Syllabus

Subject

Subject / Group	11009 - Spatiotemporal Dynamics / 1
Degree	Master's Degree in Physics of Complex Systems
Credits	3
Period	Second semester
Language of instruction	English

Professors

Lecturers	Office hours for students					
	Starting time	Finishing time	Day	Start date	End date	Office / Building
Damià Agustí Gomila Villalonga	10:30	12:00	Tuesday	03/09/2018	31/07/2019	Despatx 216/IFISC

Context

Requirements

Recommended

11001 - Dynamical Systems and chaos

11004 - Pattern Formation

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. .

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. .

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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. Global bifurcations. Homoclinic and heteroclinic orbits.
2. High codimension bifurcation points.
3. Spatio-temporal structures.
4. Fronts and localized structures. Spatial dynamics.
5. Excitable media.

Teaching methodology

In-class work activities (0.75 credits, 18.75 hours)

Modality	Name	Typ. Grp.	Description	Hours
Theory classes	Lectures	Large group (G)	Lectures on the blackboad complemented with slides.	10
Practical classes	Tutorials	Large group (G)	Problem solving by the teacher and students.	6.25
Assessment	Written exam	Large group (G)	Written exam.	2.5

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.

Distance education tasks (2.25 credits, 56.25 hours)

Modality	Name	Description	Hours
Individual self-study	Problem solving	Solving the problems and exercises given to each student.	28.25
Individual self-study	Consolidating theoretical concepts	Autonomous individual study and work to consolidate concepts and techniques explained in the lectures.	28

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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".

Tutorials

Modality	Practical classes
Technique	Papers and projects **(retrievable)**
Description	Problem solving by the teacher and students.
Assessment criteria	Correctness of the results; quality of the explanations and interpretation of the results; quality of the written paper

Final grade percentage: 50%

Written exam

Modality	Assessment
Technique	Objective tests **(retrievable)**
Description	Written exam.
Assessment criteria	Correctness of the results; quality of the explanations and interpretation of the results; quality of the written paper

Final grade percentage: 50%

Resources, bibliography and additional documentation

Basic bibliography

- J. Guckenheimer and P. Holmes, *Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields* (Springer-Verlag, New York, 1983)
- P. Glendinning, Stability, instability and chaos (Cambridge University Press, Cambridge, 1994)

- M. Cross and H. Greenside, *Pattern formation and dynamics in nonequilibrium systems* (Cambridge University Press, New York, 2009)

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- D. Walgraef, *Spatio-Temporal Pattern Formation* (Springer-Verlag, New York, 1997)

Complementary bibliography

- Yu.A. Kuznetsov, Elements of Applied Bifurcation Theory (Springer-Verlag, New York, 2004)
- A.S. Mikhailov, *Foundations of Synergetics I* (Springer-Verlag, Berlin, 1994)

- P. Manneville, *Dissipative Structures and Weak Turbulence* (Academic Press, London, 1990)

- J.D. Murray, *Mathematical Biology 3rd Ed.* (Springer-Verlag, Berlin, 2002)

- E. Ott, *Chaos in Dynamical Systems 2nd Ed.* (Cambridge University Press, Cambridge, 2002)

- S.H. Strogatz, *Nonlinear Dynamics and Chaos* (Perseus, 1994)

- L. N. Trefethen, *Spectral Methods in Matlab* (SIAM, Philadelphia, 2000)

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