Syllabus

Subject

Subject / Group	11005 - Introduction to Complex Systems / 1
Degree	Master's Degree in Physics of Complex Systems
Credits	3
Period	First semester
Language of instruction	English

Professors

Lecturers	**Office hours for students**					
	Starting time	**Finishing time**	**Day**	**Start date**	**End date**	**Office / Building**
Maximino San Miguel Ruibal *(Responsible)* msr260@uib.es	13:00	14:30	Wednesday	01/09/2018	26/07/2019	IFISC
Emilio Hernandez Garcia ehg899@uib.es	10:00	11:30	Friday	01/10/2018	27/07/2019	IFISC, # 214
Roberta Zambrini -	15:30	16:30	Tuesday	03/09/2018	01/07/2019	206

Context

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 developped 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) .
* To acquire the capacity to develop a complete research plan covering from the bibliographic research and strategy to the conclusions (TG2) .

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* 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/

Content

Range of topics

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 (0.75 credits, 18.75 hours)

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)	Exercices and attendance to seminars	4.5
Assessment	Presentation	Large group (G)	Presentation of a document or materials on a subject of the course	3

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

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Distance education tasks (2.25 credits, 56.25 hours)

Modality	Name	Description	Hours
Individual self-study	individual study	Understanding theoretical concepts	28
Individual self-study	elaboration of document or materials	Preparation of a document or materials 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

Frau en elements d'avaluació

In accordance with article 33 of Academic regulations, "regardless of the disciplinary procedure that may be followed against the offending student, the demonstrably fraudulent performance of any of the evaluation elements included in the teaching guides of the subjects will lead, at the discretion of the teacher, a undervaluation in the qualification that may involve the qualification of "suspense 0" in the annual evaluation of the subject".

Exercises and discussions

Modality	Practical classes
Technique	Other methods **(non-retrievable)**
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 **(non-retrievable)**
Description	Presentation of a document or materials 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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elaboration of document or materials

Modality	Individual self-study
Technique	Papers and projects **(non-retrievable)**
Description	Preparation of a document or materials on a subject of the course
Assessment criteria	Deepness, and explanatory and outreach potential of the document or materials

Final grade percentage: 40%

Resources, bibliography and additional documentation

Basic bibliography

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

Papers recommended during the course

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