

MATHEMATICS II

Academic Year: **2017/2018**

1st Semester

Instructor(s): Pedro Encarnação

Course Description:

The course of Mathematics II addresses integration methods, differential calculus in \mathbb{R}^n , including non-linear optimization, integral calculus in \mathbb{R}^2 , and first order differential equations.

Course Content:

Part I – Integration methods

1. Integration by parts
2. Integration by substitution
3. Integration of rational functions

Part II – Differential calculus in \mathbb{R}^n

1. Domain of a real function of several variables. Graphical representation. Level curves
2. Limits and continuity of real functions of several variables
3. Partial derivatives. Directional derivatives
4. Differentials
5. Chain rule
6. Homogeneous functions. Euler theorem
7. Maxima and minima of functions of several variables
8. Lagrange multipliers. Karush–Kuhn–Tucker conditions
9. Graphical analysis of extrema. Applications to Economy and Management

Part III – Integral calculus in \mathbb{R}^2

1. Double integrals. Fubini's theorem
2. Reversing the order of integration
3. Changing variables

Part IV – First order differential equations

1. Separable equations
2. Linear equations
3. Exact equations. Reducible to exact equations
4. Substitution method. Homogeneous equations and Bernoulli's equations

Course Objectives:

The aim of the course of Mathematics II is to provide students the mathematical tools that allow for the study of economy and management problems, namely tools from differential and integral calculus for functions of several variables and methods for solving differential equations.

Grading:

The student is obliged to follow a continuous evaluation scheme, which may allow him/her to skip the final exam. During the semester, there will be two mini-tests (MT1 and MT2) and two tests (T1 and T2). The final grade of the continuous evaluation (CE) is the weighted average of this four evaluation moments, rounded to two decimal places, according to the weights in the following table:

	MT1	MT2	T1	T2	CE
All evaluations	10%	10%	40%	40%	100%
Missing one mini-test	15%		40%	40%	95%
Missing both mini-tests	-		42.5%	42.5%	85%
Missing one test*	10%	10%	50%		70%
Missing one mini-test and one test*	15%		50%		65%

*The student cannot be dismissed from the final exam; the final grade for this course will be the final exam grade.

The student can be dismissed from the final exam if the grade of the continuous evaluation is greater or equal to 9.50 (out of 20) and if none of the tests grades was inferior to 6.00 (out of 20).

If the continuous evaluation grade is greater or equal to 9.50 (out of 20) but one of the test grades was inferior to 6.00 (out of 20), then the final grade for this course will be the final exam grade.

In the case that the continuous evaluation grade is greater or equal to 6.50 (out of 20) and less than 9.50 (out of 20), the student still may attend the final exam and the final grade of the course will be the final exam grade.

If the grade of the continuous evaluation is less than 6.50 (out of 20), the student will fail at this course and therefore will not be allowed to attend the final exam.

If a student wishes to improve his continuous evaluation grade, the student may do so attending the final exam. The final grade for the course will then be the maximum between the following two components:

- Exam grade;
- Continuous evaluation grade minus 1 (out of 20)

If a student obtains a final grade of 17 (out of 20) or higher, be it from the continuous evaluation or from the final exam, the student must undertake an oral examination to defend that mark. In case the student misses the oral examination or fails to defend the mark, the final course grade will be 16 (out of 20).

The use of a calculator is not allowed, nor the use of tables of formulas.

Leaving a test after its beginning without submitting the test is equivalent to have a zero grade in the test.

Written tests corrected will be available for students for consultation.

The student is required to attend the classes. The maximum number of missing classes is 1/3 of the total number of classes. If this threshold is achieved, the student will have to attend the final exam even if he/she fills the above criteria. The final grade of the course will be the final exam grade.

Bibliography:

Recommended

- Pedro Encarnação, *Apontamentos de Matemática II*, UCP, 2017
- Caderno de Exercícios de Matemática II, UCP, 2016

Complementar

- H. Anton, I. C. Bivens and S. Davis, *Cálculo*, 10ª Edição, Bookman, 2014.
- W. E. Boyce and R. C. DiPrima, *Equações Diferenciais Elementares e Problemas de Valores de Contorno*, 10ª Edição, LTC, 2015.
- Vasco Simões, *Análise Matemática 1*, Edições Orion, 2009.
- Vasco Simões, *Análise Matemática 2*, Edições Orion, 2011.
- António Monteiro and Isabel Matos, *Cadernos de Matemática 1: Primitivas*, Edições Orion, 2014.
- Manuel Alberto M. Ferreira and Isabel Amaral, *Matemática – Primitivas e integrais*, Edições Sílabo, 2006.

- Manuel Alberto M. Ferreira and Isabel Amaral, *Matemática – Exercícios de Primitivas e Integrais*, Edições Sílabo, 2009.
- Manuel Alberto M. Ferreira and Isabel Amaral, *Matemática - Cálculo Diferencial em R^n* , Edições Sílabo, 2011.
- Manuel Alberto M. Ferreira, *Matemática – Exercícios de Cálculo Diferencial em R^n* , Edições Sílabo, 2008.
- Manuel Alberto M. Ferreira and Isabel Amaral, *Matemática - Integrais Múltiplos e Equações Diferenciais*, Edições Sílabo, 2005.
- Manuel Alberto M. Ferreira, *Matemática – Exercícios de Integrais Múltiplos e Equações Diferenciais*, Edições Sílabo, 2002.
- B. Demidovitch, *Problemas e Exercícios de Análise Matemática*, Escolar Editora, 2010.
- D.G. Zill, *A First Course in Differential Equations with Modeling Applications*, 10th International Metric Edition, CENGAGE Learning, 2017.

Biography:

Pedro Encarnação is an Adjunct Assistant Professor at the Católica Lisbon School of Business and Economics. He has received the 'Licenciatura' degree in 1994, the M.Sc. degree in 1998, and the Ph.D. degree in 2002, all in Electrical and Computers Engineering from the Instituto Superior Técnico, Lisbon, Portugal. He was Associate Dean of the Faculty of Engineering of Catholic University of Portugal between 2002 and 2008 and the coordinator of the subject area of Mathematics between 2001 and 2013. His current research interests include Rehabilitation Engineering, namely the use of robotic systems in the rehabilitation of persons with disabilities, and nonlinear control of autonomous vehicles.

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