



## Study Plan

**School:** School of Sciences and Technology  
**Degree:** Master  
**Course:** Mathematics for Teaching (cód. 603)

### 1st Year - 1st Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT11921	Seminar of Mathematics for Teaching	Mathematics	6	Semester	156

### Group of Options

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT10199	Complements of Discrete Mathematics	Mathematics	6	Semester	156
PED10202	Didactics of mathematics and Knowledge	Education Sciences	6	Semester	156
MAT11920	Principles of Geometry	Mathematics	6	Semester	156
MAT10201	Principles of Probabilities and Statistics	Mathematics	6	Semester	156
MAT10200	Real Analysis through an Historical Approach	Mathematics	6	Semester	156

### 1st Year - 2nd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT11923	Training Complementary in Mathematics	Mathematics	6	Semester	156

### Group of Options

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT10203	Statistical Models	Mathematics	6	Semester	156
PED10207	Technology in Mathematics Education	Education Sciences	6	Semester	156
MAT10206	Multivariate Data Statistics	Mathematics	6	Semester	156
MAT11922	Chaos and Fractals in the Classroom	Mathematics	6	Semester	156
MAT10204	Mathematical Modelling	Mathematics	6	Semester	156

### 2nd Year - 3rd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
	Dissertation				

### 2nd Year - 4th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
	Dissertation				



## Conditions for obtaining the Degree:

\*\*\* TRANSLATE ME: Para aprovação na componente curricular deste Mestrado, é necessário a aprovação (através de avaliação ou creditação) das seguintes unidades curriculares: { \ } newline

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1.º Semestre

- 1 UC Obrigatória num total de 6 ECTS { \ } newline

- 4 UC Optativas neste semestre num total de 24 ECTS { \ } newline

{ \ } newline

2.º Semestre

- 1 UC Obrigatória num total de 6 ECTS { \ } newline

- 4 UC Optativas neste semestre num total de 24 ECTS { \ } newline

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Para obtenção de grau, é necessário também a aprovação em Dissertação, no total de 60 ECTS, no 3.º e 4.º Semestre. \*\*\*

## Program Contents

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### Complements of Discrete Mathematics (MAT10199)

Elementary number theory with applications in cryptography. Graph Theory

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### Didactics of mathematics and Knowledge (PED10202)

C1. Mathematics teaching as an area of scientific knowledge;

C2. The nature of mathematics knowledge;

C3. Problem solving and research activities in the mathematics teaching.

C4. The professional knowledge of mathematics teacher.

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### Principles of Geometry (MAT11920)

Moderns elementary geometry (ulterior developments of Euclidean Geometry)

Geometrical transformations, isometries and similarities.

Symmetry and its relation with art and architecture.

Projective geometry and evolution of perspective in painting.

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### Principles of Probabilities and Statistics (MAT10201)

That treats Statistics:

The Statistics as scientific research methodology. Observational and experimental. The collection, cleaning, summary and presentation of data. Populations and samples, sampling units and variables. The scale of Stevens. Elementary notions on sampling and planning experiences.

Data Analysis:

(a) Univariate data. Sample characteristics. Graphic representations.

(b) Bivariate data: descriptive approach to correlation and regression.

Conditional Probability and Probability:

(a) Notions of probability, Kolmogorov axiomatics and its consequences.

(b) conditional probability. Probability of a chain and the multiplication rule. Independence. The Theorem of Total Probability and Bayes Theorem.

Models:

(a) discrete models: binomial, hypergeometric and Poisson, and mutual relations.

(b) continuous models: uniform and Gaussian.



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### **Real Analysis through an Historical Approach (MAT10200)**

1. Archimedes and the Parabola
2. The calculation of Fermat
3. The calculation of Newton
4. Euler: trigonometric series
5. The real numbers
6. Sequences and their limits
7. Infinite series
8. Series of functions
9. Continuity, differentiability and integrability.

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### **Statistical Models (MAT10203)**

Exploratory Data Analysis. Principal distributions of Probability. Law of Large Numbers and Central Limit Theorem. Sampling and Surveys. Correlation and Linear Regression. Selection of models. Use of Statistical Software: SPSS and R.

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### **Technology in Mathematics Education (PED10207)**

- C1. Perspectives about the use of technologies on Mathematics Education: first years of use of computer and calculator; international evolution on recent years;
- C2. Evolution of curricular orientations about the use of technologies on Mathematics Education; international tendencies; Portuguese situation.
- C3. The calculator (simple and graphic): Strategies for use; potentialities; implications.
- C4. Specific software for Mathematics: Strategies for use; potentialities; implications.
- C5. The internet in Mathematics classroom: Strategies for use; potentialities; implications.
- C6. Technologies and the curricular areas: Number; Algebra and Functions; Geometry; Statistics and Probability.
- C7. Innovative situations of use of technologies in Mathematics Education: description and analysis of particular cases.
- C8. Investigations about the use technologies on Mathematics Education: Main results from research; actual tendencies; Portuguese research in the domain.

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### **Multivariate Data Statistics (MAT10206)**

- 1- Early numerical notations
- 2-The ethnomathematical thesis
- 3-Oriental antiquity. India and Greece
- 4-The taming of the infinite through the indivisibles
- 5-The great syntheses ,analytic geometry ,and calculus
- 6-Euler,Gauss,complex numbers and number theory
- 7-Non euclidean geometry as a revolution in the axiomatic methodology
- 8-Logic and mathematics in the XXth century
- 9-The rising of applied mathematics
- 10-Philosophies of Mathematics



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### **Chaos and Fractals in the Classroom (MAT11922)**

Iteration Theory

Intuitive notions of attractor

Fractals as fixed points of MRCM or IFS systems

Fractal dimension

Cellular automata Expansion and compression, sensibility to the initial conditions. Rate of mixing and

Lyapunov Exponents

Devaney's definition of chaos

Chaos in the quadratic family

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### **Mathematical Modelling (MAT10204)**

Introduction: mathematical models in life;

Computing machines: History of computing machines. Working with a programmable calculator. When the calculator mislead. Arithmetic operations on computing machines;

Numerical methods: Numerical resolution of nonlinear equations. Numerical solution of differential equations. Numerical optimization problems.

Applications of numerical methods: Mathematical problems of classical physics (motion of an oscillator, movement of objects in an electric field, gravity, etc.). Problems of mathematical biology (population dynamics models, etc.); Optimization problems or minimum and maximum in our life (old optimization problems, optimization of curves, satellite control, etc.). Problems of Mathematical Physics (diffusion equation, wave equation). Mathematical models in economics and ecology.