Course guide

240131 - 240131 - Differential Equations

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 749 - MAT - Department of Mathematics.
Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).
Academic year: 2023  ECTS Credits: 6.0  Languages: Catalan, Spanish

LECTURER

Coordinating lecturer: PERE GUTIERREZ SERRES

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Capacity to solve mathematical problems that can appear in engineering . Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

TEACHING METHODOLOGY

There are 2 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:
* to apply the fundamental theorems of Vector Calculus
* to solve, classify and draw the phase portrait of 2D and 3D systems of linear ODEs with constant coefficients
* to use the tools to determine the stability in some systems of nonlinear ODEs
* to solve some basic PDEs (wave, heat, Laplace/Poisson, etc)
* to use sofware in order to obtain numerical approximations in problems from the previous items

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>60.0</td>
<td>40.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90.0</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h
## CONTENTS

### Vector Calculus

**Description:**
Line and surface integration of functions and vector fields. Integral theorems: Newton-Leibniz, Green, Gauss and Stokes.

**Related competencies:**
CE1. Capacity to solve mathematical problems that can appear in engineering. Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

**Full-or-part-time:** 65h
- Theory classes: 13h
- Practical classes: 13h
- Self study: 39h

### Ordinary Differential Equations (ODEs)

**Description:**

**Related competencies:**
CE1. Capacity to solve mathematical problems that can appear in engineering. Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

**Full-or-part-time:** 60h
- Theory classes: 12h
- Practical classes: 12h
- Self study: 36h

### Partial Differential Equations (PDEs)

**Description:**

**Related competencies:**
CE1. Capacity to solve mathematical problems that can appear in engineering. Aptitude to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and derived partial equations; numerical methods; numerical algorithm; statistics and optimisation.

**Full-or-part-time:** 25h
- Theory classes: 5h
- Practical classes: 5h
- Self study: 15h

### GRADING SYSTEM

A partial exam (EP), a final exam (EF) and a practice exam (M). The final score is \(0.35 \times EP + 0.55 \times EF + 0.1 \times M\). The reevaluation exam (R) is a single test and its score replaces the previous EP and EF scores, and hence the final score, in this case, becomes \(0.9 \times R + 0.1 \times M\) (to be maximized with the final score previously obtained).
EXAMINATION RULES.

In the partial and final exams, only a sheet made by oneself can be used. For the practice exam, the allowed material will previously be announced. The use of a calculator, a primitive table or other tables, and (of course) mobile phones or similar devices is not allowed. Changes of group are not allowed.

BIBLIOGRAPHY

Basic:

Complementary:

RESOURCES

Other resources:
https://mat-web.upc.edu/etseib/ed/