Course guides
230860 - CBS - Complexity in Biological Systems

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 748 - FIS - Department of Physics.
Degree: MASTER'S DEGREE IN ENGINEERING PHYSICS (Syllabus 2018). (Optional subject).
ERASMUS MUNDUS MASTER'S DEGREE IN BIO & PHARMACEUTICAL MATERIALS SCIENCE (Syllabus 2021).
(Optional subject).

Academic year: 2021  ECTS Credits: 4.0  Languages: English

LECTURER
Coordinating lecturer: Alonso Muñoz, Sergio
Others: Pons Rivero, Antonio Javier

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Basic:
CB6. (ENG) Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación.
CB7. (ENG) Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio.
CB10. (ENG) Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

TEACHING METHODOLOGY
Master class, written work, problem resolutions, practical exercises, search of information, practices

LEARNING OBJECTIVES OF THE SUBJECT

- Understand what a complex system is and how to characterize it.
- Obtain a basic knowledge in biological phenomena, from the molecular/cellular scale to the macroscale.
- Dominate numerical techniques and use specific software related with the subject.
- Be able to include the theoretical knowledge to solve biological problems.
- Be able to present the results of a project in a written text and orally. using a precise language and putting the results in the correct context.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>36,0</td>
<td>36.00</td>
</tr>
<tr>
<td>Self study</td>
<td>64,0</td>
<td>64.00</td>
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</tbody>
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Total learning time: 100 h
CONTENTS

Complex spatio-temporal dynamics in biology

Description:
Oscillations, excitability, bistability
Synchronization in biological systems
Spatio-temporal chaos: Cardiac fibrillation

Full-or-part-time: 25h
Theory classes: 9h
Self study : 16h

Analisi of complex biosignals

Description:
Deterministic and stochastic signals
Statistical properties
Nonlinear analysis of temporal series

Full-or-part-time: 25h
Theory classes: 9h
Self study : 16h

Self-organization in biological systems

Description:
Self-assembling: protein folding, and membrane formation
Growing processes: chemotaxis, tumor growing and morphogenesis
Flocking, swarming y gregarious behavior

Full-or-part-time: 25h
Theory classes: 9h
Self study : 16h

Biological networks

Description:
Metabolic networks, interactome, regulatory and signal networks
Neural networks, functional networks and conectome
Networks in ecology and epidemiology

Full-or-part-time: 25h
Theory classes: 9h
Self study : 16h

GRADING SYSTEM

Written test (30%)
Oral test (40%)
Works done by the student (30%)