295904 - FGED - Green Functions and Linear Differential Equations: Diffusive Problems, Static Inverters

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 749 - MAT - Department of Mathematics
Academic year: 2019
Degree: BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Optional) BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Optional) BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional) BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional) BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Encinas Bachiller, Andres Marcos
Others: Carmona Mejias, Angeles
Jiménez Jiménez, M. José

Opening hours
Timetable: Each teacher will determine the timetable when the course start.

Prior skills
It is advisable to have passed the subject of Càlcul Numèric i Equacions Diferencials

Degree competences to which the subject contributes

Specific:
CEB-01. 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.

Generical:
CG-03. (ENG) Conocimiento en materias básicas y tecnológicas, que les capacite para el aprendizaje de nuevos métodos y teorías y les dote de versatilidad para adaptarse a nuevas situaciones.
CG-04. (ENG) Capacidad de resolver problemas con iniciativa, toma de decisiones, creatividad, razonamiento crítico y de comunicar y transmitir conocimientos, habilidades y destrezas en el campo de la Ingeniería Industrial.

Transversal:
07 AAT N3. 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.
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Teaching methodology

- 2 hour lectures (approximately): the teacher will describe basic concepts and materials, will give examples and will propose exercises.
- 1 hour (approximately) of the weekly class time will be devoted to solving problems proposed both in class and in the course’s ancillary material. Students are required to actively participate in these classes.
- 1 hour, students will be carrying out complementary activities at computer classroom.

Learning objectives of the subject

The objective of this course is to present the concept of solving a linear differential equation of one or several variables under concentrated actions, and how to use this type of solutions to obtain the response to distributed actions. Also, we will focus on the problem of obtaining the coefficients of the equations involved from the knowledge of the corresponding Green function. We will study actual problems of interest in all the degrees taught in the EEBE, which include static problems, diffusive and undulatory problems.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 45h</th>
<th>30.00%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Hours small group: 15h</td>
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<td></td>
<td>Guided activities: 90h</td>
<td>60.00%</td>
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### Content

<table>
<thead>
<tr>
<th>Title</th>
<th>Learning time: 25h</th>
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</thead>
</table>
| **Green function for initial value problems in one dimension** | Theory classes: 5h  
Practical classes: 2h 30m  
Laboratory classes: 2h 30m  
Self study: 15h |

**Description:**


**Specific objectives:**


<table>
<thead>
<tr>
<th>Title</th>
<th>Learning time: 50h</th>
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</table>
| **title english** | Theory classes: 10h  
Practical classes: 5h  
Laboratory classes: 5h  
Self study: 30h |

**Description:**


**Specific objectives:**

Construction of Green's function in problems of transverse bending of ropes and beams, and longitudinal bars. Calculation of vibration frequencies and associated harmonics.

<table>
<thead>
<tr>
<th>Title</th>
<th>Learning time: 25h</th>
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</table>
| **Vectorial Calculus and Green's formulae** | Theory classes: 5h  
Practical classes: 2h 30m  
Laboratory classes: 2h 30m  
Self study: 15h |

**Description:**


**Specific objectives:**

To identify the problems related to static, diffusive and wave phenomena. Physical interpretation of different boundary conditions.
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<table>
<thead>
<tr>
<th>Green's functions for problems in several variables</th>
<th>Learning time: 50h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Theory classes: 10h</td>
</tr>
<tr>
<td>Problems in rectangular domains. Method of separation of variables. Concentrated actions in the domain and the boundary. Green’s function and resolvent kernels.</td>
<td>Practical classes: 5h</td>
</tr>
<tr>
<td>Specific objectives:</td>
<td>Laboratory classes: 5h</td>
</tr>
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Qualification system

The Grade is calculated through continuous assessment through the presentation of work, exercises and laboratory practices.
Problems: 25%
Jobs: 50%
Laboratory: 25%

Bibliography

Basic: