

Course Unit Dis	Discrete Mathematics			Field of study	Mathematics	
Bachelor in Info	achelor in Informatics Engineering			School	School of Technology and Management	
Academic Year 202	23/2024	Year of study	1	Level	1-1	ECTS credits 6.0
Type Ser	mestral	Semester	2	Code	9119-706-1203-00-23	
Workload (hours)	162	Contact hours	T - Lectures; TP - Lectures ar	60 PL - T(nd problem-solving; PL - Problem-s	C - S -	E - OT - O - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Edite Martins Cordeiro, Maria Fátima Moreira da Silva Pacheco Name(s) of lecturer(s)

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

- Master the basics of logic, logical operations and their properties. Operate with sets and evaluate relationships and entire functions and their properties.

- Decrete with sets and evaluate relationships and entire inductions and their properties.
 Prove propositions and algorithms using the method of finite induction.
 Use the Euclidean algorithm to calculate the greatest common divisor of two numbers and for solving diophantine equations.
 Solve counting problems by applying the combinatorial calculus and binomial and multinomial theorems.
 Determine order, paths and circuits, isomorphism, planarity, chromatic number of a graph. Applt the algorithms of Prim, Kruskal, and Dijkstra.

Prerequisites

Before the course unit the learner is expected to be able to:

Have skills to apply the mathematical concepts taught during high school.

Course contents

Logic and set theory. Number Theory. Elementary Principles of Counting. Induction and Recursion. Introduction to Graph Theory

Course contents (extended version)

- Logic and Set Theory

 Propositional Logics, logical implication, inference rules, valid and invalid arguments.
 Predicate logics, quantifiers.
 Sets and subsets. Operations with sets and related properties.
- 2. Number theory

 - Aumber theory Binary relations and discrete functions. Prime numbers, Euclid's theorem, and the fundamental theorem of arithmetic. Resolution of recurrence relations Mathematical induction.
- S Elementary Counting Principles
 Permutations and combinations of the elements of a set. Multinomial theorem.
- The pigeonhole principle.
 Lexicographical ordering of combinations and permutations.
 Graph theory.
- - Graph isomorphism, planar graphs, graph coloring, Euler and Hamilton paths and circuits.
 Trees, n-ary trees, depth-first and depth-first search algorithms.
 Minimal spanning tree, Kruskal and Prim algorithms, Dijkstra algorithm. Applications.

Recommended reading

- E. Cordeiro, Notas Teóricas e Práticas de Matemática Discreta, 2020
 Edite Cordeiro, Folha Prática Nº 1, Nº2, Nº 3, Nº4, 2020
 William Stein, Elementary Number Theory: Primes, Congruences, and Secrets, Springer, 2011
 E. G. Goodaire e M. M. Parmenter, Discrete Mathematics with Graph Theory, Prentice Hall, 1998
 Pacheco, Maria F., Notes on Discrete Mathematics, 2024

Teaching and learning methods

Most of the topics will be introduced in-classroom. The deepening of the contents will be developed outside class, and topics will be explored through the completion of tasks

Class A (English): syllabus explored both through expositive moments as well as autonomously, by students (guided by the teacher), using collaborative platforms (google docs + virtual.ipb.pt + MathE platform,...).

Assessment methods

- Distributed (Portuguese and English groups) (Regular, Student Worker) (Final)

 Intermediate Written Test 35% (Test (1 hour) to evaluate the competencies acquired in Topics 1 and 2.)
 Intermediate Written Test 35% (Test (1 hour) to evaluate the competencies acquired in Topics 3 and 4.)
 Practical Work 30% (Activities for the consolidation of the contents covered.)

 Final exam (Portuguese and English groups) (Regular, Student Worker) (Supplementary, Special)

 Final Written Exam 100% (Exam (2 hours) to evaluate the competencies acquired in Topics 1, 2, 3, and 4.)

Language of instruction

- 1. Portuguese, with additional English support for foreign students 2. English

Electronic validation			
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06-03-2024	06-03-2024	15-03-2024	24-03-2024