1. OVERVIEW

Subject area	Applications of discrete mathematics
Degree	Bachelor's degree in physics
School/Faculty	School of Architecture, Engineering and Design
Year	Third
ECTS	6
Type	Optional
Language(s)	Spanish
Delivery mode	On campus
Semester	Second semester

2. INTRODUCTION

"Discrete Mathematics" is an elective subject area on the Bachelor's Degree in Physics, worth a total of 6 ECTS credits.

Discrete mathematics emerged in the wake of information technology. Specifically, with the appearance of computers. The limitations presented by the finite nature of computer resources make this subject a fundamental tool for future professionals working with programming languages or certain models that appear in engineering. With this in mind, the subject area covers a range of topics from combinatorics and optimisation methods to graph theory.

In addition, it promotes reasoning and the application of mathematical methodology in multiple aspects of professional training.

3. SKILLS AND LEARNING OUTCOMES

Key skills (CB, by the acronym in Spanish):

- CB2: Students can apply their knowledge to their work or vocation in a professional manner and possess the skills which are usually evident through the forming and defending of opinions and resolving problems within their study area.
- CB5: Students have developed the learning skills necessary to undertake further study in a much more independent manner.

General skills (CG, by the acronym in Spanish):

- CG4: To convey knowledge, procedures, results and scientific ideas in the field of physics, both orally and in writing.

- CG5: To understand diverse phenomena that, despite being physically different, share certain similarities, allowing known solutions to be applied to new problems. **Transversal skills (CT, by the acronym in Spanish):**

- CT2: Independent learning: A range of skills in order to choose research, analysis, evaluation and information management strategies from different sources, as well as to learn and put into practice what has been learnt independently.
- CT3: Teamwork: Ability to integrate and collaborate actively with other people, areas and/or organisations to reach common goals.
- CT5: Problem solving: Be able to critically evaluate information, separate complex situations into their constituent parts, recognise patterns, and consider alternatives, different approaches and perspectives in order to find optimal solutions and negotiate efficiently.

Specific skills (CE, by the acronym in Spanish):

- CE07: To use the most suitable electronic instruments and IT tools to study physical problems and search for solutions.

Learning outcomes (RA, by the acronym in Spanish):

- To understand the principles of logic, relationships and combinatorics, and their use in applied computational problems.
- To know how to apply the principles of graph theory in general and of trees in particular in the design of efficient algorithms.
- To be able to design finite-state machines.

The following table shows how the skills developed in the subject area match up with the intended learning outcomes:

Skills	Learning outcomes
CB2, CG4, CT2, CT3	To understand the principles of logic, relationships and combinatorics, and their use in applied computational problems.
CB2, CG5, CT5, CE07	To know how to apply the principles of graph theory in general and of trees in particular in the design of efficient algorithms.
CB5, CT4, CT5	To be able to design finite-state machines.

4. CONTENTS

1. Propositional logic and Boolean algebra.
2. Relationships and recurrence.

3. Combinatorics and introduction to game theory.
4. Graph theory. Trees.
5. Languages and grammar. Finite-state machines.
6. Turing machines.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Collaborative learning: Students learn to collaborate with other people (classmates and professors) in order to find creative, comprehensive and constructive solutions to questions and problems that arise from the given case studies, using all relevant knowledge and material resources available.
- Problem-based learning: Students are given problems and asked to solve them, working individually or in groups.
- Lectures: Presentations by the professor with the necessary technological tools to maximise comprehension of the learning content.
- Guided academic activities: Individual and group work that is more independent, including information searches, written summaries, debates and the public defence of projects.

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

Type of learning activity (AF, by the acronym in Spanish)	Number of hours
Lectures	50
Oral presentations of projects and debates	6
Report writing	20
Assessment	6
Practical activities (problems, written work, projects, workshops and/or lab work)	20
Tutorials	16
Independent working	32h
TOTAL	**150**

7. ASSESSMENT

The assessment systems, plus their weighting in the final grade for the subject area, are as follows:

Assessment system	Weighting
Individual on-campus knowledge tests (theory and/or practice).	50%
Submission of group and/or individual reports, written work, projects or exercises	40%
Oral defence	10%

On the Virtual Campus, when you open the subject area, you'll find details of your assessable tasks, including the submission dates and assessment procedures for each task.

8. BIBLIOGRAPHY

The recommended reading for the subject area is listed below. All publications are available in the Dulce Chacón University Library for reference or loan:

- Apostol, T.M. Introducción a la teoría analítica de números. Ed. Reverté, Barcelona, 1984.
- Burckel, R.B. An introduction to classical complex analysis. Academic Press, New York, 1979.
- Clarke, L.E. y Singer, J. On Circular Permutations, Amer. Math. Monthly 65 (1958), 609–610.
- Conway, J.B. Functions of one complex variable. Springer, New York, 1978.
- Edwards, H.M. Riemann's zeta function. Academic Press, New York, 1975.
- Lang, S. Algebraic Number Theory. Addison Wesley, Massachussetts, 1970.
- López Fdez. Asenjo, F., Galindo Soto, F. y Tristán Vega, L.A. Funciones analíticas multiformes. Universidad de Valladolid, 1996