Course guide
390455 - MPBS - Materials Properties in Biological Systems

Unit in charge: Barcelona School of Agri-Food and Biosystems Engineering
Teaching unit: 748 - FIS - Department of Physics.
702 - CEM - Department of Materials Science and Engineering.

Degree: BACHELOR’S DEGREE IN BIOSYSTEMS ENGINEERING (Syllabus 2009). (Optional subject).

Academic year: 2023  ECTS Credits: 6.0  Languages: English

LECTURER

Coordinating lecturer: Ventura Casellas, Heura
Pineda Soler, Eloy
Prats Soler, Clara
Ardanuy Raso, Monica

Others: Rodríguez Rius, Daniel

TEACHING METHODOLOGY

Lectures, discussion sessions, laboratory sessions and seminars.

LEARNING OBJECTIVES OF THE SUBJECT

This course will first introduce basic knowledge of materials properties, types of materials, microstructure and basic characterization methods. The main bulk and surface properties of different materials will be presented and related to engineering applications. Some basic concepts on aging, degradation, durability and reusability of materials will be also presented. The principles of materials selection in engineering applications will be also discussed.

Secondly, several examples of biomaterials and biological materials will be presented. These examples include the study of structure and properties of natural materials, the synthesis and analysis of biopolymers or the properties of certain living tissues. The interaction between materials and biological systems will be also discussed, presenting some examples of biomaterials for bioprocessing and medical applications.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>60,0</td>
<td>40.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h
## CONTENTS

### Materials properties and characterization

**Description:**
1.1 Introduction to materials properties and characterization.
1.2 Bulk and surface properties. Functional and structural properties.
1.3 Classes of materials. Microstructures. Synthesis and techniques of characterization.
1.4 Ageing, fatigue and corrosion. Durability and reusability of materials.
1.5 How to choose the right material? Merit indices and selection of materials in engineering design.

**Related activities:**
Lectures
Team work

**Full-or-part-time:** 50h
Theory classes: 14h
Laboratory classes: 6h
Self study: 30h

### Biopolymers

**Description:**
2.1 Natural materials for engineering applications: biopolymers. Definition, classification and examples. Characterization techniques.
2.2 Comprehensive description of PLA, PHA and other bio-based polymers. Structure, properties, and applications.
2.3 Biocomposites. Definition and properties. Natural fibers and nanoparticles as reinforcements in biocomposites. Biocomposites production techniques and applications.

**Related activities:**
Lectures.
Seminars
Laboratory: Biopolymer characterization
Team work

**Full-or-part-time:** 50h
Theory classes: 11h
Laboratory classes: 9h
Self study: 30h
Living tissues and biomaterials

Description:

Related activities:
Lectures
Seminars
Team work

Full-or-part-time: 50h
Theory classes: 15h
Laboratory classes: 5h
Self study: 30h

GRADING SYSTEM
N1: Written report and oral presentation of the course project.
N2: Practicum reports.
N3: Summaries of the attended seminars and written tests.
Nfinal = 0.40 N1 +0.35 N2 +0.25 N3

BIBLIOGRAPHY
Basic: