

**COURSE DATA****DATA SUBJECT**

Code: 34504
Name: New technologies in biomedicine
Cycle: Undergraduate Studies
ECTS Credits: 4.5
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1204 - Degree in Medicine	Facultat de Medicina i Odontologia	2	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1204 - Degree in Medicine	Optional subjects	ELECTIVES

COORDINATION

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SUMMARY

The first part of the subject introduces and develops the more relevant aspects of image analysis to understand the bases of the image techniques used in Medicine. Thus, the principles of use of laser, thermography, ultrasounds, 3D printing, etc., are established. The second part of the subject is focused on the design and technology to build artificial tissues. Different methods to obtain these tissues are studied, as well as the specific revision of their application to the different systems that form the human body.

PREVIOUS KNOWLEDGE**RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE**

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS**COMPETENCES / LEARNING OUTCOMES**



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Acknowledge diversity and multiculturality.

Capacity for communicating with professional circles from other domains.

Consideration of ethics as a fundamental value in the professional practise.

Criticism and self-criticism skills.

Know how to use IT in clinical, therapeutic and preventive activities, and those of research.

Proper organisation and planning of the workload and timing in professional activities.

Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.

Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.

Team-working skills and engaging with other people in the same line of work or different.

Working capacity to function in an international context.

DESCRIPTION OF CONTENTS

1. INTRODUCTION

UNIT 1. Introduction to the subject.

2. IMAGES BASES AND TECHNIQUES OF USE IN MEDICINE

UNIT 2. Information digitalization. Generalities about the automatic treatment of information. Concept of pixel, voxel, texel. Intensification and restoration of image. Storage, black and white, color and pseudo-color images.

UNIT 3. Techniques of image improvement. Image compression. Preprocessed. Histograms. Segmentation. Characteristics extraction. Visualization improvement. Information extraction. Advanced techniques.



UNIT 4. Properties of ultrasounds. Concept of ultrasound (US). Frequency and intensity ranges of the US in medical applications. Directivity and orientation of the US. Production and detection of the US: direct and inverse piezoelectric effect. Ultrasonic transducers.

UNIT 5. Physical principles of Ultrasonography. General principle of the echography. Echography techniques: A, B and TM. Ultrasonic Doppler. Echographies 3D and 4D.

UNIT 6. Thermography. General characteristics of the thermal radiation (TR). Laws that rule the emission of the TR. Detection of the TR. Characteristics of the obtained image.

UNIT 7. Principles of the laser for medical use. Introduction to laser. Practical consecution of the laser emission. Types of lasers.

UNIT 8. Laser applications in medicine and surgery. Fields of laser application in medicine. Laser surgical application.

UNIT 9. Foundations of 3D printing.

3. BASES OF TISSUE ENGINEERING

UNIT 10. Foundations of tissue engineering and other emerging platforms in translational medicine.

UNIT 11. Extracellular matrix in tissue engineering.

UNIT 12. Technology and design for the construction of artificial tissues.

UNIT 13. Tissue engineering of the cardiovascular system.

UNIT 14. Tissue engineering of the muscle-skeletal system.

UNIT 15. Tissue engineering of the digestive system.

UNIT 16. Tissue engineering of the nervous system.

UNIT 17.- Tissue engineering of the skin and other ectodermic structures.



4. LABORATORY PRACTICES

1. Digital capture and processing of images: use of systems of image captures. Storage, black and white, color and pseudo-color images. Image compression. Preprocessing. Histograms. Segmentation. Characteristics extraction.
2. Image restoration. Improvement in the image visualization. Information extraction. Advanced techniques.
3. Thermography: use of thermographic camera and specific software to determine the map of corporal temperature.
4. Visit to the research laboratory in laser techniques.
5. 3D printing.
6. The laboratory of structural study. Handling of biological samples. Use of essential equipment for sample processing.
7. Handling of experimental in vivo models. Visualization techniques in the histological routine. Morphometric studies.
8. Handling of experimental in vitro models. Supports and substrates for cell culture. Phase contrast microscopy, digital holography to obtain phase contrast images and elastometer.
9. Microscope visualization of constructs obtained by techniques of tissue engineering.
10. Processing techniques of the samples. Parameters to be quantified in the histological studies of constructs.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	19,00
Seminar	6,00
Laboratory	20,00
Total hours	45,00

NON PRESENCIAL ACTIVITIES

Activity	Hours
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Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	42,50
Preparation of lessons	16,00
Preparation for assessment activities	9,00
Resolution of case studies	0,00
Total hours	67,50

TEACHING METHODOLOGY

In the **theoretical lessons**, the teacher will expose, through master class, the most important concepts and contents in a structured way, to obtain the knowledge and skills that the students must acquire. The students' participation will be encouraged. The teaching materials used by the professor will be available, if he considers it appropriate, through the electronic resource Aula Virtual.

Classroom practices: **seminars**. In reduced groups, the professor will set specialized topics in depth, cases studies, bibliography management, current topics... the group work and the oral presentation will be encouraged. It could be understood as "cooperative learning".

Laboratory practices in reduced groups. They are focused on the consolidation of the theoretical knowledge through the practical application of this knowledge. The professor will set the objectives, will inform about the material management, will supervise the realization of the work and will help in the results interpretation.

The gender perspective, the respect for diversity, and the sustainable development goals (SDGs) will be incorporated into teaching, whenever possible.

EVALUATION

Exam assessment of the subject:

60% corresponds to theoretical content of the subject and the 40% of the practical content.

Written test (9 points): 36 test questions with 4 answers, only one valid. 18 questions from each part of the subject.

Continuous evaluation, valuable in the attendance to classes and practices (1 point).

The subject will be passes with a mark equal or superior to 5 points.

Attendance at practical activities is mandatory. The student is considered to meet this requirement if he or she has attended a minimum of 80% of these activities and has adequately justified the impossibility of attending the remaining sessions due to the occurrence of a cause of force majeure. It will be essential to comply with this requirement to pass the subject.



Students are reminded of the importance of carrying out evaluation surveys on all the teaching staff of the degree subjects.

REFERENCES

BASIC:

- Física. Catalá J, ed. Cometa SA, Madrid. 1988.
- Biophysique. Gremy F, ed. Ed. Flammarion Medicine-Sciences. 1982.
- Principios de Ingeniería Tisular, 3ª ed. Lanza R, Lange R, Vacanti J, eds. 2011.
- Recursos e-Salut: ClinicalKey Student Medicina, Odontologia y Enfermería [<https://uv-es.libguides.com/RecursosSalut>] Acces Medicina [https://uv-es.libguides.com/Access_Medicina] Médica Panamericana [https://uv-es.libguides.com/Medica_Panamericana]

COMPLEMENTARY:

- Scientific basis of medical imaging. Wells PNT (Ed.) Longman Group Limited. 2009.