POLI ESCOLA SUPERIOR TECNOLOGIA GESTÃO TÉCNICO GUARDA	**SUBJECT DESCRIPTION**	**MODELO** PED.013.03

Course	**Energy and Environment**					
Subject	**Air pollution and gaseous effluents treatment**					
Academic year	2023/2024	*Curricular year*	3rd	*Study period*	1st semester	
Type of subject	Compulsory	*Student workload (H)*	Total: 154	Contact: 75	*ECTS*	5.5
Professor(s)	Carlos Alberto Figueiredo Ramos					
☒ *Area/Group Coordinator* ☐ *Head of Department*	Rui Pitarma Ferreira					

PLANNED SUBJECT DESCRIPTION

1. LEARNING OBJECTIVES

It is intended with this curricular unit, in continuity and articulation with the other CU of the degree course in energy and environment, in the context of the Climate Framework Law and the road map for carbon neutrality that students develop knowledge, skills and tools that enable them to be able to:

A. Identify and understand the essential aspects related to the origin of atmospheric pollution, pollutant dispersion, associated transformations and their effects.

B. Identify and understand the main current working tools in the field of air pollution, namely the main aspects of legislation, decarbonization strategies, standards, and regulations as well as the methods of sampling for pollutants.

C. Identify and understand key aspects concerning the main gaseous effluent treatment technologies, including the main decarbonisation techniques and carbon capture.

D. Design and define the main operating conditions of equipment for the control of pollutants in gaseous effluents.

E. Develop technical recommendations to improve the environmental performance of an installation, from the point of view of pollutant emissions.

2. PROGRAMME

1. Introduction. The atmosphere.
2. Major air pollutants their sources and effects of air pollution.
3. Behaviour of pollutants - atmospheric aerosol. Chemical kinetics and photochemistry in the atmosphere.
4. Dispersion of pollutants. Dispersion modelling of pollutants.
5. Management of air quality.
6. Legal and customary procedures.

7. Characterization of gaseous effluents. Gaseous and particulate composition and measurement of air pollutants methods.
8. Dynamic particles. Separation of particles. Overall efficiency. Output distribution.
9. Technologies for removing particulate pollutants: Cyclone Separators. Electrostatic precipitators. Dried filters. Wet scrubbers.
10. Technologies for removing gaseous pollutants: gas-liquid absorption. Gas-solid adsorption. Incineration. Techniques for biological gaseous effluents treatment.
11. Complementary technologies: processes for desulfurization, denitrification and deodorizing.
12. Decarbonisation strategies and techniques: Framework, decarbonisation strategies, decarbonisation techniques and carbon capture.

3. COHERENCE BETWEEN PROGRAMME AND OBJECTIVES

Objective A on key aspects of air pollution is achieved by chapters 1, 2, 3, 4, 5 and 6.

Objective B on the use of key working tools in the field of air pollution is achieved by chapters 4, 5, 6, 7 and 12.

Objective C on key aspects of key technologies for waste gas treatment and decarbonisation is covered in Chapters 8, 9, 10, 11 and 12.

Objective D about the design of equipment for the control of pollutants in gaseous effluents and definition of operating conditions is achieved through the competences acquired in Chapters 8, 9, 10 and 11.

The objective E, concerning the ability to develop technical recommendations to improve the environmental performance of an installation, from the point of view of pollutant emissions, is the most comprehensive of all and requires a critical sense in relation to all the contents taught.

4. MAIN BIBLIOGRAPHY

Mandatory

[1] Nevers, Noel de (2000); Air Pollution Control Engineering, Second Edition, McGraw-Hill International Editions, Civil Engineering Series, New York.

[2] Pereira, Fernando e Matos, M. Arlindo (2007); Técnicas de Tratamento de Efluentes Gasosos, Universidade de Aveiro.

[3] Boubel, R.W. (1994). “Fundamentals of Air Pollution” Academic Press New York.

[4] Almeida, José, (2004); Poluição Atmosférica e Ambiente: Manual de apoio, IPG, Guarda.

Recommended

[5] Jacobson, M.Z. (2002). "Atmospheric Pollution". Cambridge University Press London.

[6] Wark, Kenneth, Warner, Cecil F., Davis, Wayne T. (1998); Air Polution, its origin and control, third edition, Addison Wesley Longman, Inc, Menlo Park, California.

[7] Seinfeld, J.H. and Pandis, S.N. (1998). "Atmospheric Chemistry and Physics – From air pollution to climate change". John Wiley and Sons, New York.

[8] Heumann, William L., (1997); Air Pollution Control Systems, McGraw-Hill, New York.

[9] Resolução do Conselho de Ministros n.º 107/2019; Roteiro para a Neutralidade Carbónica 2050 (RNC 2050).

[10] Figueiredo Ramos, C. A. (2023); Atmospheric and Environment Pollution: support material, IPG; Guarda.

[11] Support material from the subject professor (2023).

5. TEACHING METHODOLOGIES (INCLUDING EVALUATION)

The teaching methodologies used in theoretical and theoretical-practical classes, or on-line, when necessary, are very varied and include interactive exposure, dialogue and methods: demonstrative, interrogative, case studies, simulations, problem solving and site visits with implementation of measures in the areas of environment and energy.

The assessment can be continuous by frequency or normal by final examination.

The continuous assessment by frequency is composed of a test with the value of 12 values and a group work, delivered and presented, with the weighting of 8 values.

6. COHERENCE BETWEEN TEACHING METHODOLOGIES AND OBJECTIVES

The basic concepts and tools at the level of air pollution and waste gas treatment. are taught primarily through the expository method, case studies and site visits with implementation of measures in the areas of environment and energy, to provide students with analytical skills, critical sense and characterization.

7. ATTENDANCE

Students must be present in all classes to make the course more interactive and interesting to reach the proposed objectives with greater efficiency.

8. CONTACTS AND OFFICE HOURS

Contacts of the coordinator of the subject area and the professor of the subject:

Coordinator of the subject area

Name: PhD Rui Pitarma Ferreira

Email: rpitarma@ipg.pt

Office nº 14

Professor of the course

Name: PhD C. A. Figueiredo Ramos

Email: framos@ipg.pt

Office nº 13

Renewable Energies Lab

CISE – GIRS-RES

Attendance hours: Monday, from 11:00 to 12:00;

Tuesday, from 11:30 to 12:30.

DATE 18 de setembro de 2023

SIGNATURES

Professor(s) and Area/Group Coordinator or Head of Department signatures

Area/Group Coordinator

(*PhD Rui Pitarma Ferreira*)

Professor

(*PhD C. A. Figueiredo Ramos*)