3200011 - M1 - Mathematical Methods I

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 749 - MAT - Department of Mathematics
Academic year: 2018
Degree: BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan

Teaching staff
Coordinator: JOSEP GIBERGANS BAGUENA
Others: Monso Burgues, Enrique Pedro Jaime
Puerta Coll, Xavier
Pujol Vazquez, Gisela

Prior skills
Is highly desirable to have completed mathematics courses provided in the curriculum of the different types of secondary education giving access to degree studies.

Evaluations consist of acts of classroom evaluation and / or other evaluation activities as part of continuous assessment. If you do not perform any of the acts or activities shall be considered qualified to zero.

Degree competences to which the subject contributes

Specific:
3. (ENG) Capacitat per a la resolució dels problemes matemàtics que puguin platenjar-se a l'enginyeria. Aptitud per aplicar els coneixements sobre: àlgebra lineal; geometria, geometria diferencial; càlcul diferencial i integral; equacions diferenciales i amb derivades parcials; mètodes numèrics; algorítmica numèrica; estadística i optimització.

Transversal:
2. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.
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Teaching methodology

- Lectures presenting content.
- Face-to-face sessions of practical work.
- Independent work study and conducting exercises.
- Preparation and implementation of individual and / or group activities.

In the sessions of explanatory content teacher introduce the theoretical foundations of the subject, concepts, methods and illustrated with suitable examples to facilitate understanding results. The students will independently study to assimilate the concepts, solve exercises either manually or with the help of computer.

Students will become familiar in the use of a mathematical software package in order to use it as a tool for numerical, symbolic and graphic calculation.

Learning objectives of the subject

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>30h</th>
<th>20.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>30h</td>
<td>20.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Guided activities:</td>
<td>0h</td>
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</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>90h</td>
<td>60.00%</td>
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</tbody>
</table>
### TOPIC 1: SINGLE-VARIABLE DIFFERENTIAL CALCULUS

**Learning time:** 45h  
- Theory classes: 9h  
- Practical classes: 9h  
- Self study: 27h

**Description:**  
1.2. Extrema. Optimization.  
1.3. Taylor polynomial. Linear approximation.

**Specific objectives:**  
- Understand the concept of continuous and derivable functions.  
- Correctly interpret the meaning of a derivative.  
- Correctly apply the concepts of linear approximation and Taylor polynomial approximation.  
- Correctly carry out basic operations and use the technique of optimisation.

### TOPIC 2: INTEGRAL CALCULUS

**Learning time:** 35h  
- Theory classes: 7h  
- Practical classes: 7h  
- Self study: 21h

**Description:**  
2.1. Definite integration.  
2.2. Antidifferentiation. Indefinite integration, quasi-indefinite integration and integration by parts.  
2.3. Applications of definite integral.  
2.4. Improper integrals.

**Specific objectives:**  
For students to:  
- Understand the concept of a Riemann definite integral, the fundamental theorem of calculus, and Barrow's rule.  
- Carry out indefinite integration, quasi-indefinite integration and integration by parts.  
- Apply the definite integral to find areas, moments of inertia, volumes, etc..  
- Understand the concept of improper integral and the techniques for calculating them.
### TOPIC 3: COMPLEX NUMBERS

**Description:**
- 3.1. The concept of complex numbers.
- 3.2. Graphical representation.
- 3.3. Binomial, polar and trigonometric forms.
- 3.4. Operations with complex numbers.
- 1.5. Euler’s formula.
- 1.6. Exponentiation. De Moivre’s formula.
- 1.7. N-th root of a complex number.

**Specific objectives:**
- Understand the concept and representations of complex numbers and basic operations with complex numbers.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Learning time</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOPIC 3: COMPLEX NUMBERS</td>
<td>10h</td>
</tr>
<tr>
<td>Theory classes:</td>
<td>2h</td>
</tr>
<tr>
<td>Practical classes:</td>
<td>2h</td>
</tr>
<tr>
<td>Self study:</td>
<td>6h</td>
</tr>
</tbody>
</table>

### TOPIC 4: LINEAR ALGEBRA: VECTOR SPACES AND DIAGONALISATION

**Description:**
- 4.1. Vector spaces. Subspaces of Rn:
  - Vector subspaces. Generated subspaces.
  - Linear independence. Bases.
  - Change of basis.
- 4.2. Linear transformations:
  - Transformation matrices.
  - Eigenvectors and eigenvalues.
  - Diagonalisation.

**Specific objectives:**
- Understand the specific concepts and techniques applicable to vector spaces, in particular Rn spaces: vector subspaces, the generating set of a subspace, linear dependence and independence, bases.
- Understand the change of basis technique.
- Understand the concept of linear transformation and its matrix representation.
- Calculate the eigenvalues and eigenvectors of a matrix and understand the diagonalisation technique.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Learning time</th>
</tr>
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<tbody>
<tr>
<td>TOPIC 4: LINEAR ALGEBRA: VECTOR SPACES AND DIAGONALISATION</td>
<td>60h</td>
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<tr>
<td>Theory classes:</td>
<td>12h</td>
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<tr>
<td>Practical classes:</td>
<td>12h</td>
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<tr>
<td>Self study:</td>
<td>36h</td>
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### Planning of activities

| ACTIVITY 1: COMPUTER-ASSISTED WORK | Hours: 10h  
Self study: 10h |
|-----------------------------------|------------------|
| ACTIVITY 2: COMPUTER-ASSISTED WORK | Hours: 10h  
Self study: 10h |
| ACTIVITAT 3: EXAMS | Hours: 8h  
Theory classes: 8h |

### Qualification system

The evaluation of the course will be partial evaluations by the following weights:
- Midterm exams: 70% (First exam: 25%, Segond exam: 45%)
- Tasks: 30%

### Regulations for carrying out activities

The evaluations consist of the partial exams and other evaluable activities that are part of the continuous evaluation. If any of the exams or activities are not carried out, it will be considered qualified with zero.

### Bibliography

**Basic:**

**Complementary:**

**Others resources:**
- Exercices
- Basic Maple tutorials