Climate Change: The Science and Global Impact Course Syllabus

Module 1. Introduction to Climate and Climate Change
1.0 Course Introduction
1.1 What is climate change?
1.2 What should we care about climate change?
1.3 Overview of the climate system: How is the climate system constructed?
1.4 Overview of the climate system: How do energy balances work?
1.5 Overview of the climate system: Global circulation systems
1.6 Other fundamental principles: Feedback mechanisms and the carbon cycle

Module 2: Observing and Measuring Anthropogenic Climate Change
2.1 Changes in atmospheric greenhouse gases
2.2 Modern surface temperature trends
2.3 The oceans
2.4 Extreme weather
2.5 Sea ice, glaciers and global sea level
2.6 Paleoclimate evidence of climate change

Module 3: Modeling the Climate System: The Basics
3.1 Introduction to climate modeling
3.2 Expressing a zero-dimensional energy model as a linear equation
3.3 0d-EBM demonstration
3.4 Estimating climate sensitivity

Module 4: Modeling the Climate System: Advanced
4.1 One-dimensional energy balance models
4.2 Case Study: Using a one-dimensional EBM to model the ice ages
4.3 General circulation models
4.4 Validating climate models
4.5 Detecting climate change
4.6 Interpreting climate sensitivity

Module 5: Carbon Emission Scenarios
5.1 Emissions Scenarios
5.2 Stabilizing CO_2 concentrations

Module 6: Applying Climate Models: Projected Changes in the Climate System
6.1 Surface temperature projections
6.2 Projected changes in global precipitation and drought

6.3 Atmospheric and oceanic circulation changes
6.4 The melting cryosphere
6.5 Sea level rise projections
6.6 Tropical cyclone and hurricane projections
6.7 Extreme weather projections

Module 7: Climate Change Impacts: The Future for People and Planet
7.1 Carbon cycle feedbacks
7.2 Sea level rise and coastal impacts
7.3 Ecosystems and biodiversity
7.4 Shifting water and food resources
7.5 Human health impacts
7.6 Security concerns
7.7 Tipping points

Module 8: What Is Our Path Forward?
8.1 Geoengineering: A scientist’s perspective, Part 1
8.2 Geoengineering: A scientist’s perspective, Part 2
8.3 Emissions reductions: The only viable way forward
8.4 Conclusion: A path of hope