Universitat de les Illes Balears

Teaching guide

Academic year	2015-16
Subject	11299 - Techniques for Studying Periodic Solutions to Periodic Differential Equatio
Group	Group 1, 1S
Teaching guide	A
Language	English

Subject identification

Subject	11299 - Techniques for Studying Periodic Solutions to Periodic Differential Equatio
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	First semester
Teaching language	English

Professors

Lecturers	**Horari d'atenció als alumnes**					
	Starting time	**Finishing time**	**Day**	**Start date**	**Finish date**	**Office**
María Jesús Álvarez Torres chus.alvarez@uib.es	11:30	12:30	Monday	01/09/2015	31/07/2016	Despacho 120, Anselm Turmeda
Rafel Jaume Prohens Sastre rafel.prohens@uib.cat	15:30	16:30	Thursday	14/09/2015	22/07/2016	AT-D-165

Contextualisation

This course is part of the module Dynamical Systems with particular emphasis on the study of certain special solutions -periodic orbits- and their stability. We deserve special attention to the applications. Part of the subject will be also devoted to understand phase portraits and bifurcation diagrams.

Requirements

Recommendable

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

Skills

Specific

* 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....
* CE2 Students must possess the ability to use and adapt mathematical models to describe physical phenomena of different nature..

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* CE3 Acquire advanced knowledge in the frontiers of knowledge and demonstrate in the context of internationally recognized scientific research, a full understanding of the theoretical and practical aspects and scientific methodology..

Generic

* CG1 systematic understanding of a field of study and mastery of the 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. Intoduction to the qualitative theory
    * Phase portrait
    * Singular points
    * alpha- and omega-limit set
    * Hartman-Grobman Theorem
    * Hilbert's XVI problem
2. Stability of periodic orbits
    * Transversal sections
    * Poicaré return map
    * Stability of periodic orbits
    * Semi Complete Family of Rotated Vector Fields
3. Critical points
    * Center-focus problem: Lyapunov constants,...
    * Small limit cycles: Hopf bifurcation
4. Perturbative methods
    * Abelian integrals
    * Medium limit cycles
5. Limit cycles in the cilinder
    * Ricatti equation
    * Abel equation
    * Generalized Abel equation

Teaching methodology

In-class work activities

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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

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%

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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

Final grade percentage: 40%

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
* "Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields" Springer (Applied Mathematical Sciences-42); John Guckenheimer and Philip Holmes; ISBN-10: 0387908196 | ISBN-13: 978-0387908199 | Edition: 1st ed. 1983. Corr. 6th printing 2002

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