Materials science and engineering

Academic Year: (2023 / 2024) **Review date: 12/02/2024 11:09:28**

Department assigned to the subject: Materials Science and Engineering and Chemical Engineering Department

Coordinating teacher: MARTINEZ CISNEROS, CYNTHIA SUSANA

Type: Compulsory ECTS Credits : 6.0

Year : 2 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Chemistry

LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgements which include reflection on relevant social, scientific or ethical issues.
CB4. Students should be able to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.
CB5. Students will have developed the learning skills necessary to undertake further study with a high degree of autonomy.
CG1. Analyze and synthesize basic problems related to physics and engineering, solve them and communicate them efficiently.
CG2. Learn new methods and technologies from basic scientific and technical knowledge, and being able to adapt to new situations.
CG3. Solve problems with initiative, decision making, creativity, and communicate and transmit knowledge, skills and abilities, understanding the ethical, social and professional responsibility of the engineering activity. Capacity for leadership, innovation and entrepreneurial spirit.
CG5. Use the theoretical and practical knowledge acquired in the definition, approach and resolution of problems in the framework of the exercise of their profession.
CE7. Understand and apply the principles of basic knowledge of general and inorganic chemistry and its use in engineering.
CE9. Understand and handle the fundamentals of materials science, technology and chemistry, as well as the relationship between microstructure, synthesis or processing and the properties of materials.
CT1. Work in multidisciplinary and international teams as well as organize and plan work making the right decisions based on available information, gathering and interpreting relevant data to make judgments and critical thinking within the area of study.

RA1. To have acquired sufficient knowledge and proved a sufficiently deep comprehension of the basic principles, both theoretical and practical, and methodology of the more important fields in science and technology as to be able to work successfully in them.
RA2. To be able, using arguments, strategies and procedures developed by themselves, to apply their knowledge and abilities to the successful solution of complex technological problems that require creating and innovative thinking.
RA3. To be able to search for, collect and interpret relevant information and data to back up their conclusions including, whenever needed, the consideration of any social, scientific and ethical aspects relevant in their field of study.
RA6. To be aware of their own shortcomings and formative needs in their field of specialty, and to be able to plan and organize their own training with a high degree of independence.

OBJECTIVES

Upon the successful completion of this subject, students will have acquired the following skills:

1. Knowledge, understanding and correlation skills regarding the fundamentals of science, technology and chemistry of materials.
2. Ability to apply the knowledge acquired to identify, formulate and solve problems of science, technology and chemistry of materials.
3. Ability to design and carry out experiments to solve problems of science, technology and chemistry of materials, interpret data and draw conclusions.
5. Ability to select and use appropriate equipment, tools and methods to solve problems of science, technology and chemistry of materials.
7. Ability to combine theory and practice to solve problems of materials science, technology and chemistry of materials.
8. Understanding methods and techniques applicable to science, technology and chemistry of materials and their limitations.
9. Acquisition of technical and laboratory skills in materials science, technology and chemistry of materials.

DESCRIPTION OF CONTENTS: PROGRAMME

Topic 0: Presentation of the course
Topic 1: Bonding in solids
Topic 2: Structure of materials
Topic 3: Defects in crystalline structures
Topic 4: Diffusion in solids. Mass transport
Topic 5: Mechanical properties
Topic 6: Phase diagrams
Topic 7: Metallic materials
Topic 8: Ceramic materials
Topic 9: Polymer materials
Topic 10: Composite materials
Topic 11: Magnetic and electrical properties
Topic 12: Selection of materials

LABORATORY PRACTICES

1. Crystalline structures
2. Cold working of metals
3. Thermal treatments of steels
4. Determination of polymers

LEARNING ACTIVITIES AND METHODOLOGY

Master classes, reduced-group classes, individual tutorship and personal work of the student; focused on acquiring theoretical knowledge.
Laboratory sessions, classes focused on solving problems, individual tutorships and personal work of the student; oriented to the acquisition of practical skills related to the program of the subject.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

The assessment consists of a final test (60% of the final mark) and a continuous evaluation system (40%). For the continuous evaluation to be considered, it is required to obtain a minimum of 4/10 in the final exam.

The continuous assessment consists of:

(i) Three individual tests, with a 30% weight
(ii) Laboratory: execution of four practices. The final laboratory mark will consist of solving a questionnaire or test at the beginning of each one, to check the student¿s knowledge, and a final report. Final laboratory weight: 10%.

The assistance to the laboratory sessions is MANDATORY. The entrance to the laboratory is enabled

% end-of-term-examination/test:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

once the student has watched the general security video and the specific video for chemistry/materials lab and answered both tests correctly. THE STUDENT CAN NOT ENTER THE LABORATORY IF HE/SHE HAS NOT ANSWERED THE TESTS. THE NON-ASSISTANCE TO THE LABORATORY WITHOUT JUSTIFIED CAUSE IMPLIES SUSPENDING THE CONTINUOUS EVALUATION.
Laboratories take place during october and november, according to the corresponding ongoing academic calendar.

BASIC BIBLIOGRAPHY

- M.F. Ashby Engineering materials., Elsevier, 2006

- S. Kalpakjian Manufacturing engineering and technology., Pearson Education, 2014

- W.D. Callister, Jr. Materials Science and Engineering: an introduction., Ed. John Wiley & Sons, 2003

- W.F. Smith Foundations of materials science and engineering., McGraw-Hill Higher Education, 2010