COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
DEPARTMENT	Electrical and Computer Engineering		
LEVEL OF STUDY	Undergraduate		
COURSE UNIT CODE	4.006	**SEMESTER**	4th
COURSE TITLE	Electrotechnical Materials II		

COURSEWORK BREAKDOWN	**TEACHING WEEKLY HOURS**	**ECTS Credits**
Theory (Lectures)	2	2
Tutorial/Exercises	1	1
Laboratory	1	1
TOTAL	**4**	**4**

COURSE UNIT TYPE	General knowledge
PREREQUISITES	
LANGUAGE OF INSTRUCTION/EXAMS	Greek
COURSE DELIVERED TO ERASMUS STUDENTS	No
WEB PAGE (URL)	https://eclass.hmu.gr/courses/ECE131/

(2) LEARNING OUTCOMES

Learning Outcomes

A) The **knowledge**, which the student will acquire upon successful completion of the course includes:
a) the continuous development and advancement of materials utilized in various applications.
b) the types-properties-characteristics of alloys, ceramics, polymeric and magnetic materials.
c) the design of new materials with improved properties.
d) the experimental measurements related with the absolute and relative errors, the separation of direct and indirect measurements, the correct assessment and handling of random and systematic errors in measurements and the correct presentation of results.

B) The **skills**, which the students will obtain upon successful completion of the course are:
a) the correlation of material properties with the applications for the selection of the most suitable material through a wide range of materials.
b) the selection of parameters for the design of materials with improved properties.
c) the understanding and analysis of the data from the exercises in theory as well as laboratory exercises through mathematical calculations.
d) the completion of experimental measurements with reliability, which will be based on the knowledge of the properties and characteristics of the material under investigation.
e) the evaluation of an experimental result through the laws or physical constants estimating the possible experimental errors and methodology to achieve the optimum outcome.
f) the writing-up of an experimental report, which includes the following sections: Introduction, Methodology, Discussion, Conclusions, References.

C) The **abilities**, which the students will get upon the successful completion of the course are:
a) the design of new materials with improved properties.
b) the estimation of the appropriate methodology for the correlation of alloys, ceramics, polymeric and magnetic materials with their applications.
c) the beneficial collaboration with other members of a team in the writing-up of a report.
d) the ability to recognize *in-vivo* and correct or bypass errors or even modify certain steps throughout the process of implementation of an experimental task in order to reach the answer the safest and most unambiguous way.

General Skills
• Autonomous work • Teamwork • Search, analysis and synthesis of data and information, using the necessary technologies • Decision making • Promoting liberal, creative and inductive/deductive thinking • Work in an interdisciplinary environment

(3) SYLLABUS

A. Introduction (Materials-Categories based on the composition/structure/applications)

B. Mechanical properties (Strength of materials. Mechanical stress-strain. Elastic deformation. Poisson ratio. Shear Modulus. Plastic deformation. Tensile strength. Hardness. Hardening. Durability of ceramics. Polymer deformation.)

C. Corrosion (Electrochemical reaction with the environment. Galvanic series. Oxidation. Types of corrosion. Protection. Behaviour of ceramics and polymers in corrosive environments.)

D. Alloys (Brass. Bronze. Aluminium. Magnesium. Titanium.)

E. Ceramics & glasses (Bonds in ceramics. Structure stability. Mechanical properties. Categories of ceramics. Applications. Electrotechnical (inorganic dielectrics). Silicon glasses (tempered glass, powder sintering.)).

F. Polymers (Macromolecules. Crystalline or amorphous. Homopolymers. Copolymers. Composites. Structure of polymers. Thermal and mechanical behaviour. Common artificial polymers. Natural polymers. Organic polymers.)

G. Magnetic materials (Magnetic quantities. Induced magnetization. Paramagnetic materials. Ferromagnetic materials. Properties of ferromagnetism. Categories of soft magnetic materials. Losses of magnetic materials.)

Laboratory Exercises

A series of laboratory exercises will be performed that will cover the following sections: Hardness. Corrosion of metallic materials. Nickel plating and evaluation of Ni coating. Galvanic elements. Glass transition temperature.

(4) TEACHING METHODS - ASSESSMENT

<table>
<tr><td>MODE OF DELIVERY</td><td>In-Class Face-to-Face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGY</td><td>Use of ICTs in lecturing
Use of ICTs for the communication with students via the e-class platform</td></tr>
<tr><td>TEACHING ORGANIZATION</td><td>
<table>
<tr><th>Method description/Activity</th><th>Semester Workload</th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Project (journal/paper reading and theoretical study)</td><td>39</td></tr>
<tr><td>Tutorials</td><td>22</td></tr>
<tr><td>Laboratory exercises</td><td>20</td></tr>
<tr><td>Total Contact Hours</td><td>120</td></tr>
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<tr><td>ASSESSMENT METHODS</td><td>All announcements for the course regulations and complementary reading material are permanently posted in the course web page. The course grade incorporates the following evaluation procedures:
1. Written examination (20 %)
• Problem solving.
• Short answer questions.
2. Final written examination (60 %)
3. Laboratory report (20 %)</td></tr>
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(5) RECOMMENDED BIBLIOGRAPHY

-Recommended Bibliography:

- *Electrotechnical Materials Principles & Applications, S.O. Kasap, Tziola, 2016* ***(in Greek).***
- *Materials Science and Technology, W. Callister, Tziola, 2015* ***(in Greek)****.*

-Relevant Scientific Journals:

- *Journal of Materials Chemistry*
- *Chemistry of Materials*
- *Journal of Electronic Materials*
- *Journal of Physics C: Solid State Physics*
- *Polymer Journal*
- *Journal of Electroceramics*
- *Journal of the European Ceramic Society*