

26949 - Biological Physics

Syllabus Information

Academic year: 2023/24

Subject: 26949 - Biological Physics

Faculty / School: 100 - Facultad de Ciencias

Degree: 447 - Degree in Physics

ECTS: 5.0

Year:

Semester: Second semester

Subject type: Optional

Module:

1. General information

Biological Physics is the study of the physical principles by which living things develop, adapt and grow.

Biological Physics is an applied discipline at the boundary between Physics and Biology. Its main objective is that the student acquires a global knowledge of the problems that are at the border between Physics and Biology and develops skills for multidisciplinary work and study. To this end, experiments and models will be studied, at different scales, for the understanding of the most relevant biological phenomena ranging from the structure and dynamics of biomolecules (DNA and proteins) to the Systems Biology.

These approaches and objectives are aligned with the Sustainable Development Goals (SDGs) of the 2030 Agenda of United Nations (<https://www.un.org/sustainabledevelopment/es/>), specifically, the learning activities planned in this subject will contribute to the achievement of Goals 3 and 4.

2. Learning results

- Ability to work and communicate in an interdisciplinary field.
- Understand the structure of the cell as a complex physical system
- Use the appropriate physical models to explain biological systems
- Understand the mechanisms for the motion of objects at low Reynolds numbers.
- Use the techniques of Statistical Physics in equilibrium and non-equilibrium in biological problems.
- Understand the relationship between structure and function based on general principles.
- Understand and obtain the main interactions between biological molecules
- Understand the mechanisms of self-organization of biological systems.

3. Syllabus

I. FUNDAMENTALS

- 0.-Physics and Biology. Motivation and historical introduction.
- 1.- Molecular and Cellular Biology Review. Biological molecules: DNA, RNA and proteins. Membranes.
- 2.- Random walks and diffusion
- 3.- Statistical Physics in equilibrium and out of equilibrium.
- 4.- Life at low Reynolds number.

II. APPLICATIONS

- 5.- Properties of water.
- 6.- Physics of Biopolymers.
- 7.- Cooperative phenomena
- 8.-Self-organization phenomena
9. - Molecular machines: enzymes and molecular motors.
- 10.- Membranes and physics of the nervous system: neurons and networks
- 11.- Systems Biology Gene regulatory networks.

4. Academic activities

1.- **Classroom work** 2 ECTS (50 hours) distributed as follows:

1A .- Participative master classes (35 hours). The following contents will be presented in these classes: 1B .- Group problem solving classes and presentation of articles (12 hours).

1C .- Laboratory practice and/or simulation (3 hours).

2.- Study of scientific works in the context of the subject 0.9 ECTS (22.5 hours).

3.- Study and non-face-to-face work by the student 2 ECTS (50 hours)

4.- Evaluation 0.1 ECTS (2.5 hours).

5. Assessment system

Continuous assessment:

1. Continuous evaluation of the student's learning through the resolution of problems, questions and other activities proposed by subject. The student must submit throughout the term a compendium of all the problems and activities performed (40% of the 4 out of 10).
2. Study and presentation of scientific papers related to the contents of the subject. The student will be provided with series of papers and discussed throughout the term (30% of the final grade, minimum of 4 out of 10).
3. Realisation of a theoretical-practical test in (30% of the final grade, minimum of 4 out of 10). This test will consist of questions on the subject and an exam of problems and questions.

A minimum grade of 4 out of 10 in each section is required to pass the subject. The student can obtain 100% of the final grade of the subject through activities 1, 2, 3.

Passing the subject by means of a single global test

This global test will consist of a written exam (70% of the final grade) and the evaluation of the report of a paper proposed by the teacher (study and analysis of an article related to the subject) and the public defence of the same (30% of the final grade). Students who have passed activity 2 may be exempted from presenting the paper as part of the single global test.