Universitat de les Illes Balears

Teaching guide

Subject identification

Subject	11004 - Pattern Formation
Credits	0.75 de presencials (18.75 hours) 2.25 de no presencials (56.25 hours) 3 de totals (75 hours).
Group	Group 1, 1S (Campus Extens)
Teaching period	First semester
Teaching language	English

Professors

Lecturers	Horari d'atenció als alumnes					
	Starting time	Finishing time	Day	Start date	Finish date	Office
Damià Agustí Gomila Villalonga	10:30	12:30	Tuesday	03/10/2016	30/06/2017	216

Contextualisation

This is one of the compulsory courses of the Structural Module of the master in Physics of Complex Systems. It runs paralelly and greatly complements the "Dynamical systems and chaos" course (11001) to privide the foundations for the analysis and modeling of nonlinear spatially distributed systems. The contents exposed here are necessary in several of the courses of the Specific Module, in particular the course on "Spatiotemporal dynamics" (11009) is a direct continuation of this one.

Requirements

Recommendable

It is convenient to have knowledge on the basics of ordinary and partial differential equations, and on linear algebra.

Skills

This course develops both specific and generic skills:

Specific

* E9: To know stability analysis techniques and know how to build bifurcation diagrams..
* E12: To know the essential phenomenology of pattern formation in physical, chemical or biological systems..
* E13: To Know the multiple scales methods and how to obtain amplitude equations..

Document automatically generated at 1301:19 of 29/06/2017

Teaching guide

Generic

* TG1: To be able to describe, both mathematically and physically, complex systems in different situations..
* TG2: To acquire the capacity to develop a complete research plan covering from the bibliographic research and strategy to the conclusions..
* TG3: To write and describe rigorously the research process and present the conclusions to an expert audience..

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

Theme content

1.-. Introduction and Phenomenology
Patterns in convection and other fluid instabilities. Chemical reactions. Optics. Biological processes.

2.-. Linear stability analysis for partial differential equations
The cases of confined systems and large systems.

3.-. Weakly nonlinear analysis
Method of multiple scales. The Swift-Hohenberg model. Types of instabilities.

4.-. Amplitude equations
Generic phenomena. Ginzburg-Landau type equations. Secondary instabilities. Complex spatiotemporal behavior.

5.-. Phase dynamics
Periodic modulations of patterns and waves.

Teaching methodology

In-class work activities

Modality	Name	Typ. Grp.	Description	Hours
Theory classes	Theoretical lectures	Large group (G)	Exposition of theoretical concepts by the lecturer.	9.5
Practical classes	Practical sessions and demonstrations	Large group (G)	Resolution of problems and questions. Observations of nonlinear phenomena.	6.5
Assessment	Exam	Large group (G)	The exam is intended to evaluate the knowledge adquired by the students. It will contain problems and some conceptual questions.	2.75

Document automatically generated at 1301:19 of 29/06/2017

Teaching guide

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 Campus Extens platform.

Distance education work activities

Modality	Name	Description	Hours
Individual self-study	Assignments	The student has to solve assigned exercises and present the solutions in written form.	28.25
Individual self-study	Study and understanding theoretical concepts	The student should understand and assimilate the theoretical concepts and techniques explained in the lectures.	28

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

Exam

Modality	Assessment
Technique	Objective tests **(non-retrievable)**
Description	The exam is intended to evaluate the knowledge adquired by the students. It will contain problems and some conceptual questions.
Assessment criteria	Accuracy of the answers. Clarity and quality of the explanations

Final grade percentage: 50%

Assignments

Modality	Individual self-study
Technique	Papers and projects **(non-retrievable)**
Description	The student has to solve assigned exercises and present the solutions in written form.
Assessment criteria	Accuracy of the results. Clarity and quality of the explanations and interpretation of the results. Quality of the written presentation

Final grade percentage: 50%

Resources, bibliography and additional documentation

Date of publication: 14/07/2016

Document automatically generated at 1301:19 of 29/06/2017

Teaching guide

Universitat de les Illes Balears

Basic bibliography

M. Cross and H. Greenside, Pattern Formation and Dynamics in Nonequilibrium Systems, Cambridge University Press 2009.
D. Walgraef, Spatio-Temporal Pattern Formation, Springer 1997.

Date of publication: 14/07/2016

Document automatically generated at 1301:19 of 29/06/2017