Course guides
820092 - NSAE - Numerical Simulation Applied to Engineering

Unit in charge: Barcelona East School of Engineering
Teaching unit: 748 - FIS - Department of Physics.

Degree:
- BACHELOR’S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Optional subject).
- BACHELOR’S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional subject).
- BACHELOR’S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject).
- BACHELOR’S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).
- BACHELOR’S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2021   ECTS Credits: 6.0   Languages: English

LECTURER

Coordinating lecturer: Domingo García Senz
Others: Domingo García Senz

PRIOR SKILLS

Ability to work with the computer and a basic knowledge of a programming language.

REQUIREMENTS

Basic knowledge of algebra, calculus and physics. The main teaching language of the course will be English.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Transversal:
1. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

TEACHING METHODOLOGY

40 % Expositive methodology plus 35% individual work plus 25% working in group.

LEARNING OBJECTIVES OF THE SUBJECT

To introduce the student into basic techniques of numerical simulation and their application to solve basic engineering problems.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<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>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
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</table>

Total learning time: 150 h
## CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Description</th>
<th>Specific objectives</th>
<th>Related activities</th>
<th>Full-or-part-time: 60h</th>
<th>Theory classes: 24h</th>
<th>Self study : 36h</th>
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<tbody>
<tr>
<td>1. Chapter: A primer on numerical calculus.</td>
<td>Interpolation, fitting. Applied matrix algebra (inversion matrix algorithms. the homogeneous matrix of transformation, sparse matrix). Notions of fractal geometry. Numerical differentiation. Numerical resolution of differential equations. Stability. Explicit and Implicit methods. The fast Fourier transform FFT.</td>
<td>To introduce the student to the basic numerical techniques addressed to program and simulate physical and engineering systems</td>
<td>A fraction of the laboratori sessions will be devoted to write easy programs of numerical calculus using MatLab.</td>
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## GRADING SYSTEM

Two classroom exams P1 and P2 and a practical work, T, consiting in planify and devise a computer algorithm aimed at solving a particular engineering problem.

Final qualification: 0.25 P1+0.25 P2+0.5 T.

NSAE does not have a final reavaluation exam.

The generic competence will be evaluated taking into account: 1) The ability of the student to apply the concepts explained in the classroom to practical engineering problems, 2) the self-study abilities of the students, improvement and collective work, 3) abilities to make a public presentation and defend the work done. The weight of the generic competence within the evaluation of the course will be of 10%.
BIBLIOGRAPHY

Basic: