Course guides
200141 - EDOS - Ordinary Differential Equations

Unit in charge: School of Mathematics and Statistics
Teaching unit: 749 - MAT - Department of Mathematics.
Degree: BACHELOR'S DEGREE IN MATHEMATICS (Syllabus 2009). (Compulsory subject).
Academic year: 2020 ECTS Credits: 7.5 Languages: Catalan

LECTURER

Coordinating lecturer: PAU MARTIN DE LA TORRE
Others:
Primer quadrimestre:
MARCEL GUARDIA MUNARRIZ - M-A, M-B
PAU MARTIN DE LA TORRE - M-A, M-B
RAFAEL RAMIREZ ROS - M-A, M-B

PRIOR SKILLS

Linear and multilinear algebra, differential and integral calculus, topology, physics, computer science, and one complex variable.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. CE-2. Solve problems in Mathematics, through basic calculation skills, taking in account tools availability and the constraints of time and resources.
2. CE-3. Have the knowledge of specific programming languages and software.
3. CE-4. Have the ability to use computational tools as an aid to mathematical processes.

General:
5. CB-1. Demonstrate knowledge and understanding in Mathematics that is founded upon and extends that typically associated with Bachelor’s level, and that provides a basis for originality in developing and applying ideas, often within a research context.
6. CB-2. Know how to apply their mathematical knowledge and understanding, and problem solving abilities in new or unfamiliar environments within broader or multidisciplinary contexts related to Mathematics.
7. CB-3. Have the ability to integrate knowledge and handle complexity, and formulate judgements with incomplete or limited information, but that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgements.
8. CG-1. Show knowledge and proficiency in the use of mathematical language.
10. CG-3. Have the ability to define new mathematical objects in terms of others already know and ability to use these objects in different contexts.
11. CG-4. Translate into mathematical terms problems stated in non-mathematical language, and take advantage of this translation to solve them.
12. CG-6 Detect deficiencies in their own knowledge and pass them through critical reflection and choice of the best action to extend this knowledge.

Transversal:
4. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

TEACHING METHODOLOGY

There are 3 hours per week of "magistral lectures" (exposition of theoretical aspects), and 2 hours per week of "problem solving."
LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course, students should be able: 1) To apply the fundamental theorems of ODEs; 2) To solve several simple ODEs (first-order linear ODEs, separable ODEs, Bernoulli, Ricatti, linear ODEs with constant coefficients, etc.); 3) To sketch the phase portrait of 2D and 3D systems of linear ODEs with constant coefficients; 4) To determine the stability of systems of linear ODEs with periodic coefficients; and 5) To determine the stability of some simple solutions of systems of nonlinear ODEs.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>45.0</td>
<td>24.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>30.0</td>
<td>16.00</td>
</tr>
<tr>
<td>Self study</td>
<td>112.5</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Total learning time: 187.5 h

CONTENTS

Linear equations and linear systems

Description:
Linear ODEs: reduction of order, characteristic equation, oscillations, undetermined coefficients, and variation of parameters.

Full-or-part-time: 50h
Theory classes: 10h
Practical classes: 10h
Self study: 30h

Fundamental theorems

Description:

Full-or-part-time: 60h
Theory classes: 18h
Practical classes: 6h
Self study: 36h

Solving simple ODEs

Description:
First-order linear ODEs. Separable ODEs and integrant factor. Changes of variables. Homogeneous, Bernoulli, Ricatti, Lagrange, and Clairaut ODEs.

Full-or-part-time: 25h
Practical classes: 10h
Self study: 15h
Introduction to the qualitative theory of ODEs

Description:
Classification of 2D and 3D systems of linear ODEs with constant coefficients. Stability of systems of linear ODEs with periodic coefficients. Stability of some simple solutions of nonlinear systems.

Full-or-part-time: 27h 30m
Theory classes: 11h
Self study: 16h 30m

GRADING SYSTEM

A partial exam (P), and a final exam (F). The final grade is
\[ N = \max(F, 0.3*P + 0.7*F) \]

An extra exam will take place on July for students that failed during the regular semester.

EXAMINATION RULES.

Students can use a handwritten sheet of paper (DIN A4 size), except in the theoretical part of the exams.

BIBLIOGRAPHY

Basic: