UNIVERSITAT POLITĖCNICA
DE CATALUNYA
BARCELONATECH

## Course guide

280632-280632 - Fundamentals of Mathematics I

Last modified: 17/01/2024<br>Unit in charge:<br>Teaching unit:<br>Degree:<br>Academic year: 2023<br>Barcelona School of Nautical Studies<br>749 - MAT - Department of Mathematics.<br>BACHELOR'S DEGREE IN MARINE TECHNOLOGIES (Syllabus 2010). (Compulsory subject). BACHELOR'S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).<br>ECTS Credits: 6.0<br>Languages: Catalan

## LECTURER

## Coordinating lecturer:

Others:

FRANCESC TIÑENA SALVAÑÀ - JOSEP ELGUETA MONTO

Primer quadrimestre:
JOSEP ELGUETA MONTO - GESTN, GTM

Segon quadrimestre:
FRANCESC TIÑENA SALVAÑÀ - GESTN, GTM

## DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

## Specific:

GTM.CEO. 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.
GESTN.CE1. 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:

URI N1. 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.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 information collected.


## STUDY LOAD

| Type | Hours | Percentage |
| :--- | :--- | :--- |
| Hours large group | 30,0 | 20.00 |
| Hours medium group | 30,0 | 20.00 |
| Self study | 90,0 | 60.00 |

Total learning time: 150 h

## CONTENTS

## 1. Real and complex numbers

## Description:

Real numbers: basic properties. Inequalities and absolute values. Intervals.
Complex numbers: Basic operations, graphical representation.
Newton's binomial.
Polynomials. Factorization. Decomposition into simple fractions.
Numerical Series: Convergence. Geometric and harmonic series. Series of positive terms, the convergence criteria. Alternating series, convergence.

Full-or-part-time: 29h
Theory classes: 6h
Practical classes: 6h
Self study : 17h

## 2. Vectors

## Description:

Vectors: geometric vision of algebraic operations with vectors.
The vector space $\mathrm{R}^{\wedge} \mathrm{n}$ : dependence and linear independence, bases and dimension, components of a vector.
Analytical representation and coordinate systems into the three-dimensional space.
Scalar product. Distance. Angles and orthogonality. Vector product
Full-or-part-time: 29h
Theory classes: 6h
Practical classes: 6h
Self study : 17 h

## 3. Matrices, determinants and systems of linear equations

## Description:

Matrices. Matrix operations. Rang. Gauss's method. Determinant of a matrix. Inverse matrix.
Systems of linear equations. Rouché-Frobenius theorem. Resolution of systems.
Applications.
Full-or-part-time: 15h
Theory classes: 2h
Practical classes: 3 h
Self study : 10 h

## 4. Linear Maps

## Description:

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

## Full-or-part-time: 29h

Theory classes: 6 h
Practical classes: 6h
Self study : 17h

## 5. Plane and spherical trigonometry

## 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.
Full-or-part-time: 23h
Theory classes: 5h
Practical classes: 4h
Self study : 14h

## 6. Probability

## Description:

Set theory. Boolean algebra. Permutations, variations and combinations.
Probability. Conditional probability and Bayes formula.
Continuous and discrete random variables. Probability and density functions. Distribution function. Binomial distributions, Poisson and normal distributions.

Full-or-part-time: 25h
Theory classes: 5h
Practical classes: 5h
Self study : 15h

## GRADING SYSTEM

The final grade, Nfinal, is highest of Nmig and Npf
Nfinal $=$ Maxim( Nmig, Npf)
where: $\mathrm{Nmig}=0,40 \mathrm{Nac}+0.60 \mathrm{Npf}$
Npf: grade of final test,
Nac: continuous grade.

The final test consist 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.

## EXAMINATION RULES.

- 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:

- Larson, R. Introducción al álgebra lineal. Madrid: Limusa, 1994. ISBN 9681848861.
- Vila, A. Elementos de trigonometria esférica. 2a ed. Barcelona: Edicions UPC, 1994. ISBN 8476534205.
- Colomer, M. A. Curs d'estadística. Lleida: Universitat de Lleida, 1997. ISBN 8489727503.


## Complementary:

- Ross, Sheldon M. Introducción a la estadística [on line]. Barcelona: Reverté, 2007 [Consultation: 01/09/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB BooksVis?cod primaria=1000187\&codigo libro=7717. ISBN 9788429151916.
- Rodríguez Arós, Á.; Blanco, F.; Muiños, M.J. Trigonometría plana y esférica con aplicaciones a la navegación. Madrid: Paraninfo, 2012. ISBN 9788497329057
- Anton, H. Introducción al álgebra lineal. 3a ed. Mexico: Limusa, 2003. ISBN 9681863173.

