



IDENTIFYING DATA

(*)Biomateriales avanzados e enxeñaría tisular

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|---------------------|--|-----------|------|------------|
| Subject | (*)Biomateriales avanzados e enxeñaría tisular | | | |
| Code | V04M192V01106 | | | |
| Study programme | Máster Universitario en Ingeniería Biomédica | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Mandatory | 1st | 1st |
| Teaching language | Spanish | | | |
| Department | | | | |
| Coordinator | González Fernández, Pio Manuel Serra Rodríguez, Julia Asunción | | | |
| Lecturers | Chiussi , Stefano González Fernández, Pio Manuel Serra Rodríguez, Julia Asunción | | | |
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| Web | | | | |
| General description | | | | |

Skills

| | |
|------|--|
| Code | |
| A4 | Students can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences clearly and unambiguously. |
| B1 | Ability to design, develop, implement, manage and improve products and processes in the different areas of the biomedical engineering, by means of appropriate analytical, computational or experimental techniques. |
| B3 | Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations. |
| 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. |
| B5 | Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar works. |
| C6 | Knowledge of tissue engineering and ability to analyze, manage and design biomaterials with advanced properties and response to stimuli. |
| D1 | Ability to understand the meaning and application of the gender perspective in the different fields of knowledge and in professional practice with the aim of achieving a more just and equal society. |
| D3 | Sustainability and environmental commitment. Equitable, responsible and efficient use of resources. |

Learning outcomes

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|--|-------------------------------|
| Expected results from this subject | Training and Learning Results |
| Know the basic principles of tissue engineering and the ones of biomaterials with advanced properties, including response to stimuli | B3 C6 D1 D3 |

| | |
|---|--|
| Apply knowledge of the theoretical concepts of tissue engineering and the ones of biomaterials with advanced properties, including response to stimuli. | A4 B1 B4 B5 C6 D1 D3 |
|---|--|

Contents

| Topic | |
|--|---|
| 1.- Introduction to advanced biomaterials and tissue engineering | 1.1. Basic concepts on advanced biomaterials 1.2. Basic concepts on tissue engineering |
| 2.- Design of advanced biomaterials | 2.1. Basic technical features and examples of bioinspired biomaterials 2.2. Basic 3D design tools 2.3. Scaffolds for tissue engineering 2.4. Biomaterials with osteoconductive and osteoinductive properties 2.5. Biomaterials with bactericidal properties 2.6. Biomaterials with antitumor properties |
| 3.- Smart biomaterials | 3.1. Basic technical features and examples of biosensors 3.2. Heat-transfer-based biomedical devices by laser-induced phototherapy 3.3. Heat-transfer-based biomedical devices by electromagnetic induction 3.4. 4D Printing: 3D biomaterials shape/function modification over time in response to specific temperature, humidity or pressure conditions |
| 4.- Manufacture, characterization and sterilization of advanced biomaterials | 4.1. Techniques for the manufacture of advanced biomaterials 4.2. Techniques for the characterization of advanced biomaterials 4.3. Techniques for the sterilization of biomaterials |
| 5.- Biological evaluation of biomedical devices | 5.1. Nature of the substrate/support for culture and aseptic techniques 5.2. Physicochemical and physiological conditions of the cell growth medium 5.3. Incubation conditions: gas phase, humidity and temperature 5.4. Advantages and disadvantages of cell culture |
| 6.- Case reports | 6.1. Case study in Musculoskeletal System 6.2. Case study in Dentistry 6.3. Case study in Otorhinolaryngology 6.4. Case study in Tissue Engineering |
| 7.- Practical experiences | 7.1. Design and manufacture of advanced biomaterials 7.2. Design and 3D manufacture for tissue engineering 7.3. Hyperthermia testing 7.4. Analysis of advanced biomaterials 7.5. Manufacturing in Clean Room 7.6. Cytotoxicity assay |

Planning

| | Class hours | Hours outside the classroom | Total hours |
|---|-------------|-----------------------------|-------------|
| Lecturing | 10 | 25 | 35 |
| Presentation | 10 | 21 | 31 |
| Case studies | 4 | 5 | 9 |
| Research based methodologies | 4 | 5 | 9 |
| Laboratory practical | 16 | 30 | 46 |
| Essay questions exam | 1 | 0 | 1 |
| Presentation | 1 | 0 | 1 |
| Report of practices, practicum and external practices | 1 | 16 | 17 |
| Systematic observation | 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 | Content exposure by the lecturer on the subject matter of study, including theoretical bases, guidelines for reports and proposal of practical exercises that the student has to develop. |
| Presentation | Oral exposure by the students to the teacher and a group of students on a particular subject of interest within the contents or on the obtained results from a task, exercise, project... It will be carried out individually or in a group. |
| Case studies | Analysis of specific cases on the subject under study. The results of the search and analysis of the information will be presented to the teacher and group of students. |

| | |
|------------------------------|--|
| Research based methodologies | Activities developed in the laboratory practices and the preparation of reports based on the results of the scientific research carried out by following the scientific methodology. |
| Laboratory practical | Activities of application of knowledge to specific situations implying the acquisition of basic and procedural skills related to the subject matter of study. They will be performed in prepared spaces with specialized equipment (laboratories, computer rooms...) |

Personalized assistance

| Methodologies | Description |
|------------------------------|--|
| Presentation | Resolution of doubts and personalized help during one-on-one tutoring hours |
| Research based methodologies | Personalized guide on the experimental work taking into account the specific strengths and needs of each student |
| Laboratory practical | Personalized guide on the experimental work taking into account the specific strengths and needs of each student |

Assessment

| | Description | Qualification | Training and Learning Results | | |
|---|--|---------------|-------------------------------|----------------------|----------|
| Essay questions exam | Tests that include open questions on a developed topic as well as short answer questions. | 30 | B1 | C6 | |
| Presentation | Content exposure by the students to the teacher and/or a group of students on a topic of relevance about the contents or the obtained results from a task, exercise, project... It can be carried out individually or in a group. | 30 | A4 | B3 B4 | C6 |
| Report of practices, practicum and external practices | Preparation of a report by the students in which the characteristics of the assigned work will be reflected. Students must describe the tasks and developed protocol, show the obtained results or observations made, as well as the procedure followed for data analysis and treatment. | 30 | A4 | B1 B3 B4 B5 | C6 |
| Systematic observation | Attentive, rational, planned and systematic perception to describe and record the attitude/aptitude of the student. | 10 | A4 | B4 | D1 D3 |

Other comments on the Evaluation

Sources of information

Basic Bibliography

R. Ian Freshney, **Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications**, 978-1-118-87365-6, 7th, Wiley Blackwell, 2016

William R. Wagner, Shelly E. Sakiyama-Elbert, Guigen Zhang, Michael J. Yaszemsk, **Biomaterials science : an introduction to materials in medicine**, 9780128161388, 4, Elsevier, 2020

Clemens A. van Blitterswijk, Jan de Boer, **Tissue engineering**, 9780124202108, 2, Academic Press, 2015

Complementary Bibliography

Recommendations

Other comments

EXCEPTIONAL MEASURES PLANNED

=== ADAPTATION OF METHODOLOGIES ===

* Teaching methodologies that are modified

* Remote-teaching

The Remote Campus tools will be used in synchronous mode for the presentation of contents, fundamentals, theory, general guidelines for carrying out activities and practical cases. All teaching material and resources will be available on the Faitic platform.

* Non-face-to-face mechanism for student assistance (tutoring)

Personalized attention. Communication via e-mail or other necessary telematic tool. Virtual Office Tutoring (Remote Campus).

=== ADAPTATION OF THE ASSESSMENT ===

On-line tests will be carried out (Remote Campus and Faitic) to expose topics, send papers and a multiple answer questionnaire.

The ratios indicated in the teaching guide of the subject will be maintained.

