

Course Outlines



School of Civil and Environmental Engineering (SCEE)

National University of Sciences & Technology

Course Title: Climate Change Science

Course Code: ENS-807

Objectives: This is designed to engage students in critical thinking about contemporary issues in climate science. This course introduces students to science that describes the major forces, feedbacks, cycles and oscillations that create climate at local and global levels. Changes in climate over geological as well as historic time will be studied and impacts on biodiversity and man will be discussed.

Students will use Climate Science as a tool to familiarize themselves with how modern science is practiced and how evidence is assessed by the scientific community. understanding the concept of greenhouse effect, cycles of greenhouse gases and corresponding environmental impacts on both regional and global scales.

Course Learning Outcomes:

Upon successful completion of the course, the student will demonstrate competency by being able to:

- Understand and communicate the fundamentals of climate change
- Demonstrate the ability to acquire and apply scientific information to reach well justified conclusions
- Demonstrate the use of quantitative data in forming scientific explanations and generate logical conclusions from acquired data.
- Gain a base of knowledge in a scientific field (Climate Change Science), define the major concepts, and argue against common misconceptions about climate change.
- Gain an understanding of the nature of scientific inquiry by gaining knowledge of the natural world and an approach to problem solving.
- Demonstrate an understanding about the role and impact of natural science on society in identifying the scientific issues associated with global problems and role of societal support for scientific research.

Contents:

Greenhouse effect. Matter: atoms & chemical bonds; gases vs. liquids. Electromagnetic waves, photons, and interaction with matter. Energy budget of earth system. Four Spheres of the Earth, Weather and Climate, Vertical structure of the Atmosphere, Atmosphere evolution, composition of the lower atmosphere. Chemical reactions, including redox. Global cycle of carbon, Nitrogen and Water Cycle. Introduction, Green House Gases, types and their climatic effects, Modeling of climate change, types of climate change models, Effects of climate change on atmosphere and terrestrial and aquatic ecosystems, Climate change and food production, climate change and its effects on Pakistan's agriculture, water resources, forests, Brief description of MEAs (multilateral environmental agreements) etc;

Recommended Books

1. Climate Change - Causes, Effects, and Solutions, 1st Edition, Hardy, J. T., John Wiley & Sons, 2003.
2. Global Warming -The Complete Briefing by John T. Houghton. (3rd edition) Cambridge University Press, 2004.
3. Henson, R. (2011). The Rough Guide to Climate Change. 3rd Ed. Rough Guides Ltd.London
4. IPCC Assessment Reports on Climate Change
5. Climate Impact and Adaptation Assessment. A Guide to the IPCC Approach, Earthscan Publication Ltd, London, 2005.
6. Climate Change - Causes, Effects, and Solutions, Hardy, J.T., John Wiley & Sons, 2003.
7. The Green House Effect, Climate Change and Ecosystems. Warrick, B &Jager, D. (Ed.). ECOPE 29. John Wiley & Sons. Chic ester. UK 1991.