



Study Plan

School: School of Sciences and Technology

Degree: Bachelor

Course: Applied Mathematics (cód. 618)

Specialization * TRANSLATE ME: Maior em Matemática e Menor em Ciências da Computação *****

1st Year - 1st Semester

Specialization * TRANSLATE ME: Maior em Matemática e Menor em Ciências da Computação *****

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0905L	Mathematical Analysis I	Mathematics	6	Semester	162
MAT0900L	Linear Algebra and Geometry I	Mathematics	6	Semester	156
MAT0932L	Discrete Mathematics	Mathematics	6	Semester	156
MAT0922L	Geometry I	Mathematics	6	Semester	156
INF0880L	Programming I	Informatics	6	Semester	162

1st Year - 2nd Semester

Specialization * TRANSLATE ME: Maior em Matemática e Menor em Ciências da Computação *****

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0906L	Mathematical Analysis II	Mathematics	6	Semester	162
MAT12063L	Linear Algebra and Geometry II	Mathematics	6	Semester	156
MAT10689L	Mathematics and Statistics Laboratory	Mathematics	6	Semester	156
INF0881L	Programming II	Informatics	6	Semester	162
FIS0703L	General Physics I	Physics	6	Semester	158

2nd Year - 3rd Semester

Specialization * TRANSLATE ME: Maior em Matemática e Menor em Ciências da Computação *****

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0907L	Mathematical Analysis III	Mathematics	6	Semester	162
MAT0925L	Introduction to Probability and Statistics	Mathematics	6	Semester	154
MAT0938L	Metrics and Topology	Mathematics	6	Semester	156
MAT0898L	Algebra I	Mathematics	6	Semester	156
MAT0909L	Numerical Analysis I	Mathematics	6	Semester	156

2nd Year - 4th Semester

Specialization * TRANSLATE ME: Maior em Matemática e Menor em Ciências da Computação *****

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0908L	Mathematical Analysis IV	Mathematics	6	Semester	162



2nd Year - 4th Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Ciências da Computação ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0912L	Complements of Probability and Statistics	Mathematics	6	Semester	162
MAT0929L	Computational Logic	Mathematics	6	Semester	156
MAT7735L	Computational Methods	Mathematics	6	Semester	159
MAT0924L	History and Philosophy of Mathematics	Mathematics	6	Semester	157

3rd Year - 5th Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Ciências da Computação ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0918L	Mathematical Statistics	Mathematics	6	Semester	156
MAT0903L	Complex Analysis	Mathematics	6	Semester	156

*** TRANSLATE ME:Optativas-Quadro A ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0930L	Logic and Foundations of Mathematics	Mathematics	6	Semester	156
MAT0943L	Topics of Group Theory	Mathematics	6	Semester	156
MAT0942L	Number Theory and Cryptography	Mathematics	6	Semester	156
MAT0913L	Ordinary Differential Equations	Mathematics	6	Semester	156
MAT0939L	Functional Optimization	Mathematics	6	Semester	156

*** TRANSLATE ME:Optativas-Quadro C ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0927L	Introduction to Stochastic Processes	Mathematics	6	Semester	156
MAT0916L	Applied Statistics	Mathematics	6	Semester	157
MAT0919L	Multivariate Statistics	Mathematics	6	Semester	156

*** TRANSLATE ME:Optativas-Quadro E ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
INF0868L	Algorithms and Data Structures I	Informatics	6	Semester	162
INF0864L	Databases	Informatics	6	Semester	157
INF0879L	Declarative Programming	Informatics	6	Semester	162

3rd Year - 6th Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Ciências da Computação ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0936L	Measure, Probability and Integration	Mathematics	6	Semester	156
MAT0940L	Project in Mathematics	Mathematics	6	Semester	156



3rd Year - 6th Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Ciências da Computação ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
*** TRANSLATE ME:Optativas-Quadro B ***					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0899L	Algebra II	Mathematics	6	Semester	156
MAT0897L	Computational Algebra	Mathematics	6	Semester	156
MAT0941L	Computability and Complexity Theory	Mathematics	6	Semester	156
MAT0914L	Partial Differential Equations	Mathematics	6	Semester	156
MAT0921L	Differential Geometry	Mathematics	6	Semester	156
MAT0904L	Functional Analysis	Mathematics	6	Semester	156
MAT0910L	Numerical Analysis II	Mathematics	6	Semester	156
MAT0923L	Geometry II	Mathematics	6	Semester	156
*** TRANSLATE ME:Optativas-Quadro D ***					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0920L	Fundaments of Operations Research	Mathematics	6	Semester	158
MAT0926L	Introduction to Quality Control and Reliability	Mathematics	6	Semester	156
MAT0902L	Sampling	Mathematics	6	Semester	156
*** TRANSLATE ME:Optativas-Quadro F ***					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
INF0862L	Computer and Systems Architecture I	Informatics	6	Semester	159
INF0872L	Programming Languages	Informatics	6	Semester	160
INF0866L	Computer Graphics	Informatics	6	Semester	160

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Matemática ***

1st Year - 1st Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Matemática ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0905L	Mathematical Analysis I	Mathematics	6	Semester	162
MAT0900L	Linear Algebra and Geometry I	Mathematics	6	Semester	156
MAT0932L	Discrete Mathematics	Mathematics	6	Semester	156
MAT0922L	Geometry I	Mathematics	6	Semester	156
INF0880L	Programming I	Informatics	6	Semester	162



1st Year - 2nd Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Matemática ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0906L	Mathematical Analysis II	Mathematics	6	Semester	162
MAT12063L	Linear Algebra and Geometry II	Mathematics	6	Semester	156
MAT10689L	Mathematics and Statistics Laboratory	Mathematics	6	Semester	156
INF0881L	Programming II	Informatics	6	Semester	162
FIS0703L	General Physics I	Physics	6	Semester	158

2nd Year - 3rd Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Matemática ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0907L	Mathematical Analysis III	Mathematics	6	Semester	162
MAT0925L	Introduction to Probability and Statistics	Mathematics	6	Semester	154
MAT0938L	Metrics and Topology	Mathematics	6	Semester	156
MAT0898L	Algebra I	Mathematics	6	Semester	156
MAT0909L	Numerical Analysis I	Mathematics	6	Semester	156

2nd Year - 4th Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Matemática ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0908L	Mathematical Analysis IV	Mathematics	6	Semester	162
MAT0912L	Complements of Probability and Statistics	Mathematics	6	Semester	162
MAT0929L	Computational Logic	Mathematics	6	Semester	156
MAT7735L	Computational Methods	Mathematics	6	Semester	159
MAT0924L	History and Philosophy of Mathematics	Mathematics	6	Semester	157

3rd Year - 5th Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Matemática ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0918L	Mathematical Statistics	Mathematics	6	Semester	156
MAT0903L	Complex Analysis	Mathematics	6	Semester	156



3rd Year - 5th Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Matemática ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
*** TRANSLATE ME:Optativas-Quadro A ***					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0930L	Logic and Foundations of Mathematics	Mathematics	6	Semester	156
MAT0943L	Topics of Group Theory	Mathematics	6	Semester	156
MAT0942L	Number Theory and Cryptography	Mathematics	6	Semester	156
MAT0913L	Ordinary Differential Equations	Mathematics	6	Semester	156
MAT0939L	Functional Optimization	Mathematics	6	Semester	156
*** TRANSLATE ME:Optativas-Quadro C ***					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0927L	Introduction to Stochastic Processes	Mathematics	6	Semester	156
MAT0916L	Applied Statistics	Mathematics	6	Semester	157
MAT0919L	Multivariate Statistics	Mathematics	6	Semester	156

3rd Year - 6th Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Matemática ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0936L	Measure, Probability and Integration	Mathematics	6	Semester	156
MAT0940L	Project in Mathematics	Mathematics	6	Semester	156
*** TRANSLATE ME:Optativas-Quadro B ***					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0899L	Algebra II	Mathematics	6	Semester	156
MAT0897L	Computational Algebra	Mathematics	6	Semester	156
MAT0941L	Computability and Complexity Theory	Mathematics	6	Semester	156
MAT0914L	Partial Differential Equations	Mathematics	6	Semester	156
MAT0921L	Differential Geometry	Mathematics	6	Semester	156
MAT0904L	Functional Analysis	Mathematics	6	Semester	156
MAT0910L	Numerical Analysis II	Mathematics	6	Semester	156
MAT0923L	Geometry II	Mathematics	6	Semester	156



