COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
DEPARTMENT	PRODUCT AND SYSTEMS DESIGN ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**1004**	**SEMESTER**	**2^{O}**
COURSE TITLE	INTRODUCTION TO THE SCIENCE OF MATERIALS (BSM)		
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		3	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, specialised general knowledge, skills development*	GENERAL BACKGROUND		
PREREQUISITE COURSES:	NONE		
LANGUAGE OF TEACHING AND EXAMINATIONS:	GREEK		
COURSE DELIVERED TO ERASMUS STUDENTS	YES		
MODULE WEB PAGE(URL)	https://eclass.uowm.gr/		

2. LEARNING OUTCOMES

Learning Outcomes

The course is the main introductory course to the concepts of materials and their technology.
The aim of this course is to familiarize students with basic concepts and sizes of materials science. With the lectures, the course aims to provide the student with the necessary knowledge and the basis to be able to understand courses of knowledge and processing of materials, which will be taught in the following semesters. The student is also asked to understand the principles and the way of structuring the technological interest of materials, the relationship between structure, morphology, and behavior of properties of materials that he intends to use as a Product and Systems Design Engineer.

On successful completion of this module the learner will be able to:

1. Know the basic science and technological principles related to materials.
2. Understand basic principles of material properties.
3. Acquire the fundamental experimental and computational skills as an engineer in the field of Materials.
4. Understand the relationship between structure-properties and processes for the design of materials.
5. Apply general mathematics, science, and engineering skills to solving problems related to materials and engineering science.
6. Choose the most suitable materials for various applications.
7. Analyze the data and suggest ways to change the properties of the material.
8. Acquire the necessary skills and techniques for the development and use of modern materials.

General Skills

Upon successful completion of the program students will:

- have the theoretical and practical background that concerns the cognitive field of product design with the most suitable materials.
- apply a wide range of scientific and technical knowledge concerning the design and development of industrial products.

3. COURSE CONTENTS

The course is the first contact of students with the subject of Materials Science and Technology. The aim of the course is to introduce students to the basic concepts of materials and to give them the best background so that they can attend the next courses in the field of materials.
The content of the course is as follows:

- ***Introduction*** The course of Materials over time. Evolution and key milestones. Materials Science and Technology. Classification and Advanced Materials. Today's requirements. Modern Materials and Environment. Examples.
- ***Atomic Structure and Bonds between Individuals.*** Fundamental concepts; Periodic Table; Atomic bonds; Forces and Energies of Bonds, Chemical bonds and classification of materials related to them.
- ***Basic Principles of Crystallography.*** Crystalline structures; crystalline systems; arrangement of atoms; points, directions, and levels in unit cells; monocrystalline; polycrystalline materials; non-crystalline solids.
- ***The Structure of Crystalline Solids.*** Crystalline Metal Structures. FCC Structures, HCP, BCC. Ceramic structure. Crystalline polymer crystallinity, Polymorphism, and allotropy; crystalline structures of dense arrangement. The phenomenon of diffusion. Drying techniques.
- ***The Structure of Polymers.*** Hydrocarbon molecules; Polymer molecules; The chemistry of polymer molecules; molecular configurations.
- ***Imperfections of Solids.*** Point defects; impurities in solids; disturbances; linear defects; trans-surface defects; basic principles of microscopy; microscopy techniques; grain boundaries; determination of granule sizes.
- ***Movement of atoms in materials.*** Diffusion. Diffusion mechanisms. Steady-state diffusion. 1st Fick Law. 2nd Fick Law. Diffusion of non-steady state. Factors of effect on diffusion. Diffusion in Semi-Conductive, Ionic and Polymeric Materials.
- ***Mechanical Properties of Metals.*** Voltage and Deformation; hardness; variation in material properties; design and safety factors.
- ***Disorders and Mechanisms of Strengthening.*** Disturbances and plastic deformity. Characteristics of disturbances. Slipping. Deformation in solution. Potentization by reducing the size of the granules; hardening with endo-shortening. Recovery. Recrystallization. Grain growth.
- ***Failure of materials.*** Fracture. Fundamental principles of fracture. Ductile fracture; Brittle fracture; fatigue; Cyclic tendencies; initiation and propagation of a crack; environmental influences. Creeping. Creeping behavior. Effect of voltage and temperature. Alloys.

4. TEACHING METHODS - ASSESSMENT

<table>
<tr><td>MODE OF DELIVERY
Face to face, Distance learning, etc.</td><td>THEORY.
In class, face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td><td>• Use of appropriate software
• Use of projection system
• Support of teaching process via the electronic platform e-class.</td></tr>
<tr><td>TEACHING METHODS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures (teaching hours)</td><td>45</td></tr>
<tr><td>Independent student's own-time course, preparation of the final exam</td><td>55</td></tr>
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<tr><td>Total Course</td><td>100</td></tr>
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<tr><td>ASSESSMENT METHODS</td><td>Written exam at the end of the semester based on theory and exercises developed during the courses.
The final written exam include:
i. Short-answer questions
ii. Problem solving and
iii. Multiple choice questions</td></tr>
</table>

5. ATTACHED

-Suggested Bibliography:

- Materials science and technology, William D. Callister, Jr., David G. Rethwisch, A. TZIOLA PUBLICATIONS & SONS S.A., 9th Edition, 2016.
- Solid State Physics, Ibach Harald, Luth Hans, ZITI EDITIONS, 1st Edition, 2011.
- Materials Science and Technology, V. Zaspalis, Volume A, 2014, A. TZIOLAS PUBLICATIONS & SONS S.A., 1st Edition

- Related academic journals.