ETY503 - Chemical Process Engineering

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ETY 503	**SEMESTER**	5
COURSE TITLE	Chemical Process Engineering		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	6	6
Add rows if necessary. The organization of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialized general knowledge, skills development*	Specialized general knowledge
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES (IN ENGLISH)
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

The contemporary needs of the Greek Chemical Industry, which during the last years was oriented to the heavy production processes, require knowledge of Chemical Industry Processes. By completing the course, the students are expected to have acquired the following:

Knowledge:

Undergraduate students will learn the parameters which influence a production or treatment process with chemical methods. Students will possess fundamental principles of Chemical Reaction and Process Engineering and Kinetics. Furthermore, students will become capable of designing all the basic types of chemical reactors and analyze their operation under ideal flow conditions. Moreover, students should deeply understand the basic principles for solids pore structure analysis and characterization and should be able to calculate Specific Surface area S_g (m^2/g) and Specific Pore Volume V_g(m^2/g) of a porous material using the experimental measurements of a porosimeter. Finally, students should deeply possess the heterogeneous catalytic processes theory and its applications and the catalyst pore structure interpretation.

Abilities:

In the end, the student should possess the ability to choose and operate the optimal chemical systems for a specific process especially heterogeneous catalytic process using the theoretical knowledge and skills gained from this course.

Skills:

Using the theoretical knowledge students will possess the ability to develop the equation of the intrinsic catalytic reaction rate through the reaction mechanism and validate this equation using experimental data. Also, the student will have the ability to combine internal and/or external mass and heat transfer phenomena with mass and energy balances to dimension a chemical reactor and the flow streams of it aiming to its use for a specific chemical process. Finally, the student will have the ability to interpret the pore structure of a solid material using the appropriate theoretical models for experimental porosimetry data treatment.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Production of free, creative and inductive thinking
- Team work
- Decision-making
- Adapting to new situations
- Project planning and management
- Criticism and self-criticism

(3) SYLLABUS

Elements of Thermodynamics of Chemical Reactions. Kinetic behavior of homogeneous chemical reactions: chemical kinetics. Adsorption: materials, equilibrium, isotherms, specific surface area determination, hysteresis phenomena, pore size distribution determination. Adsorption processes: adsorption at equilibrium steps, adsorption by continuous differential contact, chromatography, ion-exchange. Heterogeneous catalytic action - Catalysts: Species, mechanism - theories of heterogeneous catalytic action. Heterogeneous catalytic processes and reactors. Non-catalytic heterogeneous chemical processes: models, types of reactors. Elements of optimization of chemical processes. Complete Mixed Batch Flow Tank Reactors (Batch Tank Reactor). Complete Mixed Continuous Flow Tank Reactors (CSTR). Continuous Plug Flow Reactors (PFR). Mass and Energy Balances for Reactors under Steady or Non-Steady state conditions. Ideal Reactor Size comparison. Tank in series model. Recycle or Batch recycle Reactors. Semi-Batch Reactors. Non-Isothermal Reactor operation.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In class, lectures	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Communication with the students also through the course website	
TEACHING METHODS	***Activity***	***Semester workload***

The manner and methods of teaching are described in detail. *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	Lectures	40
	Tutoring	20
	Self-study for preparing for final examination	40
	Course total	100
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	LANGUAGE OF EVALUATION: Greek METHOD OF EVALUATION: Written final exam based on theory and problems demonstration which were provided through course lectures	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Chemical Process Engineering, Octave Levenspiel, (in Greek, Pomonis, Matis, Papayiannakos, Kordoulis, Mavros, Kolonia, Tziolas Ed., Thessaloniki 2011).
- Chemical Processes for Chemical Technology (in Greek, Antonios Sdoukos, Phillipos Pomonis, Tziola Ed., Thessaloniki 2009).
- Elements of Chemical Processes (in Greek, Konstantinos Matis, Paul Mavros, Konstantinos Triantafyllidis, Tziola Ed., Thessaloniki 2009).