3rd Year - 6th Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Matemática ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
*** TRANSLATE ME: Optativas-Quadro D ***					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0920L	Fundaments of Operations Research	Mathematics	6	Semester	158
MAT0926L	Introduction to Quality Control and Reliability	Mathematics	6	Semester	156
MAT0902L	Sampling	Mathematics	6	Semester	156

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Estatística ***

1st Year - 1st Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Estatística ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0905L	Mathematical Analysis I	Mathematics	6	Semester	162
MAT0900L	Linear Algebra and Geometry I	Mathematics	6	Semester	156
MAT0932L	Discrete Mathematics	Mathematics	6	Semester	156
MAT0922L	Geometry I	Mathematics	6	Semester	156
INF0880L	Programming I	Informatics	6	Semester	162

1st Year - 2nd Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Estatística ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0906L	Mathematical Analysis II	Mathematics	6	Semester	162
MAT12063L	Linear Algebra and Geometry II	Mathematics	6	Semester	156
MAT10689L	Mathematics and Statistics Laboratory	Mathematics	6	Semester	156
INF0881L	Programming II	Informatics	6	Semester	162
FIS0703L	General Physics I	Physics	6	Semester	158

2nd Year - 3rd Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Estatística ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0907L	Mathematical Analysis III	Mathematics	6	Semester	162
MAT0925L	Introduction to Probability and Statistics	Mathematics	6	Semester	154
MAT0938L	Metrics and Topology	Mathematics	6	Semester	156
MAT0898L	Algebra I	Mathematics	6	Semester	156
MAT0909L	Numerical Analysis I	Mathematics	6	Semester	156



2nd Year - 4th Semester

Specialization * TRANSLATE ME: Maior em Matemática e Menor em Estatística *****

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0908L	Mathematical Analysis IV	Mathematics	6	Semester	162
MAT0912L	Complements of Probability and Statistics	Mathematics	6	Semester	162
MAT0929L	Computational Logic	Mathematics	6	Semester	156
MAT7735L	Computational Methods	Mathematics	6	Semester	159
MAT0924L	History and Philosophy of Mathematics	Mathematics	6	Semester	157

3rd Year - 5th Semester

Specialization * TRANSLATE ME: Maior em Matemática e Menor em Estatística *****

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0918L	Mathematical Statistics	Mathematics	6	Semester	156
MAT0903L	Complex Analysis	Mathematics	6	Semester	156

***** TRANSLATE ME:Optativas-Quadro A *****

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0930L	Logic and Foundations of Mathematics	Mathematics	6	Semester	156
MAT0943L	Topics of Group Theory	Mathematics	6	Semester	156
MAT0942L	Number Theory and Cryptography	Mathematics	6	Semester	156
MAT0913L	Ordinary Differential Equations	Mathematics	6	Semester	156
MAT0939L	Functional Optimization	Mathematics	6	Semester	156

***** TRANSLATE ME:Optativas-Quadro C *****

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0927L	Introduction to Stochastic Processes	Mathematics	6	Semester	156
MAT0916L	Applied Statistics	Mathematics	6	Semester	157
MAT0919L	Multivariate Statistics	Mathematics	6	Semester	156

3rd Year - 6th Semester

Specialization * TRANSLATE ME: Maior em Matemática e Menor em Estatística *****

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0936L	Measure, Probability and Integration	Mathematics	6	Semester	156
MAT0940L	Project in Mathematics	Mathematics	6	Semester	156



3rd Year - 6th Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Estatística ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
*** TRANSLATE ME:Optativas-Quadro B ***					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0899L	Algebra II	Mathematics	6	Semester	156
MAT0897L	Computational Algebra	Mathematics	6	Semester	156
MAT0941L	Computability and Complexity Theory	Mathematics	6	Semester	156
MAT0914L	Partial Differential Equations	Mathematics	6	Semester	156
MAT0921L	Differential Geometry	Mathematics	6	Semester	156
MAT0904L	Functional Analysis	Mathematics	6	Semester	156
MAT0910L	Numerical Analysis II	Mathematics	6	Semester	156
MAT0923L	Geometry II	Mathematics	6	Semester	156
*** TRANSLATE ME:Optativas-Quadro D ***					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0920L	Fundaments of Operations Research	Mathematics	6	Semester	158
MAT0926L	Introduction to Quality Control and Reliability	Mathematics	6	Semester	156
MAT0902L	Sampling	Mathematics	6	Semester	156

