INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Air pollution			Field of study	Environment Protection								
Bachelor in	Environmental Engineering			School	School of Agriculture								
Academic Year	2022/2023	Year of study	3	Level	1-3	ECTS credits	6.0						
Type	Semestral	Semester	2	Code	9099-309-3204-00-22								
Workload (hours)	162	Contact hours	T 30	TP -	PL 30	TC -	S -	E -	OT 20	O -			

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s): Carlos Miguel De Sousa Silveira, Manuel Joaquim Sabença Feliciano

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Understand the stages of the global cycle of the major air pollutants;
2. Perform emission inventories of air pollutants;
3. Describe and predict the potential impacts of stationary and mobile air pollution sources;
4. Know the basic for collecting and analyzing air pollution data and information;
5. Assess air quality in accordance with quality standards and criteria;
6. Know and implement preventive and corrective measures to improve air quality;
7. Know the causes and effects of indoor air quality problems.

Prerequisites

Before the course unit the learner is expected to be able to:
Basic knowledge in mathematics, chemistry and physics.

Course contents

1. Terrestrial Atmosphere 2. Air pollution sources and inventory 3. Effects of air pollution 4. Transport and dispersion of air polluttants 5. Chemical transformations and atmospheric deposition 6. Sulphur compounds 8. Nitrogen compounds 9. Carbon and halogenated compounds 10. Atmodpheric ozone 11. Airborne particles 12. Air quality management 13. Emissions prevention and control technologies 14. Indoor air quality

Course contents (extended version)

1. Terrestrial atmosphere
   - structure.
   - composition.
   - temporal and spatial scales of atmospheric phenomena.
2. Sources of air pollution and emissions inventory
   - brief history of air pollution.
   - classification of air pollution sources.
   - main sources and air pollutants.
   - emissions inventory.
3. Air pollution impacts
   - effects on human health and well-being.
   - effects on plants and animals.
   - effects on atmosphere, soil and water.
   - effects on artificial surfaces.
   - effects on planet.
4. Air pollutants transport and dispersion
   - general circulation of atmosphere.
   - mesoscale movements.
   - microscale movements.
   - atmospheric stability.
   - air pollution plumes - behavior and types.
   - air pollution dispersion modelling.
5. Atmospheric chemistry and deposition
   - kinetics, photochemistry and radicals.
   - gaseous phase reactions.
   - gas-particle reactions.
   - dry deposition.
   - wet and occult deposition.
6. Sulphur-containing compounds
   - dimethyl sulfide.
   - carbonyl sulfide.
   - sulphur oxides.
   - the atmospheric sulphur cycle.
7. Nitrogen-containing compounds
   - nitrous oxide.
   - nitrogen oxides.
   - ammonia.
   - the atmospheric nitrogen cycle.
8. Carbon-containing and halogenated-containing compounds
   - classification of hydrocarbons.
   - methane.
   - volatile organic compounds.
   - biogenic hydrocarbons.
   - carbon monoxide and carbon dioxide.
   - halogenated compounds.
9. Atmospheric ozone
   - stratospheric ozone.
   - tropospheric ozone.
   - ozone transport from stratosphere to troposphere.
10. Airborne particles
   - stratospheric aerosol.
   - tropospheric aerosol.
11. Air quality management
   - management strategies and legal framework.
   - air quality criteria and standards.

Course contents (extended version)

- emissions standards.
- monitoring and surveillance networks.
- monitoring methods of air quality and emissions.

12. Emissions prevention and control technologies
    - prevention versus control.
    - exhausting and control emissions system.
    - selection of control emission technologies.
    - particles emissions control technologies.
    - gaseous emissions control technologies.
13. Indoor air quality.
    - pollutants and sources.
    - problems and impacts on human health.
    - prevention and control.

Recommended reading

1. Boubel R. W. , Fox D. L. , Turner D. B. e Stern A. C. 1994. Fundamental of Air Pollution. 3ª Ed. , Academic Press, USA.
2. Gomes J. 2001. Poluição atmosférica: Um Manual Universitário. Publindústria. Edições Técnicas.
3. Hobbs P. V. 2000, Introduction to atmospheric chemistry: a companion text to basic physical chemistry for atmospheric sciences. Cambridge University Press, EUA.
4. Jacob D. J. , 1999. Introduction to atmospheric chemistry. Princeton. EUA.
5. Seinfeld J. H. e Pandis S. N. , 1998. Atmospheric chemistry and physics: from air pollution to climate change. John Wiley & Sons, Canada.

Teaching and learning methods

Conventional lectures with oral presentation of subjects. Labs based upon development of pratical exercises and field experiences involving air pollutant measurents. In tutorial classes, students receive further assistance in ongoing research activities. In tutorial classes, students receive further assistance in ongoing research activities.

Assessment methods

1. Alternative 1 - (Regular) (Final, Supplementary, Special)
    - Practical Work - 30%
    - Final Written Exam - 70%
2. Alternative 2 - (Student Worker) (Final, Supplementary, Special)
    - Practical Work - 30%
    - Practical Work - 70%

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

Carlos Miguel De Sousa Silveira, Manuel Joaquim Sabença Feliciano	Luís de Sousa Costa	Artur Jorge de Jesus Gonçalves	Maria Sameiro Ferreira Patrício
16-12-2022	18-12-2022	20-12-2022	21-12-2022