COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
ACADEMIC UNIT	Mechanical Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	ΓΕ1000	**SEMESTER**	1st
COURSE TITLE	Engineering Chemistry		
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**
For the whole course		5	6
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE *general background, special background, specialized general knowledge, skills development*	General Background		
PREREQUISITE COURSES:	None		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE	https://www.mie.uth.gr/?page_id=17686&lang=en		

(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 main purpose of the course is to enable mechanical engineering students develop the chemistry in current and future applications. More specifically, the aim is to acquire the knowledge that help them understand the principles and chemical processes that take place in different systems (cars, fuel cells, photovoltaic systems, antipollution systems, sensors, batteries etc). Moreover introduces the student in subsequent courses (materials, thermodynamics,)

The mission at the completion of the course is to educate engineers in the following areas:

1. The transition from atoms to molecules to devices and then to systems (eg energy conversion and storage)
2. The effect of chemical bonds on physics (evaporation, phase change etc.) and chemical phenomena (eg combustion).
3. The value of chemical reactions and chemical kinetics
4. The role of catalysts and catalysts in modern technological systems (automotive, chemical industry) etc.

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

- Adapting to new situations
- Production of new research ideas
- Search, analyze and synthesize data and information using the necessary technologies
- Independent work

• Team work

(3) SYLLABUS

Introduction to Chemistry: Chemistry and its Evolution as Science, The Purpose of Chemistry, Periodic Table of Elements, Fermi Level, Atom Structure, Periodic Table, Superficial potential, thermocouples. **Chemical bonds:** bonds with and without electrons, covalent, non-polar covalent, polar covalent (heteropolar), ionic, metallic, hydrogen bond, van der Waals, London bonds, states of matter, solids, liquids, gases. **Gases:** Gases, Kinetic-Molecular Theory of Gases, Ideal and Real Gases. **Liquids:** Properties of liquids, density, vapor pressure, surface tension, viscosity, latent heat etc. Aqueous solutions, electrolytes and non-electrolytes, **Solids:** Electrical conductors, Semiconductors, Insulators, Fermi level, Thermocouples, Polymers, Solid Electrolytes, Applications, Semiconductors, Photovoltaic Cells **Thermodynamics:** The Value of Thermodynamics in Mechanical Engineering, First Law of thermodynamics, Second Law of thermodynamics, Gibbs Equation, exergy, anergy. **Chemical reactions:** Thermochemistry, Reaction rate and chemical equilibrium, Acid-base equilibrium, Salt solubility, Oxidation reactions, Acid reactions with metals., Kinetics of chemical reactions, Arrhenius equation. **Introduction to Catalysis:** Catalysis, Catalytic reactions, Combustion reactions. Catalytic converter, λ-sensor, exhaust gas & exhaust control. **Electrochemistry:** Electrochemistry. Electrolysis, Galvanic Systems, Corrosion, Solid State, Electrochemical Systems for Energy Conversion and Storage. Fuel Cells, Electrolysis cells, Lithium batteries etc.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY ***Face-to-face, Distance learning, etc.***	Face to face, Student-centered teaching.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of ICT in teaching and communication with student	
TEACHING METHODS *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*	***Activity***	***Semester workload***
	Lectures	65
	Midterm exams	10
	Team works	15
	Autonomous work	60
	Course total	*150*
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.*	The grades are derived from the written final examination of the semester, the progress made during the semester and the degree of teamwork assigned to students during the semester. The grade in the final exams must be at least five (5) and shall be 70% of the final grade. The remaining 30% is taken into account by the average progress over the semester and the work that are taken from small groups and examined at the end of the semester before the final examination.	

(5) ATTACHED BIBLIOGRAPHY

- D. Ebbing and S. Gammon. “General Chemistry”, Μετάφραση Ν. Κλούρας, Εκδόσεις Π. Τραυλός, 2002
- F.A. Cotton, G.Wilkinson, “Advanced Inorganic Chemistry”, Interscience Science Publishers, 3rd Edition, 1972
- Ν.Δ. Κλούρα, «Βασική ανόργανη Χημεία», Έκτη Έκδοση, Εκδόσεις Τραυλός, 2002.