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Física ***

1st Year - 1st Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Física ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0905L	Mathematical Analysis I	Mathematics	6	Semester	162
MAT0900L	Linear Algebra and Geometry I	Mathematics	6	Semester	156
MAT0932L	Discrete Mathematics	Mathematics	6	Semester	156
MAT0922L	Geometry I	Mathematics	6	Semester	156
INF0880L	Programming I	Informatics	6	Semester	162

1st Year - 2nd Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Física ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0906L	Mathematical Analysis II	Mathematics	6	Semester	162
MAT12063L	Linear Algebra and Geometry II	Mathematics	6	Semester	156
MAT10689L	Mathematics and Statistics Laboratory	Mathematics	6	Semester	156



1st Year - 2nd Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Física ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
INF0881L	Programming II	Informatics	6	Semester	162
FIS0703L	General Physics I	Physics	6	Semester	158

2nd Year - 3rd Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Física ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0907L	Mathematical Analysis III	Mathematics	6	Semester	162
MAT0925L	Introduction to Probability and Statistics	Mathematics	6	Semester	154
MAT0938L	Metrics and Topology	Mathematics	6	Semester	156
MAT0898L	Algebra I	Mathematics	6	Semester	156
MAT0909L	Numerical Analysis I	Mathematics	6	Semester	156

2nd Year - 4th Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Física ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0908L	Mathematical Analysis IV	Mathematics	6	Semester	162
MAT0912L	Complements of Probability and Statistics	Mathematics	6	Semester	162
MAT0929L	Computational Logic	Mathematics	6	Semester	156
MAT7735L	Computational Methods	Mathematics	6	Semester	159
MAT0924L	History and Philosophy of Mathematics	Mathematics	6	Semester	157

3rd Year - 5th Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Física ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0918L	Mathematical Statistics	Mathematics	6	Semester	156
MAT0903L	Complex Analysis	Mathematics	6	Semester	156

*** TRANSLATE ME: Optativas-Quadro A ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0930L	Logic and Foundations of Mathematics	Mathematics	6	Semester	156
MAT0943L	Topics of Group Theory	Mathematics	6	Semester	156
MAT0942L	Number Theory and Cryptography	Mathematics	6	Semester	156
MAT0913L	Ordinary Differential Equations	Mathematics	6	Semester	156
MAT0939L	Functional Optimization	Mathematics	6	Semester	156



3rd Year - 5th Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Física ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
*** TRANSLATE ME:Optativas-Quadro C ***					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0927L	Introduction to Stochastic Processes	Mathematics	6	Semester	156
MAT0916L	Applied Statistics	Mathematics	6	Semester	157
MAT0919L	Multivariate Statistics	Mathematics	6	Semester	156
*** TRANSLATE ME:Optativas-Quadro G ***					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS0701L	Statistical Physics and Thermodynamics	Physics	6	Semester	156
FIS0714L	Classical Mechanics	Physics	6	Semester	156
FIS0715L	Quantum Mechanics I	Physics	6	Semester	156
FIS0723L	Relativity and Cosmology	Physics	6	Semester	157

3rd Year - 6th Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Física ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0936L	Measure, Probability and Integration	Mathematics	6	Semester	156
MAT0940L	Project in Mathematics	Mathematics	6	Semester	156
*** TRANSLATE ME:Optativas-Quadro B ***					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0899L	Algebra II	Mathematics	6	Semester	156
MAT0897L	Computational Algebra	Mathematics	6	Semester	156
MAT0941L	Computability and Complexity Theory	Mathematics	6	Semester	156
MAT0914L	Partial Differential Equations	Mathematics	6	Semester	156
MAT0921L	Differential Geometry	Mathematics	6	Semester	156
MAT0904L	Functional Analysis	Mathematics	6	Semester	156
MAT0910L	Numerical Analysis II	Mathematics	6	Semester	156
MAT0923L	Geometry II	Mathematics	6	Semester	156
*** TRANSLATE ME:Optativas-Quadro D ***					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0920L	Fundaments of Operations Research	Mathematics	6	Semester	158
MAT0926L	Introduction to Quality Control and Reliability	Mathematics	6	Semester	156
MAT0902L	Sampling	Mathematics	6	Semester	156



3rd Year - 6th Semester

Specialization *** TRANSLATE ME: Maior em Matemática e Menor em Física ***

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
*** TRANSLATE ME:Optativas-Quadro H ***					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS0689L	Undulatory Phenomena	Physics	6	Semester	156
FIS0700L	Physics of Continuous Matter	Physics	6	Semester	156



Conditions for obtaining the Degree:

*** TRANSLATE ME: Matemática Aplicada

Para obtenção do grau de licenciado em Matemática Aplicada - Maior em Matemática e Menor em Matemática é necessário obter aprovação a 144 ECTS em unidades curriculares obrigatórias e 36 ECTS em unidades curriculares optativas, distribuídas da seguinte forma:

1º Ano

1º Semestre

5 UC Obrigatórias num total de 30 ECTS

2º Semestre

5 UC Obrigatórias num total de 30 ECTS

2º Ano

3º Semestre

5 UC Obrigatórias num total de 30 ECTS

4º Semestre

5 UC Obrigatórias num total de 30 ECTS

3º Ano

5º Semestre

2 UC Obrigatórias num total de 12 ECTS

3 UC Optativas num total de 18 ECTS

* Dos 36 ECTS optativos do conjunto dos 5º e 6º semestres, 24 ECTS deverão ser escolhidos entre as unidades curriculares dos Quadros A e B, que constituem o menor em Matemática, e os restantes 12 ECTS deverão ser escolhidos entre as unidades curriculares dos Quadros A, B, C e D.

6º Semestre

2 UC Obrigatória num total de 12 ECTS

3 UC Optativas num total de 18 ECTS

* Dos 36 ECTS optativos do conjunto dos 5º e 6º semestres, 24 ECTS deverão ser escolhidos entre as unidades curriculares dos Quadros A e B que constituem o menor em Matemática, e os restantes 12 ECTS deverão ser escolhidos entre as unidades curriculares dos Quadros A, B, C e D.

Para obtenção do grau de licenciado em Matemática Aplicada - Maior em Matemática e Menor em Estatística é necessário obter aprovação a 144 ECTS em unidades curriculares obrigatórias e 36 ECTS em unidades curriculares optativas, distribuídas da seguinte forma:

1º Ano

1º Semestre

5 UC Obrigatórias num total de 30 ECTS

2º Semestre

5 UC Obrigatórias num total de 30 ECTS

2º Ano

3º Semestre

5 UC Obrigatórias num total de 30 ECTS

4º Semestre

5 UC Obrigatórias num total de 30 ECTS

3º Ano

5º Semestre

2 UC Obrigatórias num total de 12 ECTS

3 UC Optativas num total de 18 ECTS

* Dos 36 ECTS optativos do conjunto dos 5º e 6º semestres, 24 ECTS deverão ser escolhidos entre as unidades curriculares dos Quadros C e D, que constituem o menor em Matemática, e os restantes 12 ECTS deverão ser escolhidos entre as unidades curriculares dos Quadros A, B, C e D.

6º Semestre

2 UC Obrigatória num total de 12 ECTS

3 UC Optativas num total de 18 ECTS

* Dos 36 ECTS optativos do conjunto dos 5º e 6º semestres, 24 ECTS deverão ser escolhidos entre as unidades curriculares dos Quadros C e D, que constituem o menor em Matemática, e os restantes 12 ECTS deverão ser escolhidos entre as unidades curriculares dos Quadros A, B, C e D.

