Course guide
820009 - CNED - Numerical Calculus. Differential Equations

Unit in charge: Barcelona East School of Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

Degree:
BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2023  ECTS Credits: 6.0  Languages: Catalan, Spanish

LECTURER

Coordinating lecturer: M. JOSÉ JIMÉNEZ JIMÉNEZ - JOSE JAVIER MUÑOZ ROMERO

Others:
Primer quadrimestre:
ENRIC AMADO VICENTE - Grup: T11, Grup: T12
ADRIÁN DOMINGO GIMENEZ - Grup: T31, Grup: T32
RAIMON ELGUETA MONTO - Grup: T31, Grup: T32
ALFONSO ESCOBOSA FERNANDEZ - Grup: T31, Grup: T32
M. JOSÉ JIMÉNEZ JIMÉNEZ - Grup: M11, Grup: M12, Grup: M21, Grup: M22
ALVARO MARTIN LLOPIS - Grup: T11, Grup: T12, Grup: T21, Grup: T22
NURIA PARES MARINE - Grup: M11, Grup: M12, Grup: M21, Grup: M22
MARGARITA TORRE ALCOCEBA - Grup: T21, Grup: T22, Grup: T31, Grup: T32

Segon quadrimestre:
EDWIN SANTIAGO ALFÉREZ BAQUERO - Grup: M42, Grup: M61
ENRIC AMADO VICENTE - Grup: T11, Grup: T12
KEVIN IVAN BARRERA LLANGA - Grup: M41, Grup: M62, Grup: M71, Grup: M72
ADRIÁN DOMINGO GIMENEZ - Grup: M71, Grup: M72
MARIONA GONZÁLEZ ESTEVE - Grup: T11, Grup: T12
M. JOSÉ JIMÉNEZ JIMÉNEZ - Grup: M31, Grup: M32
PERE LOPEZ BROSÁ - Grup: M21, Grup: M22, Grup: M51, Grup: M52
ALVARO MARTIN LLOPIS - Grup: T21, Grup: T22, Grup: T31, Grup: T32
JOSE JAVIER MUÑOZ ROMERO - Grup: M11
CÉCILIA OLIVESI - Grup: M11
NURIA PARES MARINE - Grup: M11, Grup: M31, Grup: M32
JOAN QUINTANA COMPTÉ - Grup: M41, Grup: M42, Grup: M61, Grup: M62
MARGARITA TORRE ALCOCEBA - Grup: T11, Grup: T12, Grup: T21, Grup: T22, Grup: T31, Grup: T32
ROGER VALDÉS I MARTÍN - Grup: M21, Grup: M22, Grup: M51, Grup: M52
DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
2. Solve mathematical problems that may arise in engineering. Apply knowledge of linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and partial differential equations; numerical methods; numerical algorithms; statistics and optimisation.

Transversal:
1. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

TEACHING METHODOLOGY

Apart from the 6 hours per week in the classroom, self-study must las and average of 9 hours per week (40% of the total work at class and 60% of individual work).

LEARNING OBJECTIVES OF THE SUBJECT

Unit 1: Introduce the students to computer simulation explaining its capabilities, potential and limitations. Programming of basic numerical algorithms. Correct and judgeful use of basic numerical methods. Ability to chose the appropriate method for different engineering applications.
Unit 2: State, analyze and numerically and analytically solve ordinary differential equations. Physical interpretation of ode's.
Unit 3: Use of integral transforms in engineering applications.
Unit 4: State, analyze and numerically and analytically solve partial differential equations. Physical interpretation of pde's.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>45,0</td>
<td>30.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

Unit 1: Basics of numerical calculus

Description:
1.1. Numbers and errors. Finite arithmetic storage. Absolute error, relative error, truncation error. Correct significant digits.

Full-or-part-time: 67h 15m
Theory classes: 18h
Laboratory classes: 9h 30m
Self study: 39h 45m
## Unit 2: Ordinary differential equations

**Description:**
2.3. Linear differential equations of order 2 with constant coefficients. Undetermined coefficients method. Variation of constants method.

**Full-or-part-time:** 36h 15m  
Theory classes: 12h  
Laboratory classes: 2h 30m  
Self study : 21h 45m

## Unit 3: Integral transforms and solution of ordinary differential equations

**Description:**
3.2. Fourier series.

**Full-or-part-time:** 27h 45m  
Theory classes: 9h  
Laboratory classes: 1h 30m  
Self study : 17h 15m

## Unit 4: Partial differential equations

**Description:**
4.1. Introduction to partial differential equations. Motivation.
4.2. Equations of mathematical fisics. Boundary conditions.

**Full-or-part-time:** 18h 45m  
Theory classes: 6h  
Laboratory classes: 1h 30m  
Self study : 11h 15m

## GRADING SYSTEM

First exam: 30%  
Second exam: 40%  
Matlab Laboratory: 25%  
Generic competence: 5%

Students can pass the course through the continuous assessment based on two exams (a first mid course exam and a second exam during the period fixed in the academic calendar of the school devoted to the final exams) and the delivery of laboratory assessments.

Finally, as detailed in the academic normative of the EEBE, a reevaluation exam will take place (excluding the Matlab Laboratory exam and the Generic Competence). To be able to do the reevaluation exam, the student has to attend to all the evaluation exams of the subject and its mark, \( N \), for the part which can be reevaluated has to be such that \( 3.0 \).  
EXAMINATION RULES.

In the two exams it will be allowed to use scientific calculators, but NEITHER PROGRAMMABLE NOR GRAPHING calculators.

BIBLIOGRAPHY

Basic:

Complementary: