Course guide
240EM132 - 240EM132 - Living Tissues and Biointerface

Last modified: 02/06/2022

Unit in charge: Barcelona East School of Engineering
Teaching unit: 702 - CEM - Department of Materials Science and Engineering.

Degree: ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014). (Optional subject).
MASTER'S DEGREE IN MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014). (Optional subject).

Academic year: 2022 **ECTS Credits:** 4.5 **Languages:** English

LECTURER

Coordinating lecturer: ELISABET ENGEL LOPEZ

Others: Primer quadrimestre:
ELISABET ENGEL LOPEZ - T10
SOLEDAD GRACIELA PEREZ AMODIO - T10

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEMCEM-11. (ENG) Gestionar la investigació. Desenvolupament e Innovació Tecnològica, atenent a la tranferència de tecnologia i els drets de propietat i de patents
CEMCEM-01. (ENG) Aplicar coneixements de matemàtiques, física, química, biologia i altres ciències naturals, obtinguts mitjançant estudi, experiènciea i, pràctica, amb raonament crític per a establir solucions viables a problemes tècnics.

Transversal:
01 EIN N2. ENTREPRENEURSHIP AND INNOVATION - Level 2. Taking initiatives that give rise to opportunities and to new products and solutions, doing so with a vision of process implementation and market understanding, and involving others in projects that have to be carried out.
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

TEACHING METHODOLOGY

The subject presents 4,5 ECTS, 2,5 are related to theory, 1 ECTS to the work done by the students consisting in preparing and presenting a work done in group, 0,5 ECTS of continuos evaluation and 0,5 to lab practices. The 2,5 credits of theory will be done in class where the main aspects of living tissues and the interaction with biointerfaces will be developed with the support of books and research papers. Students will do some lab practices for a total time of 6h.
The subject presents a part of continuous evaluation that will involve the development of different works such as solve quetions raisen in class by the professor, discussion of relevant research papers, looking for information about a relevant issue related to the subject, etc. Students will be evaluated for the correct performance of the work as well as for their active participation in class.

LEARNING OBJECTIVES OF THE SUBJECT

Tissue regeneration and reparation can be performed by using substitutive materials or biomaterials and involve some requirements related to the interactions between this biomaterials end the biological entities.
The general objective of this course is to introduce the students in the biological world and to get to know the biological entities (such as cells, proteins and tissues) that will get in contact with the biomaterials and implants. We will analyze all the tissue components, the surface properties and their role in the biological-materials interactions when biomaterials devices are implanted. Also a revision on tissue composition and structure will be performed.

STUDY LOAD

Type	Hours	Percentage
Hours small group	13,5	12.00
Hours large group	27,0	24.00
Self study	72,0	64.00

Total learning time: 112.5 h

CONTENTS

The Cell

Description:
Introduction. Live constitutive molecules. Cell structure. Organization and cell functions. Cell behavior.

Specific objectives:
Introduction of basic concepts on cell biology. Get to know the composition, structure and cell behaviour with the surrounding environment and how they produce the extracelular matrix.

Full-or-part-time: 8h
Theory classes: 8h

Tissues

Description:
Extracelular matrix. Composition. Introduction to animal tissues. Tendons, ligaments, bone, cartilage, skin, etc

Specific objectives:
To knw tissue composition, structure and function.

Related activities:
Oral group presentations on selected tissues.

Full-or-part-time: 11h
Theory classes: 11h

Surfaces

Description:
Surfaces. Modification and functionalization. Surface characterization techniques: wettability, topography, electrical charge, chemical analysis, etc.

Specific objectives:
To identify surface tipology and how to modify them and characterize.

Related activities:
Individual work related to the subject.

Full-or-part-time: 9h
Theory classes: 9h

Role of absorbev proteins on tissue reaction to biomaterials

Description:
Adhesion effect of the adsorbed proteins on the cells materials interactions.
Conformational and biological changes of adsorbed proteins. Relation with surface properties.

Specific objectives:
To analyze surface interactions and biological environments.

Full-or-part-time: 3h
Theory classes: 3h

Tissue response to implants.

Description:
Implants: types and characteristics. Inflamation and repair. Tissue-biomaterial interactions. Inflamtory reaction. Inflamation, scar and foreign body reaction. Blood coagulation. Blood-materials interactions.

Specific objectives:
Revision of the implants knowledge.
Analysis of the body reaction processes to implants.

Related activities:
Individual assesment on the subject.

Full-or-part-time: 6h
Theory classes: 6h

Examples and applications on tissue engineering.

Description:
Tissue engineering applications. Scaffold designs. Examples on tissue regeneration: skin, ligaments, bone, heart, central nervous system, etc.

Specific objectives:
To Correlate the biocompatibility concept with the surface properties and the body's strategies to regenerate tissues.

Related activities:
Team work based on an oral presentation in class where the group will explain a tissue engineering based application.

Full-or-part-time: 8h
Theory classes: 8h

GRADING SYSTEM

The final qualification will come from:
Nfinal 1= 0.45 Nef + 0.25 Npp + 0.35 Ntc
Nfinal 2= 0.65 Nef + 0.35 Ntc
Nfinal final mark
Nef: final exam mark
Npp: mark from partial marks
Ntc: final work mark + continuous evaluation

There will be re evaluation.