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|------------------|---------------------|---------------|----------------|-------------------------------------|------|
| Course Unit      | Mathematics II      |               | Field of study | Mathematics                         |      |
| Bachelor in      | Management          |               | School         | School of Technology and Management |      |
| Academic Year    | 2022/2023           | Year of study | 1              | Level                               | 1-1  |
| Type             | Semestral           | Semester      | 2              | ECTS credits                        | 6.0  |
| Code             | 9147-707-1205-00-22 |               |                |                                     |      |
| Workload (hours) | 162                 | Contact hours | T -            | TP 60                               | PL - |
|                  |                     |               | TC -           | S -                                 | E -  |
|                  |                     |               | OT -           | O -                                 |      |

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Florbela Alexandra Pires Fernandes, Maria Fátima Moreira da Silva Pacheco

### Learning outcomes and competences

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

1. Compute definite integrals and improper integrals of elementary functions.
2. Apply integral calculus to determine areas of plane regions, volumes of solids of revolution and the average value of a function on an interval.
3. Analyze real functions of two real variables and use them to describe and solve optimization problems.
4. Solve some types of first order differential equations: separable equations, exact equations and linear equations.
5. Analyze numerical series with respect to their convergence.
6. Represent functions by power series. Relate the concepts of numerical series and power series.

### Prerequisites

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

1. Analyze elementary functions.
2. Compute derivatives and integrals of elementary functions.

### Course contents

Integral calculus. Real functions of several variables. Introduction to ordinary differential equations. Infinite series and power series.

### Course contents (extended version)

1. Integral calculus.
  - Fundamental theorem of integral calculus and properties of definite integrals.
  - Improper integrals.
  - Applications of definite integral and improper integral: mean value, areas and volumes.
2. Real functions of several real variables.
  - Domain, codomain and graph of functions with several variables.
  - Continuity of real functions of two real variables
  - Partial derivatives and its graphical interpretation. Higher order partial derivatives.
  - Chain rule and implicit differentiation.
  - Extrema of a real function with several variables. Optimization problems.
3. Introduction to ordinary differential equations.
  - Particular solution and general solution of a differential equation.
  - Initial value problems: existence theorems and uniqueness of a particular solution.
  - Techniques for solving separable equations, exact equations and first order linear equations.
4. Numerical series and power series.
  - Definition and properties of numerical series.
  - Criteria of convergence of series with positive terms; absolute convergence.
  - Taylor polynomial; power series; convergence interval.
  - Representation of functions by power series.

### Recommended reading

1. Sowokowski, E. W. (1994). Cálculo com geometria analítica. São Paulo: Makron Books.
2. Anton, H. , Bives, I & Davis, S. (2007). Cálculo (vol. I). Bookman.
3. Stewart, J. (2006). Cálculo (Vol. I e Vol II). São Paulo: Thomson Learning.
4. Biblioteca de recursos pedagógicos MathE (mathe.pixel-online.org)
5. Fernandes, Florbela P., Pacheco, Maria F., (2023) Apontamentos de Apoio à Disciplina.

### Teaching and learning methods

The themes will be presented and discussed during the classes, resorting to the resolution of tasks for their deepening. The use of collaborative IT tools (IPB Virtual, google docs) will be encouraged. Students will be challenged to view selected videos on MathE, Coursera, and Youtube platforms about the content to be addressed in the next class, following a «flipped classroom» approach.

### Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final)
  - Intermediate Written Test - 40% (First partial test assesses the acquired skills in Chapters 1 and 2 and is held during classes.)
  - Intermediate Written Test - 40% (The second test assesses skills in Chapters 3 and 4 and is held on final exam (normal season) date.)
  - Practical Work - 20% (Exercises, self-assessment, final interview and questionnaire, and tests using the MathE platform.)
2. Alternative 2 - (Student Worker) (Final)
  - Intermediate Written Test - 50% (Midterm exam)
  - Intermediate Written Test - 50% (Partial exam at the end of the semester.)
3. Alternative 3 - (Regular, Student Worker) (Supplementary, Special)
  - Final Written Exam - 100% (Final exam.)

### Language of instruction

Portuguese

| Electronic validation  |                             |                          |                          |
|--|-----------------------------|--------------------------|--------------------------|
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| 03-03-2023   | 07-03-2023                  | 17-03-2023               | 17-03-2023               |

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