ETY308 - Chemical Engineering Thermodynamics

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING			
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING			
LEVEL OF STUDIES	UNDERGRADUATE			
COURSE CODE	ETY308	**SEMESTER**	3	
COURSE TITLE	Chemical Thermodynamics			
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			4	4
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*	General background			
PREREQUISITE COURSES:	NO			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK			
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO			
COURSE WEBSITE (URL)	www.polymers.gr			

(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 course is a pivotal axis in engineering and aims to introduce the students in problem solving from an engineering perspective. Course material is focused on the understanding of physical measures such as work, energy and entropy, as well as in the application of those measures as tools to solve practical problems (e.g. optimization of heat transfer, cost effective use of energy for thermal and refrigeration engines, etc.). The most critical focus is the understanding of the fundamental principles of work, energy, entropy, enthalpy, free energy, etc. and their use to solve practical problems.

Upon successful completion of the course the student will be in a position to:

- Grasp the differences between quantities such as work, energy, heat, etc.
- Be able to solve real practical problems obtaining accurate numerical results
- Design and optimize processes in which heat is transformed to work

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…*
	…….

- Project planning and management
- Respect to natural environment
- Working independently

(3) SYLLABUS

The course includes theoretical lessons and laboratory exercises. The course content is concentrated in the following sections:

- Introduction to thermodynamics, energy, heat, work, units, factor-label method
- First law of thermodynamics, state functions, enthalpy, equilibrium, Gibbs phase rule, reversible process, specific heat
- Volumetric properties of pure fluids, state equations, generalized correlations, ideal gas, real gas, virial equation of state, cubic equations of state
- Thermal phenomena, latent heats, standard heat of reaction, thermochemistry
- Second law of thermodynamics, thermal engines, entropy, mathematical representation of the second law of thermodynamics, thermal and thermodynamic efficiency, Carnot cycle.
- Thermodynamic properties of fluids, residual properties, two phase systems, thermodynamic diagrams, tables of thermodynamic properties
- Flow processes, balance equations, duct flow of compressible fluids, turbines, compressors
- Power production from heat, steam engines, internal combustion engines, jet engines, rocket engines
- Refrigeration of liquefaction, Carnot refrigerator, choice of refrigerant, heat pumps, liquefaction processes

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face in class (distant learning during the COVID19 pandemic)
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Extensive use of IT in teaching, power-point presentation, use of internet for teaching, communication via e-mail, MS Teams, and Skype with students.
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*	

Activity	*Semester workload*
Lectures	32
Problem solving lectures	20
Personal study	48

the ECTS		
	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 exams at the end of semester, comsisting of problems to be solved with open books and course material. Final grading is specified from the beginning of the semester to the students to depend upon the accurate numerical result solution as well as the clear and defined path to the final solution of the problems.	

(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography (Greek and Greek translated international books):

– J.M. Smith, H.C. Van Ness, M.M. Abbott, Εισαγωγή στη Θερμοδυναμική, 7η έκδοση, Εκδόσεις Τζιόλα 2012

– • Α. Θ. Παπαϊωάννου, Θερμοδυναμική τόμος Ι, Εκδόσεις Κοράλλι, 2007