VNIVERSITAT DE VALÈNCIA

Course Guide
34172 Mathematic modelling

COURSE DATA

Data Subject	
Code	34172
Name	Mathematic modelling
Cycle	Grade
ECTS Credits	6.0
Academic year	2024 - 2025

Study (s)

Degree	Center	Acad. year	Period
1107 - Degree in Mathematics	Faculty of Mathematics	3	First term

Subject-matter

Degree	Subject-matter	Character
1107 - Degree in Mathematics	13 - Mathematical modelling	Obligatory

Coordination

Name	Department
BAEZA MANZANARES, ANTONIO	363 - Mathematics
CANDELA POMARES, VICENTE FCO	363 - Mathematics

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.

1107 - Degree in Mathematics

- Capacity for analysis and synthesis.
- Capacity for organization and planning.
- Capacity for criticism.
- Solve problems that require the use of mathematical tools.
- Ability to work in teams.
- Adapting to new situations.
- Possess and understand the mathematical knowledge.
- Apply the knowledge in the professional world.
- Expressing mathematically in a rigorous and clear manner.
- Reason logically and identify errors in the procedures.
- Capacity of abstraction and modeling.
- Participate in the implementation of software and learn mathematical software.
- Knowing the time and the historical context in which occurred the great contributions of women and men in the development of mathematics.

The student must be able to analyze and describe mathematically problems of experimental or social sciences and select an appropriate mathematical model for description.

You must resolve, by exact or approximate methods, mathematical models that correspond to the problems studied.

You should know the solution obtained contrast with reality and suggest modifications in view of the discrepancies between the model and the observed data. Parameters in models should be able to adapt the parameter values to the data.

You must know how to interpret the results in order to obtain general properties of the model and recognize other problems that can be adapted to the same model.

You must handle mathematical and computer tools in analyzing and solving problems.

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

ACTIVITY	Hours	% To be attended
Theory classes	24,00	100
Computer classroom practice	20,00	100
Classroom practices	10,00	100
Other activities	6,00	100
Development of group work	5,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	30,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	20,00	0
Resolution of case studies	20,00	0
TOTAL	**150,00**	

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

Basic

- Dennis G. Zill, Ecuaciones diferenciales con aplicaciones de modelado. Thomson Ed. 1997.
- 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.

Additional

- Daniel Kaplan, Leon Glass. Understanding nonlinear dynamics. Springer. 1992.
- 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.