

## Course guide

### 330212 - MBE - Basic Engineering Mathematics

**Last modified:** 28/04/2025

**Unit in charge:** Manresa School of Engineering  
**Teaching unit:** 749 - MAT - Department of Mathematics.

**Degree:** BACHELOR'S DEGREE IN ICT SYSTEMS ENGINEERING (Syllabus 2010). (Compulsory subject).

**Academic year:** 2025    **ECTS Credits:** 6.0    **Languages:** Catalan

#### LECTURER

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**Coordinating lecturer:** Rossell Garriga, Josep Maria

**Others:** MONTSERRAT ALSINA AUBACH - JOSEP M. CORS IGLESIAS - MARGARITA DOMENECH  
BLAZQUEZ - JOSEP FREIXAS BOSCH - JOSE MIGUEL GIMENEZ PRADALES - M. ALBINA  
PUENTE DEL CAMPO - JOSEP RUBIÓ MASSEGÚ - ENRIC VENTURA CAPELL

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**Specific:**

1. CE1: Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge about: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial differential equations, numerical methods, numerical algorithms, statistics and optimization.

**Transversal:**

2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.  
3. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.  
4. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

#### TEACHING METHODOLOGY

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Face-to-face sessions in a large group in which the professor explains the foundations of each topic, gives examples and sets the students exercises or tasks.

Independent study sessions in which students study the professor's explanations, look at them in depth with the help of the textbook and do the exercises or tasks proposed.

Face-to-face sessions in a small group in which the professor answers students' queries after their independent study and/or students carry out practicals.

#### LEARNING OBJECTIVES OF THE SUBJECT

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On completion of the subject Basic Engineering Mathematics, students must be able to:

- Solve linear algebra and single variable calculus problems with the support of Maple software without difficulties.
- Think in increasingly abstract terms.
- Understand and apply deductive reasoning.
- Organise and apply theoretical knowledge to solve concrete problems.
- Interpret the results obtained with the help of computer tools.



## STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	20.00
Hours small group	30,0	20.00
Self study	90,0	60.00

**Total learning time:** 150 h

## CONTENTS

### 1. SINGLE VARIABLE DIFFERENTIAL CALCULUS

**Description:**

Basic functions in engineering.  
Differentiation and applications of the derivative.  
Linear approximation.  
Relative and absolute extrema.  
Zeros of functions: bisection and Newton-Raphson methods.

**Related activities:**

Activities A1, A2 and P1

**Full-or-part-time:** 47h

Theory classes: 10h  
Laboratory classes: 10h  
Self study : 27h

### 2. SINGLE VARIABLE INTEGRAL CALCULUS

**Description:**

Area between curves. Definite integrals: Barrow's rule  
Indefinite integrals  
Integration techniques: direct integration, by substitution, by parts and rational functions.  
Improper integrals  
Numerical integration: trapezoidal rule and Simpson's rule

**Related activities:**

Activities A2 and P1

**Full-or-part-time:** 37h

Theory classes: 8h  
Laboratory classes: 8h  
Self study : 21h

### 3. LINEAR SYSTEMS, MATRICES AND DETERMINANTS

**Description:**

Calculation of matrices and determinants  
Systems of linear equations  
Gauss method: numerical solution  
Least squares curve fitting

**Related activities:**

Activities A2 and P2

**Full-or-part-time:** 30h

Theory classes: 6h  
Laboratory classes: 6h  
Self study : 18h

### 4. LINEAR ALGEBRA

**Description:**

$R^n$  spaces  
Vector subspaces generated by a set of vectors  
Basis, dimension  
Change of basis  
Eigenvalues and eigenvectors  
Diagonalisation

**Related activities:**

Activities A2 and P2

**Full-or-part-time:** 30h

Theory classes: 6h  
Laboratory classes: 6h  
Self study : 18h

### 5. COMPLEX NUMBERS

**Description:**

Basic knowledge of complex numbers.

**Specific objectives:**

Students can learn this topic on their own, based on notes and questionnaires that are made available to them.

**Related activities:**

P1

**Full-or-part-time:** 6h

Self study : 6h

## GRADING SYSTEM

The mark NC is calculated from the marks corresponding to activities A1, A2, P1 i P2 in the following way:  $NC = 0,4 \cdot P1 + 0,4 \cdot P2 + 0,1 \cdot (A1 + A2)$

The learning objectives are considered to have been met if the final mark for continuous assessment NC is greater than or equal to 5. Students with a mark for the subject NC of less than 5 may take a final examination (mark: NF).

The student's final mark ND will be  $ND = \max(NC, NF)$ .



## EXAMINATION RULES.

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All the activities are compulsory.

If students do not carry out one of the activities for the subject they will be given a mark of 0.

## BIBLIOGRAPHY

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### Basic:

- Nakos, George; Joyner, David. Álgebra lineal con aplicaciones. México: Thomson, 1999. ISBN 9687529865.
- Lay, David C. Álgebra lineal y sus aplicaciones [on line]. 5ª ed. México: Pearson Educación, 2016 [Consultation: 07/06/2022]. Available on : [https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=6765](https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6765). ISBN 9786073237451.
- Larson, Ron; Hostetler, Robert P.; Edwards, Bruce H. Cálculo y geometría analítica. Vol. 1. 6ª ed. Madrid: McGraw-Hill, 1999. ISBN 8448122291.
- Stewart, James. Cálculo de una variable: trascendentes tempranas. 6ª ed. México: International Thomson, 2008. ISBN 9789706866530.
- Yasskin, Philip B. CalcLabs with Maple for Stewart's single variable calculus. 5th ed. [Toronto, Ontario]: Thomson. Brooks/Cole, cop. 2003. ISBN 0534393705.
- Benavent, Roberto. Cuestiones sobre álgebra lineal. Madrid: Paraninfo, 2010. ISBN 9788428380973.
- Smith, Robert T.; Minton, Roland B.; Rafhi, Ziad A. T. Cálculo de una variable: trascendentes tempranas [on line]. 5a. McGraw Hill, 2019 [Consultation: 13/02/2023]. Available on : [https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=8726](https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=8726). ISBN 9781456272340.