COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
ACADEMIC UNIT	Department of mechanical Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	MY0700	**SEMESTER**	4
COURSE TITLE	Physical Metallurgy		

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 and work assignments	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*	Specialized general knowledge
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://www.mie.uth.gr/?page_id=17846&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 Objective of the course is to introduce the student to the fundamental principles of Physical Metallurgy, which underline the evolution and control of the structure of metals and the way by which structure controls properties. The student should understand the crystal structure of metals as well as the thermodynamics and kinetics of structure as a framework for studying phase transformations. He must become able to perform basic calculations concerning phase diagrams, diffusion in metals and alloys as well as to prescribe the basic heat treatments of metallic materials.

With the completion of the course the students will be able to:

- Understand the similarities and differences between the crystal structure of metals and alloys
- Predict weather a structural transformation is feasible with the aid of thermodynamics
- Understand the thermodynamic principles of phase diagrams
- Recognize the basic microstructural elements and perform heat treatments

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…*
	…….

- Search for analysis and synthesis of data and information
- Decision making
- Working independently
- Team work

(3) SYLLABUS

Crystal structure of metals – Grains and grain boundaries – Phases and interphase boundaries – Thermodynamics of structure – Gibbs free energy of Alloys and thermodynamic equilibrium – The Gibbs phase rule – Binary phase diagrams – Kinetic processes in materials – Diffusion and Fick's law – Phase transformations – Nucleation and growth of a new phase – Annealing and recrystallization of metals – The Fe-C system and steels – Martesnitic transformations and hardenability of steels – Heat treatment of steels – Light alloys – Precipitation strengthening and aging – Aluminum, magnesium and titanium alloys – Superalloys.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY ***Face-to-face, Distance learning, etc.***	Face-to-Face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Search phase in the web Search physical and chemical properties in databases Spreadsheet calculations

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	56
Homework	52
Individual Project	42
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.*	Homework, lab project, individual project, mid-term exam, final exam. The mid-term and final exams are closed-book exams and include theoretical questions and problem solving.

(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography:
- Related academic journals:

- G.N. Haidemenopoulos, Physical Metallurgy, Tziolas Publishing, 2007 (in Greek)
- ASM Handbook 9th edition, Vol.1-20, ASM International, 1992
- D.A. Porter and K.E. Easterling, Transformations in Metals and Alloys, Van Nostrand Reinhold, 1983
- R.E. Reed-Hill, Physical Metallurgy Principles, Brooks/Cole Engineering Division, 1973
- P. Haasen, Physical Metallurgy, Cambridge University Press, 1978
- R.W. Cahn and P. Haasen, Physical Metallurgy, Elsevier Science Publishers,1983
- J.K. Wessel, The Hanbook of Advanced Materials, Wiley Interscience, 2004.