VNIVERSITAT DE VALÈNCIA

# Course Guide
# 34172 Mathematic modelling

## COURSE DATA

### DATA SUBJECT

**Code:** 34172
**Name:** Mathematic modelling
**Cycle:** Undergraduate Studies
**ECTS Credits:** 6
**Academic year:** 2025-26

### STUDY (S)

| Degree | Center | Acad. year | Period |
|---|---|---|---|
| 1107 - Degree in Mathematics | Facultat de Ciències Matemàtiques | 3 | First quarter |

### SUBJECT-MATTER

| Degree | Subject-matter | Character |
|---|---|---|
| 1107 - Degree in Mathematics | Mathematical modelling | COMPULSORY |

### COORDINATION

CANDELA POMARES VICENTE FCO

BAEZA MANZANARES ANTONIO

## SUMMARY

The purpose of this subject is to apply the concepts and techniques studied in previous courses to problems in the real world.

Students will be introduced to mathematical modeling problems and to techniques for their analysis and resolution. Also, by studying the models in detail, it will be possible to establish variants and improvements through their parameters. The models used will be mainly based on difference equations (discrete models) or on ordinary differential equations (continuous models) and will come from experimental sciences, engineering, and social sciences, among other disciplines.

## PREVIOUS KNOWLEDGE

### RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

### OTHER REQUIREMENTS

The basic notions necessary for being introduced to this subject will have been previously studied in the courses of Discrete Mathematics, Computer Tools and Ordinary Differential Equations.

## COMPETENCES / LEARNING OUTCOMES

### 1107 - Degree in Mathematics

Ability to work in teams.

Adapting to new situations.

Apply the knowledge in the professional world.

Capacity for analysis and synthesis.

Capacity for criticism.

Capacity for organization and planning.

Capacity of abstraction and modeling.

Expressing mathematically in a rigorous and clear manner.

Knowing the time and the historical context in which occurred the great contributions of women and men in the development of mathematics.

Participate in the implementation of software and learn mathematical software.

Possess and understand the mathematical knowledge.

Reason logically and identify errors in the procedures.

Solve problems that require the use of mathematical tools.

## DESCRIPTION OF CONTENTS

### 1. Introduction to mathematical modeling.

Mathematical description of well-defined problems. Generalities.

## 2. Mathematical models based on finite difference equations.

Models of natural, physical and/or engineering science phenomena based on finite difference equations are presented and analyzed.

## 3. Mathematical models based on ordinary differential equations.

Models of natural, physical and/or engineering science phenomena based on ordinary differential equations are presented and analyzed.

# WORKLOAD

### PRESENCIAL ACTIVITIES

| Activity | Hours |
|---|---|
| Theory | 24,00 |
| Other activities | 6,00 |
| Computer classroom practice | 20,00 |
| Classroom practices | 10,00 |
| **Total hours** | **60,00** |

### NON PRESENCIAL ACTIVITIES

| Activity | Hours |
|---|---|
| Attendance at other activities | 0,00 |
| Individual or group project | 5,00 |
| Independent study and work | 5,00 |
| Preparation of lessons | 30,00 |
| Preparation for assessment activities | 30,00 |
| Resolution of case studies | 20,00 |
| **Total hours** | **90,00** |

# TEACHING METHODOLOGY

The development of the subject is structured around three axes: theory sessions, practical classes (in the classroom with the computer) and tutorials and seminars.

Regarding the former, the teacher will develop the main points of the syllabus, using the classroom computer when necessary to illustrate specific points. The student must attend to the scheduled class preparation time for optimal use. The practical classes will help the student verify the degree of knowledge acquired, facing relatively complex problems and analyzing the results obtained. As before, the student must prepare these sessions to be able to carry out the experiments in the scheduled time.

## EVALUATION

The evaluation of the skills achieved by the students will be done continuously along the course and will consist of the following evaluation blocks:

1. Theory and practices: since the objectives of the subject focus on the guaranteeing of computer calculation techniques, this assessment will be carried out in two stages:

i. Continuous assessment of the subject, carried out through periodic checks and/or delivery of proposed practices or exercises: Up to 4 points, i. e. 40% of the final grade.

ii. Final assessment, consisting of a theoretical-practical exam scored up to 5 points, i. e. 50% of the final grade.

2. Seminars and tutorials: participation in these sessions will be assessed with a maximum mark of 1 point, i. e. 10% of the final mark.

To pass the subject, it is necessary that the score of sub-block 1.i exceeds 40% of its maximum score and that the score of sub-block 1.ii exceeds 50% of its maximum score.

The grades obtained corresponding to the continuous evaluation of section 1.i and the seminars and tutorials of section 2 will be kept in the two calls of the academic year that have been made given that their evaluation will only be possible throughout the semester, and are therefore not recoverable.

## REFERENCES


- Dennis G. Zill, Ecuaciones diferenciales con aplicaciones de modelado. Thomson Ed. 1997.
- Daniel Kaplan, Leon Glass. Understanding nonlinear dynamics. Springer. 1992.
- Stephen Lynch. Dynamical Systems with Applications using Mathematica. Birkhäuser, 2007.
- Nail H. Ibragimov, A Practical Course un Differential Equations and Mathematical Modelling, Higher Education Press. World Scientific Publishing Co Pte Ltd. 2010.
- Basmadjian Diran, Farnood Ramin, The Art of Modelling in Science and Engineering with Mathematica, Chapman & Hall/CRC. Second Edition. 2007.
- Leah Edeltein-Keshet, Mathematical models in biology, SIAM, 2005.