University of the Balearic Islands

Teaching guide

Academic year	2014-15
Subject	11298 - Introduction to Dynamic Systems
Group	Group 1, 1S
Teaching guide	A
Language	English

Subject identification

Subject 11298 - Introduction to Dynamic Systems
Credits 1 de presencials (25 hours) 2 de no presencials (50 hours) 3 de totals (75 hours).
Group Group 1, 1S (Campus Extens)
Teaching period 1st semester
Teaching language English

Professors

Lecturers	Horari d'atenció alumnes					
	Starting time	Finishing time	Day	Start date	Finish date	Office
Bartomeu Coll Vicens tomeu.coll@uib.es	11:00h	12:00h	Tuesday	01/09/2014	30/06/2015	174, edifici Anselm Turmeda. En qualsevol cas, es pot concertar la tutoria amb els professor
	15:00h	16:00h	Monday	01/09/2014	30/06/2015	174, edifici Anselm Turmeda. En qualsevol cas, es pot concertar la tutoria amb els professor
	11:00h	12:00h	Wednesday	01/09/2014	30/06/2015	174, edifici Anselm Turmeda. En qualsevol cas, es pot concertar la tutoria amb els professor
Rafel Jaume Prohens Sastre rafel.prohens@uib.es	15:30h	16:30h	Wednesday	22/09/2014	31/07/2015	ATD165

Contextualisation

This course, which is a part of the module Dynamical Systems, has the aim to introduce advanced concepts tools concerning Dynamical Systems.

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A particular emphasis will be done in the local and global stability Theory and their relationship with structural stability of dynamical systems.
Applications and practical problems will also be of particular interest in this course. One of the main goals is to provide, through seminars and practical sessions, a good skill in these two aspects.

This course will be taught by two professors whose publications in journals on the subject ensure proper development of the topics.

Requirements

Recommendable

It is highly recommended to have attended a course in differential equations.

Skills

Specific

* CE6. Ability to translate the research results in a written report and of expose clearly and succinctly in an oral presentation, according to the usual practice in the international cientific community..
* EMA1 Ability to understand the specific language of the treated application (neuroscience, images, dynamic systems) and ability to work in the field interdisciplinary..
* * EMA3 Ability to relate the theory of dynamical systems with applications in the different covered fields: mechanics, circuit theory, neuroscience.....

Generic

* CG1. A systematic understanding of a field of study and mastery of skills and methods of research associated with that field..

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 to the Qualitative Theory of ODEs
    * Vectorial field, flow
    * Dynamical System
    * Phase portrait, equivalence, local structure of equilibrium points, Hartman-Grobman Theorem
2. Return map
    * Transversal section

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* Tubular flow box Theorem
* Return map and periodic orbits

3. Poincaré-Bendixson Theorem
* alpha- and omega-limit set
* Poincaré-Bendixson Theorem
* Applications

4. Stability Theory
* Lyapunov functions
* Stability Theory
* Perturbation Theory
* Limit cycles

5. Structural instability Theory
* Poincaré compactification, local charts, critical poits at infinity
* Structural instability Theory

Teaching methodology

In-class work activities

Modality	Name	Typ. Grp.	Description	Hours
Theory classes		Large group (G)	The basic theoretical concepts will be explained so that them could be applied to several concrete problems.	17
Seminars and workshops		Medium group (M)	These sessions will be devoted to evaluate the practical skills	2
Practical classes		Large group (G)	These sessions will be devoted to develop the practical skills	4
Assessment		Large group (G)	These sessions will be devoted to evaluate the theoretical and practical skills through an oral presentation of a memory.	2

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		Students will devote part of their home study to study in depth the concepts explained in theory class. Students will devote part of their time to solving various problems that will be done throughout the course.	50

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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

Seminars and workshops

Modality	Seminars and workshops
Technique	Oral tests **(non-retrievable)**
Description	These sessions will be devoted to evaluate the practical skills
Assessment criteria	

Final grade percentage: 60% with minimum grade 3

Assessment

Modality	Assessment
Technique	Papers and projects **(non-retrievable)**
Description	These sessions will be devoted to evaluate the theoretical and practical skills through an oral presentation of a memory.
Assessment criteria	These sessions will be devoted to evaluate the theoretical and practical skills through an oral presentation of a memory.

Final grade percentage: 40% with minimum grade 5

Resources, bibliography and additional documentation

Basic bibliography

* "Qualitative Theory of Planar Differential Systems" Springer (Universitext); Freddy Dumortier, Jaume Llibre, Joan C. Artés. ISBN-10: 3540328939 | ISBN-13: 978-3540328933 | Edition: 2006
* "Practical Bifurcation and Stability Analisys, from equilibrium to chaos" Springer-Verlag (Interdisciplinary Applied Mathematics, Vol. 5); R. Seydel, December 10, 2009 | ISBN-10: 144191739X | ISBN-13: 978-1441917393 | Edition: 3rd
* "Differential Equations, Dynamical Systems and Linear Algebra", Academic Press 1974, M. W. Hirsch, S. Smale

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