



## Course guides

# 230860 - CBS - Complexity in Biological Systems

Last modified: 29/04/2020

**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).

**Academic year:** 2020    **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/celular 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

Type	Hours	Percentage
Self study	64,0	64.00
Hours large group	36,0	36.00

**Total learning time:** 100 h



## CONTENTS

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### 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

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