280632 - Fundamentals of Mathematics I

Coordinating unit: 280 - FNB - Barcelona School of Nautical Studies
Teaching unit: 749 - MAT - Department of Mathematics
Academic year: 2018
Degree: BACHELOR'S DEGREE IN MARINE TECHNOLOGIES (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2010).
(Teaching unit Compulsory)
BACHELOR'S DEGREE IN MARINE TECHNOLOGIES/BACHELOR'S DEGREE IN NAVAL SYSTEMS AND
TECHNOLOGY ENGINEERING (Syllabus 2016). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan

Degree competences to which the subject contributes

Specific:
2. Ability to solve math problems that may arise in engineering. Ability to apply knowledge about: linear algebra, geometry, differential geometry to, differential and integral calculus, differential equations and partial differential, numerical methods, algorithmic numerical and statistical optimization.
3. Ability to solve math problems that may arise in the field of naval engineering technology. Ability to apply knowledge of: linear algebra, geometry, differential geometry, differential and integral calculus, differential equations and partial, numerical methods, numerical algorithms, statistical and optimization.

Transversal:
1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

Teaching methodology

・ Receive, understand and synthesize knowledge.
・ Pose and solve problems.
・ Develop reasoning and critical and defend it orally or in writing.
・ Perform work individually and/or in group.

Learning objectives of the subject

・ Solving mathematical problems arising in the field of engineering.
・ To get the ability to apply knowledge about linear algebra and geometry.
・ Develop the ability to solve abstract problems.
・ Identify the objectives of the group and be able to develop a plan to achieve them.
・ Identify the responsibilities of each component group and a commitment to the task assigned.
・ Use the resources and services available to develop simple searches for information. Classification and summarize the
280632 - Fundamentals of Mathematics I

information collected.

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>Hours medium group:</th>
<th>Hours small group:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total learning time:</strong></td>
<td>150h</td>
<td>30h</td>
<td>30h</td>
<td>90h</td>
</tr>
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<td>60.00%</td>
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280632 - Fundamentals of Mathematics I

## Content

### Real and complex numbers.

<table>
<thead>
<tr>
<th>Description:</th>
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<tbody>
<tr>
<td>Real numbers: basic properties. Inequalities and absolute values. Intervals.</td>
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<tr>
<td>Complex numbers: Basic operations, graphical representation.</td>
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<tr>
<td>Newton's binomial.</td>
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<tr>
<td>Polynomials. Factorization. Decomposition into simple fractions.</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Learning time:</th>
<th>29h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes:</td>
<td>6h</td>
</tr>
<tr>
<td>Practical classes:</td>
<td>6h</td>
</tr>
<tr>
<td>Self study :</td>
<td>17h</td>
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### Vectors.

<table>
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<tr>
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<tbody>
<tr>
<td>Vectors: geometric vision of algebraic operations with vectors.</td>
</tr>
<tr>
<td>The vector space $\mathbb{R}^n$: dependence and linear independence, bases and dimension, components of a vector.</td>
</tr>
<tr>
<td>Analytical representation and coordinate systems into the three-dimensional space.</td>
</tr>
<tr>
<td>Scalar product. Distance. Angles and orthogonality. Vector product</td>
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</tbody>
</table>

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<th>Learning time:</th>
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<td>Theory classes:</td>
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<tr>
<td>Practical classes:</td>
<td>6h</td>
</tr>
<tr>
<td>Self study :</td>
<td>17h</td>
</tr>
</tbody>
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### Matrices, determinants and systems of linear equations.

<table>
<thead>
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<th>Description:</th>
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<table>
<thead>
<tr>
<th>Learning time:</th>
<th>15h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes:</td>
<td>2h</td>
</tr>
<tr>
<td>Practical classes:</td>
<td>3h</td>
</tr>
<tr>
<td>Self study :</td>
<td>10h</td>
</tr>
</tbody>
</table>
### Linear Maps

**Learning time:** 29h  
Theory classes: 6h  
Practical classes: 6h  
Self study: 17h

**Description:**  
Definitions and properties. Matrix representation. Change of basis.  
Geometric transformations.  
Eigenvalues and eigenvectors. Diagonalization.

### Plane and Spherical Trigonometry

**Learning time:** 23h  
Theory classes: 5h  
Practical classes: 4h  
Self study: 14h

**Description:**  
Plane trigonometry. Solving planar triangles.  
Spherical trigonometry. Formulas of Bessel and Briggs. Resolution of spherical triangles.  
Applications of elementary spherical trigonometry. Distances on Earth.

### Probability

**Learning time:** 25h  
Theory classes: 5h  
Practical classes: 5h  
Self study: 15h

**Description:**  
Probability. Conditional probability and Bayes formula.  
Qualification system

The final grade, \(N_{\text{final}}\), is highest of \(N_{\text{mig}}\) and \(N_{\text{pf}}\)

\[
N_{\text{final}} = \max(N_{\text{mig}}, N_{\text{pf}})
\]

where:

\[
N_{\text{mig}} = 0.40 \ N_{\text{ac}} + 0.60 \ N_{\text{pf}}
\]

\(N_{\text{pf}}:\) grade of final test,
\(N_{\text{ac}}:\) continuous grade.

The final test consists of same theoretical questions about concepts related to the course' learning aims, and a set of problems that require the application of the methods studied. Its duration is 2-3 hours.

The continuous grade consist of one or two test (each one hour long), and the supervised activities carried out during the semester.

Reevaluation: If you have obtained a grade between 3 and 4.9, you can choose to reassessment will consist of a final test similar to the one described above.

Regulations for carrying out activities

- If not done any of the continuous assessment activities, this activity will grade 0.
- Absent will be considered who are not present at the final test or perform any activities of continuous assessment.

Bibliography

Basic:


Complementary: