



Universitat de Lleida

DEGREE CURRICULUM  
**ESSENTIAL PHYSICS AND  
MATHEMATICS**

Coordination: OBIS MONNE, ELIA

Academic year 2023-24

Subject's general information

<b>Subject name</b>	ESSENTIAL PHYSICS AND MATHEMATICS			
<b>Code</b>	101500			
<b>Semester</b>	1st Q(SEMESTER) CONTINUED EVALUATION			
<b>Typology</b>	Degree	Course	Character	Modality
	Bachelor's Degree in Biomedical Sciences	1	COMPULSORY	Attendance-based
<b>Course number of credits (ECTS)</b>	6			
<b>Type of activity, credits, and groups</b>	<b>Activity type</b>	PRAULA		TEORIA
	<b>Number of credits</b>	3		3
	<b>Number of groups</b>	2		1
<b>Coordination</b>	OBIS MONNE, ELIA			
<b>Department</b>	EXPERIMENTAL MEDICINE			
<b>Teaching load distribution between lectures and independent student work</b>	Face-to-face: 90 hours Online: 90 hours			
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.			
<b>Language</b>	Catalan, Spanish and English			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
OBIS MONNE, ELIA	elia.obis@udl.cat	6	
SOL CULLERÉ, JOAQUIM	solcullere@gmail.com	3	

## Subject's extra information

The didactic purpose is to make the physical study of biomedical sciences acceptable and to make the role of Physics in these disciplines understandable. It must be made understandable to the student that the laws of Physics - prior to the appearance of life - must be fulfilled by it and that, although their understanding does not guarantee knowing the laws of life, the opposite is true.

### Information needs

The informative needs consist essentially in having to provide the student with a number of specific knowledge, both theoretical and technological, from which the essence and practice of Biomedicine is totally imbued. It is especially advisable that, in the current trend towards superscription, the student has the opportunity to acquire a general knowledge of many principles and technologies, which she will hardly have the opportunity to study systematically, but which she will inevitably need in the future. Today there are a number of biomedical specialties whose theoretical foundation and whose practice are based on sufficiently complex physical or biophysical principles and theories to amply justify learning their foundations.

### Training needs

The most important reason for biophysical education is to train as a scientist. In other words, the need to provide the capacity for abstraction and analysis that the scientific mentality must adopt when faced with specific problems. In this sense, physical-mathematical training is essential. The future graduate as a scientist must acquire the inquisitive and critical attitude that leads him to constantly ask himself about the causes behind any observable and try to give answers with adequate precision and accuracy. It is about instilling in the student the idea that Biomedicine implies Research. It is this concern to contribute to new knowledge with those thousands of hours dedicated to giving answers, the most important aspect of the training of the future graduate.

## Learning objectives

### Knowledge objectives

- Know and understand the terminology of Medical Physics / Biophysics
- Know the physical principles that apply to systems and processes of the human body
- Know the experimental bases on which biophysical knowledge is based
- Know and understand the main applications of Medical Physics / Biophysics in future professional practice

### Objectives on skills

- Access information effectively. Know how to communicate the results of your work to colleagues and specialized personnel
- Acquire judgment and skill in the use of specialized technical instruments
- Learn the systematic work in the laboratory and in the activities of scientific research

### Objectives about attitudes

- Be motivated towards the use of the scientific method and the adoption of scientific attitudes
- Developing a critical spirit and intellectual concern
- Assess the impact and importance of your biophysical knowledge, both for its correct use in your career and professional practice.

## Competences

Competences according to the Study Plan approved by ANECA

1. Know the relevant mathematical and physical concepts for the study of human biology
2. Know how to apply the mathematical and physical concepts learned through biomedical experiments and research

Specific

- Use and know the language, the concepts and the basic applications of Physics to Biomedicine

Transversal

- Training in abstract and scientific thinking
- Learn to make decisions based on rational and scientific analysis within each situation

Activities

- Solving exercises and numerical problems that emulate real situations within the world of Biomedicine / Biophysics

Evaluation

- Written and / or oral resolution of situations learned in the activities

## Subject contents

1. Thermodynamics and Bioenergetics of living beings
2. Transport through membranes
3. Bioelectricity
4. Radiation
5. Biophysics of light and vision
6. Biophysics of sound and hearing
7. Biophysics of circulation
8. Biophysics of respiration
9. Biomechanics

## Methodology

To achieve the objectives and acquire the attributed competences, the following activities are scheduled:

### Master classes

They will be held with all the students.

They are intended to give an overview of the subject's thematic content highlighting those aspects that may be most useful in their training.

### Seminars

They will be held with medium groups and are compulsory attendance.

They are intended for students to apply theoretical concepts and delve into the most important and complex aspects of the topics.

Different activities will be carried out: numerical and reasoning exercises, discussion of real concrete topics in the field of physics and biomedicine, conducting oral presentations and written works, and a visit to research center facilities.

\* In principle, the master classes will be face-to-face and the seminars virtual, and the percentage of virtual and face-to-face hours will be that specified in the teaching guide, but everything is subject to the evolution of the Covid-19 pandemic.

## Evaluation

### Partial exams

There will be two partial exams that include all the theoretical part and the one applied to the seminars in the period and date set by the Faculty of Medicine.

- Partial exam November 25%
- Partial exam January 25%

The exams will consist of test questions, theoretical and numerical exercises and exclude subject.

To pass the course, the student will have to pass each exam with a minimum of 40% of its total value.

There is NO recovery exam for the entire subject.

### Seminars and continuous assessment

The evaluation will be as follows:

- Theoretical and numerical exercises 15%
- Participation in activities 15%
- Written works and oral presentations 20%

## Bibliography

- Jou i Mirabent, D. 1953-. *Física para ciencias de la vida / David Jou Mirabent, Josep Enric Llebot Rabagliati, Carlos Pérez García*. (McGraw-Hill, 1994).
- Cussó, F., López, C. & Villar, R. *Física de los procesos biológicos*. (Ariel, 2004).
- Haynie, D. T. (Donald T. *Biological thermodynamics*. (Cambridge University Press, 2001).
- Nicholls, D. G. & Ferguson, S. J. (Stuart J. *Bioenergetics 3*. (Academic Press, 2002).
- Valiente Llach, R. *Aplicaciones clínicas de la biofísica / Rafael Valiente Llach*. (Uni norte, 2002).
- Nelson, P. C., Radosavljević, M. & Bromberg, S. *Biological physics: energy, information, life*. (W.H. Freeman and Co, 2008).
- Hallett, F. R. (Frederick R. *Physics for the biological sciences: a topical approach to biophysical concepts*. (Nelson, 2003).
- Mozo Villarías, A. *Biofísica y física médica: problemas y ejercicios resueltos*. (Edicions de la Universitat de Lleida, 1994).
- Pérez, P. J., Salvatierra, E. & e-libro, C. *Fundamentos de física*. (Edicions de la Universitat de Lleida, 2014).