Course guide
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: 2023  ECTS Credits: 4.0  Languages: English

LECTURER

Coordinating lecturer: Consultar aquí / See here:
https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura
Others: Consultar aquí / See here:
https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma

PRIOR SKILLS

Linear Stability of nonlinear systems
Minimal Knowledge of computer programming
Minimal Knowledge of numeric methods

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Basic:
CB6. Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context
CB7. Students should know how to apply the knowledge acquired and their problem-solving ability in new or little-known environments within broader (or multidisciplinary) contexts related to their area of study.
CB10. Students should possess the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.

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>
</tr>
</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
- Stochastic biochemistry

**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:**
- Excitability and cardiac tissue
- Self-assembling: protein folding, and membrane formation
- Cell polarization, chemotaxis, and morphogenesis

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

Biological networks

**Description:**
- Introduction to networks
- Networks in Biology
- Networks in the brain

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

Written test (40%)
Works done by the student (60%)

Possibility of reevaluation of the 100% of the course with a written examination in case of failure only if all the works have been presented

BIBLIOGRAPHY

Basic: