COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
ACADEMIC UNIT	Mechanical Engineering		
LEVEL OF STUDIES	Graduate		
COURSE CODE	MY0701	**SEMESTER**	7th
COURSE TITLE	Technological Materials and Applications		

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 Assignments	5	6
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*	Specialized General Knowledge, Skills Development
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=18409&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 course aims to familiarize students with modern categories of technological materials and their potential applications across various engineering fields. Through a series of thematic units, the course explores materials such as ceramics, composites, porous, foams, auxetics, smart, biocompatible and nanomaterials, in terms of their structure, physicochemical properties and their production and shaping methods. The course focuses on relating the unique functional properties of these materials with cutting-edge applications in mechanical engineering, healthcare, energy, environment, transportation and construction. At the same time, the course promotes interdisciplinary thinking and provides a solid foundation for students interested in pursuing applied or research-oriented directions in engineering and emerging technologies. Special emphasis is placed on the development of skills in scientific bibliographic search, evaluation and documented presentation, enhancing students' ability to effectively communicate technological topics.

Upon completion of the course, students will be able to:

• Identify and describe fundamental characteristics and properties of technological materials.

• Relate the structure and functional properties of materials to various cutting-edge applications.

• Understand basic processing and forming techniques for different material categories.

• Evaluate the suitability of various technological materials for specific applications.

• Develop critical thinking and interdisciplinary approach to the utilization of modern materials and technologies.

• Apply scientific search, documentation and writing skills to present issues related to technological materials.

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, with the use of the necessary technology
- Decision-making
- Working independently
- Team work
- Production of new research ideas
- Production of free, creative and inductive thinking

(3) SYLLABUS

1st Chapter
Introduction to Technological Materials:
Definitions, classifications, the structure-properties-processing-performance relationship; modern requirements & trends.

2nd Chapter
Ceramic Materials:
Traditional and advanced ceramics; optical, electronic, thermal, structural, medical applications.

3rd Chapter
Composite Materials:
Particulate, fibrous, laminated, sandwich composites; examples from automotive, naval, aeronautics, aerospace, sports, construction, energy; challenges.

4th Chapter
Porous Materials:
Micro-/Meso-/Macro-porous, foamed and auxetic structures; applications in environment, energy, health, optical systems, thermal insulation, sound and vibration absorption, electromagnetic shielding, filtration, buildings, vehicles, aeronautics, aerospace, protection, sports, biomedicine.

5th Chapter
Smart Materials:
Chromogenic, electro/magneto-rheological, luminescence, thermo/piezo-electric, shape memory; applications in sensors, actuators, thermal management, energy structures, medical devices, building materials, robotics, wearables.

6th Chapter
Nanomaterials & Nanotechnology:
Nanoparticles, nanotubes, nanosheets, nanowires, nanocomposites, nanostructure-property relationship; applications in health, energy, environment, lubrication, coatings, telecommunications; nanotoxicity.

7th Chapter
Literature Search, Scientific / Technical Writing & Presentation of Projects:
Search techniques, bibliography management tools, academic writing, presentation of scientific and technical work.

(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*	Use of ICT in Teaching and Communication 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 the ECTS

Activity	*Semester workload*
Lectures	56
Homework	52
Autonomous work	42
Course total (25 hours of workload per credit unit)	***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.

Student evaluation is based on the preparation and presentation of an individual or group project, in Greek or English, which includes:

- Written assignment (weight 50%)
- Public presentation (weight 25%)
- Oral examination (weight 25%)

Students have the right to review their corrected report and submit questions about the evaluation.

During the oral presentation, a discussion will take place including questions, feedback and assessment.

The work may be individual or in a group of 2–3 students, on a selected topic related to technological materials and applications.

(5) ATTACHED BIBLIOGRAPHY

- -***Suggested bibliography:***

- "MATERIALS: ENGINEERING, SCIENCE, PROCESSING AND DESIGN", 4th ed., M. Ashby, H. Shercliff & D. Cebon
- "THE SCIENCE AND ENGINEERING OF MATERIALS", 7th ed., D. Askeland & W. Wright
- "FOUNDATIONS OF MATERIAL SCIENCE AND ENGINEERING", 7th ed., W. Smith and J. Hashemi
- "MATERIALS SCIENCE AND ENGINEERING (SI version)", 9th ed., W. Callister & D. Rethwisch
- "MODERN CERAMIC ENGINEERING: Properties, Processing & Use in Design", 4th ed., D. Richerson & W. Lee
- "COMPOSITE MATERIALS, SCIENCE AND ENGINEERING", 4th ed., K. Chawla
- "NANOSTRUCTURES, NANOMATERIALS", K. A. Charitidis
- "NON-METALLIC ENGINEERING MATERIALS", 2nd ed., D. I. Panteli
- "MATERIALS AND ENVIRONMENT", I. Deligiannaki
- "BIOMATERIALS: The Intersection of Biology and Materials Science ", J. S. Temenoff & A. G. Mikos
- "ADVANCED MATERIALS: An Introduction to Modern Materials Science", A. Behera
- "FUNDAMENTALS OF SMART MATERIALS", M. Shahinpoor

- -***Related academic journals:***

- Selected scientific articles and reviews