230860 - CBS - Complexity in Biological Systems

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 748 - FIS - Department of Physics
Academic year: 2018
ECTS credits: 4
Teaching languages: English

Teaching staff
Coordinator: Alonso Muñoz, Sergio
Others: Pons Rivero, Antonio Javier

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>Total learning time: 100h</th>
<th>Hours large group:</th>
<th>36h</th>
<th>36.00%</th>
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<tbody>
<tr>
<td></td>
<td>Self study:</td>
<td>64h</td>
<td>64.00%</td>
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## Content

### Complex spatio-temporal dynamics in biology

**Learning time:** 25h  
**Description:**  
Oscillations, excitability, bistability  
Synchronization in biological systems  
Spatio-temporal chaos: Cardiac fibrillation

### Analisi of complex biosignals

**Learning time:** 25h  
**Description:**  
Deterministic and stochastic signals  
Statistical properties  
Nonlinear analysis of temporal series

### Self-organization in biological systems

**Learning time:** 25h  
**Description:**  
Self-assembling: protein folding, and membrane formation  
Growing processes: chemotaxis, tumor growing and morphogenesis  
Flocking, swarming y gregarious behavior

### Biological networks

**Learning time:** 25h  
**Description:**  
Metabolic networks, interactome, regulatory and signal networks  
Neural networks, functional networks and conetome  
Networks in ecology and epidemiology
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**Qualification system**

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

**Bibliography**