



Academic year	2014-15
Subject	11005 - Introduction to Complex Systems
Group	Group 1, 1S
Teaching guide	A
Language	English

## Subject identification

<b>Subject</b>	11005 - Introduction to Complex Systems
<b>Credits</b>	0.75 de presencials (18.75 hours) 2.25 de no presencials (56.25 hours) 3 de totals (75 hours).
<b>Group</b>	Group 1, 1S
<b>Teaching period</b>	1st semester
<b>Teaching language</b>	English

## Professors

Lecturers	Horari d'atenció als alumnes					
	Starting time	Finishing time	Day	Start date	Finish date	Office
Emili Hernandez Garcia <a href="mailto:ehg899@uib.es">ehg899@uib.es</a>	09:00h	10:00h	Thursday	01/10/2014	31/07/2015	IFISC, 214
Maximino San Miguel Ruibal <a href="mailto:msr260@uib.es">msr260@uib.es</a>	14:00h	15:00h	Wednesday	01/09/2014	19/07/2015	IFISC 213
Roberta Zambrini --	You need to book a date with the professor in order to attend a tutorial.					

## Contextualisation

This is one of the compulsory courses of the Structural Module of the Master in Physics of Complex Systems. The objective is to provide an overview of different topics that will be developed in specific courses in order to give to the students a global view of the contents of the Master.

## Requirements

There are not specific requirements, being an introductory course.

## Skills

### Specific

- \* General understanding on key concepts of Complex Systems, such as collective phenomena, emergence, nonlinearity, thresholds, criticality, multi-scale phenomena, power laws and measures of complexity.

### Generic

- \* To be able to describe, both mathematically and physically, complex systems in different situations (TG1).





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- \* To acquire the capacity to develop a complete research plan covering from the bibliographic research and strategy to the conclusions (TG2).
- \* To write and describe rigorously the research process and present the conclusions to an expert audience (TG3).
- \* To acquire the ability to ask questions, read and listen critically and participate actively in seminars and discussions (TG4).
- \* To acquire the ability to disseminate and present the concepts acquired at a non-expert (TG5).

### Basic

- \* You may consult the basic competencies students will have to achieve by the end of the Master's degree at the following address: [http://estudis.uib.cat/master/comp\\_basiques/](http://estudis.uib.cat/master/comp_basiques/)

## Content

### Theme content

1. What are complex systems'
2. Collective phenomena. Emergence
3. Networks as skeletons of complex systems
4. Nonlinearity. Thresholds. Criticality
5. Multi-scale phenomena. Power laws
6. Information, computation and measures of complexity.
7. Complexity in physical systems
8. Complexity in social systems
9. Complexity in ecology and life sciences

## Teaching methodology

### In-class work activities

Modality	Name	Typ. Grp.	Description	Hours
Theory classes	Lessons	Large group (G)	Presentation of all the course contents	11.25
Practical classes	Exercises and discussions	Large group (G)	Exercises and attendance to seminars	6.5
Assessment	Presentation	Large group (G)	Presentation of a 2 pages paper on a subject of the course	1

At the beginning of the semester a schedule of the subject will be made available to students through the UIBdigital platform. The schedule shall at least include the dates when the continuing assessment tests will be conducted and the hand-in dates for the assignments. In addition, the lecturer shall inform students as to





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whether the subject work plan will be carried out through the schedule or through another way included in the Campus Extens platform.

### Distance education work activities

Modality	Name	Description	Hours
Individual self-study	individual study	Understanding theoretical concepts	28
Individual self-study	writing of a paper	Preparation of a 2 pages paper on a subject of the course	28.25

### Specific risks and protective measures

The learning activities of this course do not entail specific health or safety risks for the students and therefore no special protective measures are needed.

### Student learning assessment

#### Exercises and discussions

Modality	Practical classes
Technique	Other methods ( <b>non-retrievable</b> )
Description	Exercices and attendance to seminars
Assessment criteria	Exercices and active attendance to seminars (questions and comments)

Final grade percentage: 20%

#### Presentation

Modality	Assessment
Technique	Papers and projects ( <b>non-retrievable</b> )
Description	Presentation of a 2 pages paper on a subject of the course
Assessment criteria	Quality of presentation and adequacy of answers to questions

Final grade percentage: 40%





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### writing of a paper

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Modality	Individual self-study
Technique	Papers and projects ( <b>non-retrievable</b> )
Description	Preparation of a 2 pages paper on a subject of the course
Assessment criteria	Deepness and conciseness of the paper

Final grade percentage: 40%

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## Resources, bibliography and additional documentation

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### Basic bibliography

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N. Boccara  
Modeling Complex Systems  
(Springer-Verlag, 2nd edition, New York, 2010)  
M. Mitchell  
Complexity: A Guided Tour  
Oxford University Press, USA; First Edition edition (2009)  
G. Nicolis, C. Nicolis  
Foundations of Complex Systems: Nonlinear Dynamics, Statistical Physics, Information and Prediction  
World Scientific (2007)

### Complementary bibliography

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Papers recommended during the course

