Universidad Zaragoza

Curso Académico: 2021/22

68451 - Introducción a los Métodos Físicos y Matemáticos en Biología

Información del Plan Docente

Año académico: 2021/22
Asignatura: 68451 - Introducción a los Métodos Físicos y Matemáticos en Biología
Centro académico: 100 - Facultad de Ciencias
Titulación: 626 - Máster Universitario en Biofísica y Biotecnología Cuantitativa/Biophysics and Quantitative Biotechnology
Créditos: 6.0
Curso: 01
Periodo de impartición: Primer semestre
Clase de asignatura: Obligatoria
Materia:

1. Información Básica

1.1. Objetivos de la asignatura

The aim of this course is to present a brief summary of the main mathematical and physical tools which will be required during the master to those students whose degree does not include them.

1.2. Contexto y sentido de la asignatura en la titulación

The contents of the course will be necessary to follow subjects such as "*Systems and synthetic biology*" and "*Simulation of Biomolecules*" also in the first semester, or "*Biological modelling*" in the second.

1.3. Recomendaciones para cursar la asignatura

No special recommendations.

2. Competencias y resultados de aprendizaje

2.1. Competencias

Basic and General

1. Order, analyze critically, and interpret information from different types of sources.
2. Develop the learning skills needed to continue studying autonomously new data, methods and applications.
3. Communicate results clear and unambiguously, using suitable presentation tools and with the limitations imposed by time or space.
4. Learn to manage the resources and time available for solving a problem or developing a project.
5. Learn to apply new knowledge to solve problems in wider contexts related to the own area.

Specific

1. Identify the basic algebraic properties present in biological models
2. Understand the analytic tools necessary to formulate evolution models and how they can be solved with computational tools.
3. Understand basic statistical distributions
4. Understand how to build basic models in classical mechanics and classical statistical mechanics.
5. Understand the necessity of quantum mechanical models in Biology and the basical tools used to build them.

2.2. Resultados de aprendizaje

At the end of the course the students should be able to understand the different mathematical tools required to construct the models of biological systems which will appear in the course of *System and synthetic biology* and the physical properties encoded in the different tools described in the course *Simulation of Biomolecules*.

2.3. Importancia de los resultados de aprendizaje

As discussed above, the contents of the course will be necessary to follow subjects such as "*Systems and synthetic biology*"

and "*Simulation of Biomolecules*" also in the first semester, or "*Biological modelling*" in the second.

3. Evaluación

3.1. Tipo de pruebas y su valor sobre la nota final y criterios de evaluación para cada prueba

The grading system will be as follows:

1: (50% of the final grade). Continuous evaluation of the student's progress during the practical and theoretical sessions, through the correction of the practice reports, as well as through direct interaction in the classroom, rewarding active participation during the lectures and practices.
2: (50% of the final grade) Written exam, possibly including computer exercises, and/or resorting to the Moodle platform, on the topics discussed throughout the course.

4. Metodología, actividades de aprendizaje, programa y recursos

4.1. Presentación metodológica general

The course is designed to achieve the learning objectives. Theoretical and practical issues will be often combined in the same session. All lectures will take place in a computer room.

Students are expected to participate actively in the class throughout the semester.

Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, the course syllabus and other course-specific learning materials.

4.2. Actividades de aprendizaje

This is a 6 ECTS course which will be organized in three types of sessions:

- Theory sessions.

- Problem sessions

- Computer laboratory sessions.

From the problem and laboratory sessions the students will have to prepare reports and submit them to be assessed. This part of the students work represents 50% of the final grade.

4.3. Programa

Mathematical Methods:

1. Introduction to linear algebra
    - Vector spaces and linear mappings
    - Matrices
    - Eigenvectors and eigenvalues. Diagonalizability

2. Introduction to calculus
    - Functions in one and several variables
    - Continuity and differentiability. Taylor series.
    - Riemann integral
    - Systems of Differential equations
        - Qualitative methods
        - Partial differential equations

3. Introduction to Statistics and Probability
    - Basic probability distributions
    - Descriptive statistics
    - Basis inference: estimation and basic tests

Physical methods

1. Classical Mechanics
    1. Newton's laws
    2. Hamiltonian mechanics

2. Introduction to Thermodynamics and Statistical Mechanics
    1. Basic thermodynamical functions: energy and entropy
    2. The concept of ensemble
    3. Microcanonical and canonical ensembles. The concept of temperature.
3. Introduction to Quantum Mechanics
    1. The wave function
    2. Schrödinger equation
    3. The hydrogen atom

4.4. Planificación de las actividades de aprendizaje y calendario de fechas clave

Being an introductory course required by the courses of the first semester, the course is scheduled for the first seven weeks of the academic year (end of september-beginning of november), with ten hours of lecture per week. The mathematical methods will cover the first half of the course (end of september-mid october) and the physical methods the second one.

4.5. Bibliografía y recursos recomendados

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=68451