# Course guide
# 200153 - CN - Numerical Calculus

**Last modified:** 07/06/2023

**Unit in charge:** School of Mathematics and Statistics
**Teaching unit:** 749 - MAT - Department of Mathematics.
748 - FIS - Department of Physics.

**Degree:** BACHELOR'S DEGREE IN MATHEMATICS (Syllabus 2009). (Compulsory subject).

**Academic year:** 2023 **ECTS Credits:** 7.5 **Languages:** Catalan

## LECTURER

**Coordinating lecturer:** SONIA FERNANDEZ MENDEZ

**Others:** Primer quadrimestre:
SONIA FERNANDEZ MENDEZ - M-A, M-B
ABEL GARGALLO PEIRO - M-A, M-B
SERGI PÉREZ ESCUDERO - M-A, M-B
ESTHER SALA LARDIES - M-A, M-B

## PRIOR SKILLS

Numerical linear algebra
Differential and integral calculus

## DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

**Specific:**
1. CE-2. Solve problems in Mathematics, through basic calculation skills, taking in account tools availability and the constraints of time and resources.
2. CE-3. Have the knowledge of specific programming languages and software.
3. CE-4. Have the ability to use computational tools as an aid to mathematical processes.

**Generical:**
5. CB-1. Demonstrate knowledge and understanding in Mathematics that is founded upon and extends that typically associated with Bachelor's level, and that provides a basis for originality in developing and applying ideas, often within a research context.
6. CB-2. Know how to apply their mathematical knowledge and understanding, and problem solving abilities in new or unfamiliar environments within broader or multidisciplinary contexts related to Mathematics.
7. CB-3. Have the ability to integrate knowledge and handle complexity, and formulate judgements with incomplete or limited information, but that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgements.
8. CG-1. Show knowledge and proficiency in the use of mathematical language.
9. CG-2. Construct rigorous proofs of some classical theorems in a variety of fields of Mathematics.
10. CG-3. Have the ability to define new mathematical objects in terms of others already know and ability to use these objects in different contexts.
11. CG-4. Translate into mathematical terms problems stated in non-mathematical language, and take advantage of this translation to solve them.
12. CG-6 Detect deficiencies in their own knowledge and pass them through critical reflection and choice of the best action to extend this knowledge.

**Transversal:**
4. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

## TEACHING METHODOLOGY

(see Catalan version)

## LEARNING OBJECTIVES OF THE SUBJECT

(see Catalan version)

## STUDY LOAD

| Type | Hours | Percentage |
|---|---|---|
| Hours large group | 45,0 | 24.00 |
| Hours small group | 30,0 | 16.00 |
| Self study | 112,5 | 60.00 |

**Total learning time:** 187.5 h

## CONTENTS

### Root finding

**Description:**
(see Catalan version)

**Full-or-part-time:** 10h
Theory classes: 6h
Practical classes: 4h

### Systems of non-linear equations

**Description:**
(see Catalan version)

**Full-or-part-time:** 10h
Theory classes: 6h
Practical classes: 4h

### Function approximation

**Description:**
(see Catalan version)

**Full-or-part-time:** 20h
Theory classes: 12h
Practical classes: 8h

**Numerical integration**

**Description:**
(see catalan version)

**Full-or-part-time:** 15h
Theory classes: 9h
Practical classes: 6h

**Introduction to numerical methods for differential equations**

**Description:**
(see catalan version)

**Full-or-part-time:** 20h
Theory classes: 12h
Practical classes: 8h

## GRADING SYSTEM

(see Catalan version)

## BIBLIOGRAPHY

**Basic:**
- Quarteroni, A.; Saleri, F. Scientific computing with MATLAB and octave [on line]. 3rd ed. Heidelberg: Springer, 2010 [Consultation: 20/06/2023]. Available on: https://link-springer-com.recursos.biblioteca.upc.edu/book/10.1007/978-3-642-12430-3. ISBN 9786613569660.
- Stoer, J.; Bulirsch, R. Introduction to numerical analysis. 3rd ed. Springer-Verlag, 2002. ISBN 9781441930064.
- Aubanell, A.; Benseny, A.; Delshams, A. Eines bàsiques de càlcul numèric : amb 87 problemes resolts. Universitat Autònoma de Barcelona, 1991. ISBN 847929230X.

**Complementary:**
- Press, W.H. [et al.]. Numerical recipes : the art of scientific computing. Cambridge University Press, 1986.
- Isaacson, E.; Keller, H. B. Analysis of numerical methods. Dover, 1994.