



## IDENTIFYING DATA

### (\*)Enxeñaría de superficies para aplicacións biomédicas

Subject	(*)Enxeñaría de superficies para aplicacións biomédicas			
Code	V04M192V01205			
Study programme	Máster Universitario en Ingeniería Biomédica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Optional	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Cristóbal Ortega, María Julia			
Lecturers	Cristóbal Ortega, María Julia			
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Web				
General description	The aim of this subject is to know the principles of surface engineering for biomedical applications.			

## Training and Learning Results

Code	
A1	Knowledge and understanding that provide a basis or opportunity for originality in developing and / or applying ideas, often in a research context.
A3	That students are able to integrate knowledge and handle complexity and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments.
A4	Students can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences clearly and unambiguously.
B4	Ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, abilities and skills in the field of biomedical engineering.
B6	Capacity for handling specifications, regulations and mandatory standards.

## Expected results from this subject

Expected results from this subject	Training and Learning Results
To know the principles of surface engineering for biomedical applications	A1
Advanced knowledge of the various techniques that make it possible to modify the surface of different biomaterials for achieve adequate control over their behavior	A1
To apply the knowledge of surface engineering for biomedical applications	A3 A4 B4 B6
To know the main techniques currently used to characterize these surfaces from the chemical point of view, and microstructural structure that allows obtaining information on the modification carried out and analyzing its effect on the behavior of the biomaterial	A1 A3 B6

## Contents

Topic	
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1. Introduction to the Engineering of Surfaces for applications *biomédicas	1.1 Importance of the surface: superficial properties 1.2 Types of *biomateriales: Interaction of with the half biological 1.3 Concept of Engineering of Surfaces
2.- Technical advanced of superficial modification	2.1 Methods of *texturización 2.2 physical Methods and chemists of *funcionalización of surfaces 2.3 ionic Implantation 2.4 electrolytic Oxidation 2.5 thermal Projection 2.6 *PVD and CVD 2.7 electrochemical Technicians and *electroforéticas 2.8 Coatings by Sol-*gel
3.- Technical of characterisation of the surface	3.1 SEM/*EDS 3.2 *TEM/*EBSD/*FIB 3.3 *SIMS 3.4 *AFM 3.5 *XRD 3.6 Technicians of thermal analysis (*TG, *DSC and *ATD) 3.7 Measures of angle of contact

### Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	20	35.5	55.5
Autonomous problem solving	0	6	6
Laboratory practical	9	9	18
Mentored work	2	20	22
Seminars	3	5	8
Problem and/or exercise solving	2	0	2
Laboratory practice	1	0	1

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

### Methodologies

	Description
Lecturing	Exhibition by part of the professor of the contents on the matter object of study, theoretical bases and/or guidelines of a work, exercise that the/the student has to develop
Autonomous problem solving	Activity in which they formulate problems and/or exercises related with the subject. The student/to has to develop the analysis and resolution of the problems and/or exercises of autonomous form.
Laboratory practical	Activities of application of the knowledges to concrete situations and of acquisition of basic skills and *procedimentales related with the matter object of study. They develop in special spaces with skilled equipment (laboratories, computer classrooms, etc).
Mentored work	The/The student, of individual way or in group, elaborates a document on the thematic of the matter or prepares seminars, investigations, memories, essays, summaries of readings, conferences, etc. The work is presented at the end of the *cuatrimestre in front of the rest of students.
Seminars	Activity focused to the work on a specific subject, that allows to deepen or complement the contents of the matter. Can employ as I complement of the theoretical classes.

### Personalized assistance

Methodologies	Description
Mentored work	The lecturer, during tutorial hours, will resolve any doubts that the student may have.
Lecturing	The teacher, during the development of the theoretical classes, will resolve any doubts that the student may have.
Seminars	The teacher, during the seminar, will resolve any doubts that the student may have.
Laboratory practical	The professor, during the development of the practical laboratory classes, will solve the doubts that the student has.

### Assessment

Description	Qualification	Training and Learning Results
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Mentored work	The student will make of way *individualizada two works *tutelados along the course. One related with the Technicians of Superficial Characterisation, and another related with the Technicians of Superficial Modification. Both works evaluated by the reports presented, and the exhibition in class of the work made. Each one of the works represents 35% of the global note of the matter.	70	A1 A3 A4	B4 B6
Problem and/or exercise solving	It will make by means of a proof written in which they formulate problems and/or exercises related with the contents of the matter	10	A1 A3 A4	B4 B6
Laboratory practice	It will evaluate according to the criteria of assistance, degree of participation and reports of development of practices or of visits to companies (individual or by groups)	20	A1 A3 A4	B4 B6

### Other comments on the Evaluation

Global evaluation: in the two official editions the renunciation to the continuous evaluation and election of the system of global evaluation will make following the procedure and the term established by the centre. It will consist of an only examination written that will have a weight of 100% of the note and will evaluate all the theoretical and practical contents of the subject. 1º EDITION OF THE RECORD: Modality of Continuous Evaluation. Will consist of distinct proofs made during the teaching of the subject and a final proof in the official date previously fixed by the centre. The note obtained will be the corresponding to the sum of the punctuations obtained in the diverse proofs. 2º EDITION OF THE RECORD: Modality of Global Evaluation. It will make a final proof in the official date previously fixed by the centre that will cover the whole of the theoretical and practical contents that will suppose 100% of the note. Extraordinary announcement: it will make in the previously fixed date by the centre. It will consider the system of global evaluation and the examination written will cover the whole of the theoretical and practical contents that will suppose 100% of the note. Ethical behaviour: it expects that the present student a suitable ethical behaviour, attending especially to the indicated in the Articles 39, 40, 41 and 42 of the Regulation on the evaluation, the qualification and the quality of the teaching and of the process of learning of the \*estudiantado of the \*Universidade of Vigo (approved in the \*claustró of 18 April 2023). WARNING: In case of discrepancies between the distinct versions of linguistic of the guide will prevail the indicated in the version in Spanish

### Sources of information

#### Basic Bibliography

M Jaffe, W. Hammond, P Tolia, T Arinzeh (Editores), **Characterization of Biomaterials**, 1, ELSEVIER, 2012

Bandyopadhyay, Amit; Bose, Susmita, **Characterization of Biomaterials**, 1, ELSEVIER, 2013

Saber Amin Yavari (Editor), **Surface Engineering of Biomaterials**, 1, Mdpi AG, 2020

#### Complementary Bibliography

Saber Amin Yavari, **Surface Engineering of Biomaterials**, Coatings, 2020

D. A. Skoog, F. J. Holler, S.R. Crouch, **Principios del análisis instrumental**, 978-607-526-664-0, 7, Cengage Learning, 2018

### Recommendations

#### Subjects that are recommended to be taken simultaneously

(\*) Técnicas avanzadas no invasivas en enseñanza biomédica: Aplicación do láser en medicina/V04M192V01208