

## Course guide

### 320029 - MEFE - Finite Element Methods for Engineering

**Last modified:** 11/04/2025

**Unit in charge:** Terrassa School of Industrial, Aerospace and Audiovisual Engineering  
**Teaching unit:** 749 - MAT - Department of Mathematics.  
737 - RMEE - Department of Strength of Materials and Structural Engineering.

**Degree:** BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Optional subject).  
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Optional subject).  
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional subject).  
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject).  
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).  
BACHELOR'S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Optional subject).  
BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).  
BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Optional subject).  
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2010). (Optional subject).  
BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).

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

#### LECTURER

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**Coordinating lecturer:** E. Monsó

**Others:** O. Cáceres, I. Gálvez, M.J. Jiménez, T. Navarro

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**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 diferencials i amb derivades parcials; mètodes numèrics; algorítmica numèrica; estadística i optimització.

**Transversal:**

1. 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.
2. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.

#### TEACHING METHODOLOGY

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- Lectures
- Practical work sessions
- Autonomous work: theory and practice
- Preparation and realisation of course activities, both in groups and individually

## LEARNING OBJECTIVES OF THE SUBJECT

The main objective in this assignature is to capacitate students to comprehend and to apply the so called Finite Elements Method. Most engineering problems are modelled through partial differential equations to be approximately solved by using FEM techniques. After the numerical method issues obtained at Matemàtiques I, our students are supposed to go deeper through them in order to solve mathematical problems and also, in order to be prepared to the introduction and use of the FEM.

A practical approach is to be applied, with a pretty wide sort of applications of the FEM to different engineering problems to be treated.

Development of our students' skills in the use either symbolic, programming and commercial software is also pretended. In particular MATLAB and ANSYS are packages to be used.

## STUDY LOAD

| Type              | Hours | Percentage |
|-------------------|-------|------------|
| Self study        | 90,0  | 60.00      |
| Hours small group | 60,0  | 40.00      |

**Total learning time:** 150 h

## CONTENTS

### (ENG) TEMA 1: INTRODUCCIÓ ALS MÈTODES NUMÈRICS

**Full-or-part-time:** 10h

Laboratory classes: 4h

Self study : 6h

### (ENG) TEMA 2: RESOLUCIÓ NUMÈRICA DE SISTEMES D'EQUACIONS LINEALS

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

Laboratory classes: 12h

Self study : 18h

### (ENG) TEMA 4: RESOLUCIÓ NUMÈRICA D'EQUACIONS DIFERENCIALS ORDINÀRIES

**Full-or-part-time:** 20h

Laboratory classes: 8h

Self study : 12h

### (ENG) TEMA 5: EQUACIONS EN DERIVADES PARCIAIS

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

Laboratory classes: 12h

Self study : 18h

### (ENG) TEMA 6: MÈTODE DELS ELEMENTS FINITS

**Full-or-part-time:** 60h

Laboratory classes: 24h

Self study : 36h



## ACTIVITIES

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(ENG) EXERCICI PER A LLIURAR 1

(ENG) EXERCICI PER A LLIURAR 2

(ENG) EX

(ENG) PROJECTE

## GRADING SYSTEM

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- Assignments to deliver: 40%
- Individual work: 40%
- Teamwork: 20%

## BIBLIOGRAPHY

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### Basic:

- John, Fritz. Partial differential equations. 4th ed. New York: Springer-Verlag, 1982. ISBN 0387906096.
- Fish, J.; Belytschko, T. A first course in finite elements [on line]. Chichester: John Wiley & Sons, 2007 [Consultation: 13/05/2022]. Available on: <https://onlinelibrary-wiley-com.recursos.biblioteca.upc.edu/doi/book/10.1002/9780470510858>. ISBN 9780470035801.
- Eriksson, K.; Estep, D.; Johnson, C. Applied mathematics: body and soul, vol. 3, Calculus in several dimensions. Berlin: Springer, 2004. ISBN 3540008918.

### Complementary:

- Aubanell, A.; Benseny, A.; Delshalms, A. Eines bàsiques de càlcul numèric: amb 87 problemes resolts. Barcelona: Universitat Autònoma de Barcelona, 1991. ISBN 8479292318.