UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Technologies for Carbon Capturing

2627-2-F7603Q027-F7603Q02701

Aims

The module “Technologies for Carbon Capturing” aims at providing knowledge and skills regarding the scientific principles and technological solutions available for carbon capture, carbon removal, carbon utilization, and long-term carbon storage. Classes will discuss the role of carbon in the Earth system, the relationship between carbon dioxide emissions and climate change, and the physicochemical principles governing carbon capture processes. Particular attention will be devoted to the analysis of technological and nature-based solutions.
Case studies and scientific literature will be analysed and discussed to provide students with the ability to critically evaluate the effectiveness, sustainability, scalability, and environmental implications of different carbon management approaches.

Students are invited to consult the syllabus of the entire course for details regarding learning- and skill-related objectives

Contents

- Carbon Cycle and Climate Change
- Principles of Carbon Capture
- Carbon Capture Technologies
- Carbon Storage and Carbon utilization
- Nature-Based Solutions for Carbon Removal

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Detailed program

- Global carbon cycle and carbon reservoirs
- Natural and anthropogenic carbon fluxes
- Greenhouse effect and climate regulation
- Carbon dioxide as a climate-forcing agent
- Decarbonization pathways and net-zero strategies
- Molecular structure and physicochemical properties of carbon dioxide
  *Carbon separation and concentration principles
- Industrial capture: Pre-combustion, Post-combustion and
  Oxy-fuel technologies
  *Direct Air Capture (DAC)
  *Carbon Storage
- Carbon dioxide utilization
  *Forest-based carbon sequestration
  *Soil carbon storage
  Blue Carbon and Marine Carbon Dioxide Removal Technologies

Prerequisites

Basic notions of general chemistry

Teaching form

• 10 two-hour lectures, in person, covering the scientific basis of carbon capture, the global carbon cycle, climate change, carbon dioxide properties, and carbon capture technologies, Delivered Didactics;

• 5 two-hour sessions, in person, dedicated to the analysis of scientific literature, discussion of case studies, evaluation of carbon capture and carbon removal technologies, assessment of environmental and technological performance data, and discussions on the sustainability and scalability of carbon management solutions, Interactive Teaching.

Attendance to lectures and interactive exercises is highly recommended.

Textbook and teaching resource

Reference textbook:

Aresta, M., Karimi, I., Kawi, S. (Eds.), An Economy Based on Carbon Dioxide and Water: Potential of Large Scale Carbon Dioxide Utilization, Springer, 2019

Additional teaching materials, including lecture slides, scientific papers, case studies, and technical reports, will be provided by the instructor through the e-learning platform.

Semester

II semester (March - June)

Assessment method

The assessment consists of the preparation of an individual written report and an oral examination. Students will prepare a critical review of a selected carbon capture technology based on scientific literature and technical reports, and discuss their work during the oral exam. The final examination will assess: (1) knowledge and understanding of the course topics; (2) ability to connect different concepts and technologies; (3) autonomy of analysis and critical judgment; and (4) ability to use appropriate scientific terminology. The final grade will be expressed on a scale from 18/30 to 30/30 cum laude.

Office hours

Sustainable Development Goals

RESPONSIBLE CONSUMPTION AND PRODUCTION | CLIMATE ACTION