CLIMATE 480 / EAS 480
Climate Change: A Multidisciplinary Approach to Problem Solving

Winter 2024

Instructor: Mohammed Ombadi (ombadi@umich.edu); He/Him

Credits: 3.0
Lecture: Tue., Thu. 10 – 11:30 am in TBD.
Office Hours: Thursday 1 – 2 pm; Location: TBD. Also, by appointment in 1539 CSRB North Campus.
Course Website: via Canvas

Course Description

This course provides a comprehensive exploration of climate change, covering its scientific foundations, mitigation strategies, adaptation measures, and the diverse intersections of climate change with various societal aspects. Students will delve into the science of climate change, examine the global efforts to mitigate greenhouse gas emissions, explore strategies for adapting to changing climate patterns, and engage in critical debates surrounding climate change's multifaceted impact on economy, public health, politics, religion, culture, law, and journalism.

The course consists of four modules.

1) ***The scientific basis of climate change:*** students will understand the fundamental principles of climate science, analyze Earth's energy balance, and learn about feedbacks, tipping points, aerosols, natural variability and numerical models of the climate system.
2) ***Mitigation of climate change:*** students will learn about emissions of global greenhouse gases, reducing CO2 sources and deployment of renewable energies, increasing sinks of CO2 and methane through engineered and nature-based solutions.
3) ***Adaptation to climate change:*** Students will study climate change impacts on sea level rise, extreme events (e.g., heavy rainfall, floods, droughts, heatwaves, wildfires) and associated impacts on infrastructure design, agriculture and public health.
4) ***Climate change debates:*** students will form groups and debate against each other. Debates will be based on motions provided by the instructor (e.g., The US should transition to zero-carbon economy by 2050). Students are encouraged to bring their disciplinary knowledge to the debate (public health, economy, journalism …etc.).

Learning Outcomes

After successfully completing this course, students will:

- Gain a holistic understanding of climate change, equipping them with the knowledge and skills to contribute meaningfully to the ongoing discourse and action surrounding this critical global challenge.
- Develop the ability to distinguish between information, mis- and dis- information regarding climate change.
- Develop an understanding of the linkage between climate change and their disciplines.

Teaching Method

The teaching method for this course combines lectures, small group work, and active (experiential) learning. Lectures will introduce students to concepts, methodologies, and fundamentals of climate science.

Homework assignments: Experiential learning is integrated into homework assignments, which require students to engage in reading tasks and critically evaluate written pieces. Assignments will also encompass quantitative analysis, exploration and visualization of climate data.

Midterm Exam.

Group project (climate debates): In the fourth module of this course, a series of debates will take place. Each debate will feature two teams, comprising of 3-5 students on each side. Each team is tasked with crafting a coherent set of arguments in favor of or against the debate motion.

Final report: Building on the topics explored in the climate debates, each student is required to submit an individual written report by the end of the course. The report should span 5-10 pages, delving into issues of mitigation and adaptation to climate change from the perspective of the student's discipline (public health, economy, journalism, etc.)

Class Climate & Inclusivity

Diversity is not only appreciated but celebrated in this classroom. The teaching staff maintains a zero-tolerance policy towards any form of discrimination. Students are expected to demonstrate respect, civility, and considerate conduct. Additionally, recognizing differences in language, culture, and personal viewpoints is encouraged. Feedback on issues related to diversity in the classroom is welcomed.

Recommended Texts:

While no textbook is mandatory for this class, several textbooks, websites and readings are recommended:

- (https://openclimate.org/course-collection-climate-change-science/). A website maintained by Prof. Richard Rood contains presentations and readings from previous years.
- Climate Change and Climate Modelling by David Neelin (https://doi.org/10.1017/CBO9780511780363)
- Sustainable Energy – without the hot air by David MacKay (eBook available for free at https://www.withouthotair.com/download.html)
- The Sixth Assessment Report (AR6), Intergovernmental Panel on Climate Change (IPCC) – The Physical Science Basis (Full report and Technical summary are available at https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/)
- AR6, IPCC – Impacts, Adaptation and Vulnerability (Full report and technical summary are available at https://www.ipcc.ch/report/sixth-assessment-report-working-group-ii/)
- AR6, IPCC – Mitigation of Climate Change (Full report and technical summary are available at https://www.ipcc.ch/report/sixth-assessment-report-working-group-3/)

Grading

Homework Assignments	45%
Midterm Exam	25%
Debate Presentation	10%
Debate Final Report	10%
Class Participation	10%

Course Schedule

Lecture	Module	Topic
1	**Module 1: The Scientific Basis of Climate Change**	Introduction to class
2		1.1 Systems and the Conservation Principle
3		1.2 Earth's Energy Balance
4		1.3 Greenhouse Gases
5		1.4 Feedbacks and Tipping Points in the Climate System
6		1.5 Aerosols
7		1.6 Natural variability of the Climate System
8		1.7 Climate Models
9	**Module 2: Mitigation of Climate Change**	2.1 Global GHG Emissions, Regional Breakdown, Historical Emissions, Coupling of GHG Emissions and Economic Development
10		2.2 Breakdown of GHG Emissions by Sector, Historical Transition in the Energy Mix, Contraction and Convergence Framework
11		2.3 Renewable Energy (Hydropower, Wind and Solar), Concerns on feasibility of large-scale deployment of renewable energy
12		2.4 Carbon Dioxide Removal (CDR) Techniques, Carbon Capture and Storage (CCS), Nature-based Solutions
13		2.5 More on renewable energy (Employment Opportunities,
14		2.6 Emissions in the Food Supply Chain, Dietary Options, Environment-Social-Governance (ESG) Movement
15	**Module 3: Adaptation to Climate Change**	3.1 International Agreements on Climate Action, Climatic Impact Drivers, Climate Risk, IPCC Calibrated Language on Uncertainty
16		3.2 Extreme Events I: Precipitation
17		3.3 Extreme Events II: Droughts
18		3.4 Extreme Events III: Heatwaves and wildfires
19		3.5 Sea level rise
20		3.6 Stationarity is Dead: Implications for Infrastructure Design
21		3.7 Public health and Agricultural impacts
22	**Module 4: Climate Change Debates** (Exploring climate change intersections with economy, public health, politics, religion, culture, law, and journalism)	Debate 1
23		Debate 2
24		Debate 3
25		Debate 4
26		Debate 5
27		Debate 6