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	KPPB71	**YEAR OF STUDY**	1st	
MODULE TITLE	Catalyst surfaces			
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:	-			
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/#k71 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=362			

2. LEARNING OUTCOMES

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:*
Upon successful completion of KPPB71, students will be able to: • Describe the constituent materials of a static catalyst, • Describe the physico-chemical characteristics that the constituent materials of a solid catalyst must possess in order to be suitable for specific catalytic processes, • Explain how the physico-chemical constituents of a static catalyst may be altered during a catalytic process, • Describe the primary methods of preparing carriers, unsupported and supported catalysts, • Describe the “oxide/aqueous solution” interface,

- Select the suitable physico-chemical methods of determining specific physical, overall chemical or surface chemical characteristics of solid catalysts,
- Describe the basic principles, corresponding experimental provisions and corresponding experimental processes of the primary methods for determining physical, overall chemical or surface chemical characteristics of static catalysts,
- Describe from both a qualitative and quantitative perspective the kinetics of reactions on catalytic surfaces and the influence of mass and heat transfer phenomena on it,
- Describe the most prominent types of catalytic reactors,
- Select the most suitable laboratory catalytic reactor for a given study.

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
- Project planning and management
- Critical thinking
- Working in an international environment
- Working in an interdisciplinary environment
- Introduction of innovative research
- Project planning and management

3. MODULE CONTENT

The module focuses on solid catalysts and especially on their surface characteristics. It deals with the structure, preparation and physicochemical characterization of solid catalysts as well as the "physicochemistry" of the reactions that take place on the catalytic surfaces.
More specifically, the structure and general characteristics of solid catalysts are studied, as well as the physicochemical basis of the preparation methods of unsupported and supported catalysts. In addition, the techniques of determining the physical and overall chemical characteristics of solid catalysts, as well as the chemical characteristics of catalytic surfaces,

are studied. Adsorption and reaction kinetics on catalytic surfaces are also studied, as well as the effect of mass and heat transfer phenomena on the kinetics of heterogeneous catalytic processes. Finally, the module presents and describes the laboratory catalytic reactors.

Module Subjects:
1. Structure of solid catalysts
2. Synthesis of static catalysts
3. Characterization of catalytic surfaces
4. Mechanics of catalytic reactions

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	***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 exam. - 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. Catalytic surfaces, C. Kordulis, A. Lycourghiotis, HOU, Patras 2003.
2. Catalysis, A. Lycourghiotis, C. Kordoulis, HOU, Patras 2003.
3. Surface Science, S. Kennou, HOU, Patras 2003.
4. Modern interactive catalysis, A. Lycourghiotis, HOU, Patras 2016. Digital material of multiple choice exercises within the study platform (study.eap.gr).

-Related scientific journals:

Applied Catalysis B: Environmental
Catalysis Today
Chemical Engineering Journal
Molecular Catalysis
Catalysis Reviews: Science and Engineering
Journal of Catalysis
Applied Catalysis A: General
ACS Catalysis
Catalysis Science and Technology
Catalysts
Catalysis Communications
ChemCatChem
Reaction Kinetics, Mechanisms and Catalysis
Langmuir

The Journal of Physical Chemistry
Industrial Engineering Chemistry Research