy, Environment, and Society).

New in 2020, we are also planning a cross-course "Gather Town" to discuss air pollution, energy and society. Stay tuned!

SCHEDULE OF TOPICS

Week	Content
January 11 – 15	Introduction to Air Pollution
January 18 – 22	Air and Climate Pollutants
January 25 – 29	Atmospheric Science & Meteorology
February 1 – 5	Industrial emissions and control
February 8 – 12	Mobile source emissions and control **Debate #1: Carbon capture and storage**
February 15 – 19	**Midterm break**
February 22 – 26	Natural source emissions and control **Debate #2: Low-carbon fuel standards**
March 1 – 5	The policy process and policy evolution **Midterm week: online**
March 8 – 12	Environmental justice **Debate #3: Geoengineering**
March 15 – 19	Collective action and public support
March 22 – 26	Global vs. local considerations **Debate #4: Social media**
March 29 – April 2	Economics of air pollution, cost-benefit analysis, externalities

| April 5 – 9 | Future trends and directions
Debate #5: Carbon taxes |
| April 12 – 14 | Review
Take-home final exam |

LEARNING OUTCOMES

At the completion of this course, you should be able to:

1. Explain fundamental concepts of air pollution (air quality, climate, and health effects)
2. Identify key air quality and climate change pollutants, their sources, and control technologies
3. Describe the role of engineering in managing air pollution
4. Understand the air pollution policy process in Canada, and the basics of international air quality management
5. Assess the social and economic impacts of air pollution using economic tools (e.g., externalities) or policy-tools (e.g., environmental impact assessment)
6. Identify examples of sustainable design and development in the context of air pollution
7. Critically assess potential design trade-offs in terms of air quality, climate, health, and economics
8. Communicate technical analysis to policy makers and the public in writing (policy briefs) and orally (presentations on grand challenges)

LEARNING ACTIVITIES

- Attending 'traditional' synchronous lectures on Zoom
- Viewing asynchronous material before the next synchronous class
- In-class / synchronous participation in class discussions, polls, activities, debates
- Recorded oral presentations uploaded to the UBC CLAS platform
- Peer discussion and evaluation of the oral presentations
- Discussion on the class UBC Blogs page: https://blogs.ubc.ca/airenergy2021/
- Writing a policy brief

LEARNING MATERIALS

Canvas: Your primary course hub. You will find lecture recordings here, assignment calendars, and links to other platforms as required (see: UBC Blogs, CLAS). You will submit your online midterm and final exam on Canvas, as well as your written policy briefs. Lecture slides will be posted to Canvas at least 24 hours prior to lecture on this platform under the appropriate module. Asynchronous videos and content will also be posted here, with dates provided to have reviewed the materials.

UBC CLAS: The UBC Collaborative Learning Annotation System. This is kind of like YouTube, except it is internal to UBC and will be embedded in Canvas. This is fundamentally a platform for uploading videos and allows for time-stamped comments if you have questions. Pre-debate

informative videos andt the "debate" oral presentations will be posted here. Your comments on the UBC CLAS platform will be partially used to assess participation in the MECH410U "debates" (see: Assessments of Learning for more details).

UBC Blogs: All course discussion posts will live on our UBC Blogs website (https://blogs.ubc.ca/airenergy2021/). You have been auto-enrolled in this service as an Author. We will go over posting to Blogs in class. To login and make a post, go to here: https://blogs.ubc.ca/airenergy2021/wp-admin/

Optional textbook for further reading: Fundamentals of Air Pollution, 5th Edition
Author(s): Daniel Vallero
ISBN: 978-0-12-401733-7
Availability: Free online through the UBC Library (see Online Library Course Reserves on Canvas)

ASSESSMENTS OF LEARNING

Assessment Plan:
- Midterm   10%
- Final Exam   35%
- Policy Brief   20%
- Presentation (Debates) 20%
- Discussion Posts   10%
- Participation   5%

Midterm (10%): The midterm will occur on Canvas at 1PM PT on Friday March 5th

Final Exam (35%): The final exam question is a take-home essay-style question. The final exam question will be based on an in-class collaborative discussion about topics of interest. You will be provided a short-list of questions in advance, and once the question is assigned, you will have 48 hours to submit your response.

Policy Brief (20%): You will summarize a peer-reviewed publication in the form of a 2-4 page policy brief. We will go over policy briefs in class. Each student much choose and register a unique publication to summarize that is approved by the instructor.

Presentation (20%): Over the semester, we will have 5 presentation days, with 2 groups presenting per presentation day. Each presentation day will focus on a contentious issue, with the two groups presenting their case on either side of the issue. These presentations will be uploaded to the UBC CLAS platform the Monday before the presentation date, to allow time for other students to view and comment on the presentations.

Discussion Posts: Six times per term, you will be prompted to respond to a discussion prompt. The quality of your post will be used for assessment. There are 9 opportunities total to respond to discussion prompts, so you need to do 6 out of 9 (66%).

Participation: This is based on three components: (1) Commenting on discussion posts; (2) Commenting on Presentation videos on UBC CLAS; and (3) Completing peer evaluation of the presentations.

Late assignments will not be accepted except in the case of an approved Academic Concession. All academic concessions must be processed on the following website: https://academicservices.engineering.ubc.ca/form-request-for-academic-concession-in-term-work/

UNIVERSITY POLICIES

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions.

Details of the policies and how to access support are available on **the UBC Senate website.**

OTHER COURSE POLICIES

Assignments
Students are expected to work independently, except in the case of group projects. Offering and accepting solutions from others is an act of plagiarism, which is a serious offense and all involved parties will be penalized according to the Academic Honesty Policy. Discussion amongst students is encouraged, but when in doubt, direct your questions to the professor or teaching assistants.

Attendance and Absences
Students are responsible for all missed work, regardless of the reason for absence. It is also the absentee's responsibility to get all missing notes or materials.

LEARNING ANALYTICS

Learning analytics includes the collection and analysis of data about learners to improve teaching and learning. This course will be using the following learning technologies: Canvas, UBC CLAS, UBC Blogs, Gather Town. Many of these tools capture data about your activity and provide information that can be used to improve the quality of teaching and learning. In this course, I plan to use analytics data to:
- View overall class progress
- Review statistics on course content being accessed to support improvements in the course
- Track participation in discussion forums
- Assess your participation in the course

LEARNING RESOURCES

If you need support, check out UBC's Academic and Learning Resources here: https://students.ubc.ca/enrolment/academic-learning-resources. I am also available by email if you need help being connected with other resources.

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Online classes on Zoom will be recorded and posted to Canvas within 24 hours of the lecture. Redistribution of these materials by any means without permission of the copyright holder(s) constitutes a breach of copyright and may lead to academic discipline.

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