200141 - EDOS - Ordinary Differential Equations

Coordinating unit: 200 - FME - School of Mathematics and Statistics
Teaching unit: 749 - MAT - Department of Mathematics
Academic year: 2019
Degree: BACHELOR'S DEGREE IN MATHEMATICS (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 7.5

Teaching staff
Coordinator: INMACULADA CONCEPCION BALDOMA BARRACA

Others: Primer quadrimestre:
INMACULADA CONCEPCION BALDOMA BARRACA - M-A, M-B
MARCEL GUARDIA MUNARRIZ - M-A, M-B
PAU MARTIN DE LA TORRE - M-A, M-B

Teaching languages: Catalan

Opening hours
Timetable: Send an e-mail to the professor to make an appointment.

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
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.

Transversal:

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.

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>Total learning time: 187h 30m</th>
<th>Hours large group: 45h 24.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group: 0h 0.00%</td>
<td>Hours small group: 30h 16.00%</td>
</tr>
<tr>
<td>Hours small group: 30h 16.00%</td>
<td>Guided activities: 0h 0.00%</td>
</tr>
<tr>
<td>Self study: 112h 30m 60.00%</td>
<td></td>
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</tbody>
</table>
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### Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Learning time:</th>
<th>Theory classes:</th>
<th>Practical classes:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fundamental theorems</strong></td>
<td>60h</td>
<td>18h</td>
<td>6h</td>
<td>36h</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td></td>
<td>Presentation and motivation. Geometric interpretation: vectorfields. Initial value problems (IVPs). Existence and uniqueness theorems. Maximal solutions. Regularity with respect to initial conditions and parameters.</td>
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<tr>
<td><strong>Solving simple ODEs</strong></td>
<td>25h</td>
<td>0h</td>
<td>10h</td>
<td>15h</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td></td>
<td>First-order linear ODEs. Separable ODEs and integrant factor. Changes of variables. Homogeneous, Bernoulli, Ricatti, Lagrange, and Clairaut ODEs.</td>
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<tr>
<td><strong>Linear equations and linear systems</strong></td>
<td>50h</td>
<td>10h</td>
<td>10h</td>
<td>30h</td>
</tr>
<tr>
<td><strong>Introduction to the qualitative theory of ODEs</strong></td>
<td>27h 30m</td>
<td>11h</td>
<td>0h</td>
<td>16h 30m</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td></td>
<td>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.</td>
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</tbody>
</table>
A partial exam (P), and a final exam (F). The final grade is
\[ N = \max(F, 0.3 \times P + 0.7 \times F). \]

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

**Qualification system**

**Regulations for carrying out activities**

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

**Bibliography**

**Basic:**


