MODULE OUTLINE

1. GENERAL INFORMATION

SCHOOL	School of Science and Technology		
PROGRAM COURSE	Environmental Catalysis for Pollution Abatement and Clean Energy Production MSc		
LEVEL OF STUDY	Post-graduate		
MODULE CODE	KPPB80	**YEAR OF STUDY**	1ST
MODULE TITLE	Pollution Abatement Processes		
INDEPENDENT TEACHING ACTIVITIES *in case credits are awarded for separate components/parts of the course, e.g. in lectures, laboratory exercises, etc. If credits are awarded for the entire course, give the weekly teaching hours and the total credits*		**HOURS**	**CREDITS**
Hours per week: 17-18 hours x 32 weeks		520	20 ECTS
MODULE TYPE Compulsory, Optional, Optional mandatory	Compulsory		
PREREQUISITE MODULES:	There are no prerequisites.		
LANGUAGE OF INSTRUCTION AND EXAMS:	GREEK		
THE MODULE IS OFFERED TO ERASMUS STUDENTS	No (due to annual duration of the module)		
MODULE WEBSITE (URL)	https://www.eap.gr/en/environmental-catalysis-for-pollution-and-clean-energy-production/topics/#k80 Each module has its own space in the Learning Management System of EAP, with controlled access (use of code) for students and teaching staff. https://study.eap.gr/course/view.php?id=363		

Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate (certain) level, which students will acquire upon successful completion of the course, are described in detail. It is necessary to consult:

APPENDIX A

- *Description of the level of learning outcomes for each level of study, in accordance with the European Higher Education Qualifications' Framework.*
- *Descriptive indicators for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and*

APPENDIX B

- *Guidelines for writing Learning Outcomes*

Upon successful completion of KPPB80, students will be able to:

- Describe the formation of the main gaseous and liquid pollutants emitted – discharged from mobile and static sources and explain the need to control their emissions, indicating the adverse effects these pollutants have on the environment.
- Describe the structure and composition of the interface that develops between an adsorbent and the aqueous phase.
- Present from both a qualitative and quantitative perspective the adsorption of substances from the gaseous and aqueous phase onto the surface of adsorptive materials.
- Select the most suitable adsorptive material for a given gaseous or aqueous pollution abatement process.
- Select the most suitable adsorption technologies for implementation in the corresponding pollution abatement processes.
- Describe the main primary and secondary catalytic and adsorptive methods of emission control and their function.
- Propose established (state of the art) or potential catalysts for the catalytic methods of emission control and justify their selection based on the conditions a catalyst must have for a given control method, pollutant, and emission source.
- Describe existing and potential applications of catalytic combustion for both primary and secondary control of air pollutant emissions, such as nitrogen oxides (NOx) and volatile organic compounds (VOCs).
- Describe the impact of chlorofluorocarbons (CFCs) on stratospheric ozone and climate change and report on catalytic and non-catalytic processes for the destruction or utilization of CFC stocks.
- Define the basic concepts of photocatalysis and describe photocatalytic processes for the treatment of sewage and potable water.

2. LEARNING OUTCOMES

General Competences

Taking into consideration the general competences that students/graduates must acquire (as those are described in the Diploma Supplement and are mentioned below), at which of the following does the course attendance aim?

Search for, analysis and synthesis of data and information by the use of appropriate technologies,
Adapting to new situations
Decision-making
Individual/Independent work
Group/Team work
Working in an international environment
Working in an interdisciplinary environment
Introduction of innovative research
Project planning and management
Respect for diversity and multiculturalism
Environmental awareness
Social, professional and ethical responsibility and sensitivity to gender issues
Critical thinking
Development of free, creative and inductive thinking
……
(Other…….citizenship, spiritual freedom, social awareness, altruism etc.) …….

After completing this module, students must have acquired the following general skills:

- Search for, analysis and synthesis of data and information by the use of appropriate technologies
- Adapting to new situations
- Decision-making
- Individual/Independent work
- Working in an interdisciplinary environment

- Introduction of innovative research
- Project planning and management
- Respect for the natural environment
- Promotion of free, creative and inductive thinking

3. MODULE CONTENT

The module aims to familiarize postgraduate students with advanced adsorptive, catalytic, and photocatalytic anti-pollution processes, i.e. processes for the destruction or capture of atmospheric pollutants released from static sources (e.g. industrial installations) and mobile sources (e.g. vehicles), as well as processes for the control of pollutants found in various types of waste.

Module Subjects:
1. Catalytic Pollution Abatement Processes
2. Adsorptive Pollution Abatement Processes

Analytical Module Content:
1. Air pollution
2. Liquid pollution
3. The interface between a charged surface of a solid adsorbent and an aqueous solution
4. Adsorption
5. Adsorbent materials
6. Adsorption technology in antipollution processes
7. Control of mobile source emissions
8. Control of emitted nitrogen oxides (NO_x) from static sources
9. Control of emitted volatile organic compounds (VOCs) from static sources
10. Catalytic combustion
11. Controlling the use and escape of chlorofluorocarbons (CFCs)
12. Control of incoming ozone (O_3) in aircraft
13. Control of carbon dioxide (CO_2) and nitrogen oxide (N_2O) emissions
14. Control of emitted sulfur dioxide (SO_2) from static sources
15. Catalytic processes of liquid waste and drinking water

4. TEACHING METHODS ASSESSMENT

MODES OF DELIVERY *Face-to-face, in-class lecturing, distance teaching and distance learning etc.*	Distance education with five Group Counseling Meetings (GCMs) during the academic year on weekends.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGY

Use of ICT in teaching, Laboratory Education, Communication with students

In the GCMs and/or operations they are used:
-remote meeting tools (cisco webex),
-presentation software (powerpoint),
-software specialized in the subjects under training.
In addition, students use office automation tools, web browsers and e-readers for digital books.

In communication with students:
- support of the learning process through the EAP online platform http://courses.eap.gr (course information, educational material postings, announcements, messages, exam results, user groups, discussion forums, etc.).
- Electronic mail (e-mail)

MODULE DESIGN

Description of teaching techniques, practices and methods: Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, Internship, Art Workshop, Interactive teaching, Educational visits, projects, Essay writing, Artistic creativity, etc.

The study hours for each learning activity as well as the hours of selfdirected study are given following the principles of the ECTS.

Activity/Method	*Annual workload*
5 GCMs (x 4 hours)	20
5 Assignments (x 24 hours)	120
Digital educational activity	24
Examination	4
Individual study	392
Total module workload (hours)	**560**

STUDENT PERFORMANCE EVALUATION/ASSESSMENT METHODS

Detailed description of the evaluation procedures:

Language of evaluation, assessment methods, formative or summative (conclusive), multiple choice tests, short- answer questions, open-ended questions, problem solving, written work, essay/report, oral exam, presentation, laboratory work, other……etc.

Specifically defined evaluation criteria are stated, as well as if and where they are accessible by the students.

- Students are assigned to submit five (5) written assignments during the academic year. The average grade of the five (5) written assignments, weighted at 30%, is taken into consideration for the calculation of the final grade. The grade of written assignments is activated only with a score equal to or above the pass level (≥5) in the final exams.
- The grade of the final exams shall be weighted at 70 % for the calculation of the final grade.
- Students have the right to participate in the final exams if (a) at least 50% of the potentially excellent grade has been obtained when adding the total of the five (5) assignments and (b) at least three (3) of the five (5) written assignments have been submitted.

Language of evaluation: Greek

All the evaluation criteria are posted, both in the general regulation of HOU at:
https://www.eap.gr/en/study-regulations/
and the web published study guide at:
https://www.eap.gr/education/odigos-spoudwn-eap/

5. SUGGESTED BIBLIOGRAPHY

- *Suggested bibliography*

1. Adsorption Processes for Pollution Abatement, K. Bourikas, HOU, Patras 2015.

2. Catalytic Processes for Pollution Abatement, K. Bourikas, HOU, Patras 2004.

- *Related scientific journals:*

Journal of the American Chemical Society
Angewandte Chemie – International Edition
Applied Catalysis B: Environmental
Journal of CO_2 Utilization
ACS Catalysis
Journal of Photochemistry and Photobiology C: Photochemistry Reviews
Catalysis Reviews: Science and Engineering
Chemical Engineering Journal
Applied Surface Science
Nature catalysis
Journal of Colloid and Interface Science
Environmental Science & Technology
Surface Science Reports
Advances in Colloid Interface Science
Journal of Environmental Management
Materials
Journal of Chemical Technology and Biotechnology
Applied Water Science
Adsorption Science & Technology
Chemosphere
Science of the Total Environment
Journal of Hazardous Materials