Para obtenção do grau de licenciado em Matemática Aplicada - Maior em Matemática e Menor em Ciências da Computação é necessário obter aprovação a 144 ECTS em unidades curriculares obrigatórias e 36 ECTS em unidades curriculares optativas, distribuídas da seguinte forma:

1º Ano

1º Semestre

5 UC Obrigatórias num total de 30 ECTS

2º Semestre



Program Contents

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Mathematical Analysis I (MAT0905L)

Sequences and series.
Real functions of one variable.
Differential calculus.
Sequences and series of functions.
Integral calculus and applications

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Linear Algebra and Geometry I (MAT0900L)

Systems of linear equations.
Matrices.
Determinants.
Vector spaces.
Linear applications.
Eigenvalues and eigenvectors. Jordan canonical form.
Geometry of plane and space.
Quadratic forms.

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Discrete Mathematics (MAT0932L)

1. Theory of sets
2. Combinatory
3. Theory of the numbers
4. Theory of the graphs and algorithms.

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Geometry I (MAT0922L)

The geometry of Euclides

2. Incidence.
3. Finite Geometries.
4. Coordenates.
5. Distance.
6. Propperties of parallellism.
7. Convexity.
8. Measuring and congruence of.
9. Congruence of triangels.
10. Theorem of Saccheri-Legendre.
11. Circumferences.
12. Circular Continuity.
13. Axiom de parallellism of Hilbert.
14. Similarity of triangles.
15. Theorem of Pytagoras.



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Programming I (INF0880L)

Introduction: Basic notions of statement and algorithm, Basic notions of variable and expression

Control structures: Conditionals, Loops

Basic data structures: Lists, Dictionaries, Tuples

Abstraction mechanisms: Functions

Recursion

Applications

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Mathematical Analysis II (MAT0906L)

Topology and Sequences in \mathbb{R}^n .

Limits and continuity of functions in \mathbb{R}^n .

Differential Calculus of functions in \mathbb{R}^n .

Taylor Formula.

Inverse function and Implicit function.

Free extrema and Conditioned extrema.

Line integrals.

Multiple integrals.

Surface integrals.

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Linear Algebra and Geometry II (MAT12063L)

1. Complements on linear transformations and their matrix representation.

2. Representation in different bases.

3. Metrics.

4. Change of base.

5. Isometric transformations.

6. Self-adjoint transformations.

7. Affine space.

8. Coordinate transformations at \mathbb{R}^3 .

9. Analytic geometry of the 1st degree.

10. Analytic geometry of the 2nd degree

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Mathematics and Statistics Laboratory (MAT10689L)

Programming in an interactive system of numerical and symbolic calculus, data manipulation and visualization. The use of statistical software.

Mathematical models in the study of physical, natural and economical phenomena, its choice, fitting, validation, analysis and interpretation of the results, as well as the use of appropriate numerical algorithms.

Exploratory Data Analysis

Index numbers

Time Series

Application to real data using SPSS, R and Excel.



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Programming II (INF0881L)

I - Basics of Object Oriented Programming

Objects

Classes

Messages

encapsulation

II - The Java language

Java classes

variables and instance methods

method overloading

non instantiable classes

class hierarchy and inheritance

inheritance mechanism for classes definition

Dynamic lookup for methods

Inheritance vs class composition

abstract classes

Interfaces

Exceptions

Input/output, and streams

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General Physics I (FIS0703L)

1. Introduction to Modern and Contemporary Physics

- Physics as Science: fundamental forces, physical laws and constants, models and orders of magnitude; main subjects of present Physics.

- Relativity: main concepts, speed of light.

- Quantum Physics: wave-particle nature of matter, quantization and Planck's constant; the photoelectric and Compton effects; the spectral lines.

- Present research on Physics: references to microscopic Physics, superconductivity and nanotechnology e applications; graphene.

2. Ondulatory Phenomena and Optics

- Harmonic oscillator; electromagnetic waves and waves in matter; the Doppler effect. Lasers.

- Geometrical optics: reflection and refraction; lenses and mirrors; optical devices. Interference and polarization.

3. Introduction to Thermodynamics

- Temperature scales.

- Kinetic Theory of Gases.

- Calorimetry and Zero Principle of Thermodynamics;

- 1st and 2nd Principles of Thermodynamics; entropy.



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Mathematical Analysis III (MAT0907L)

-Introduction to Complex Analysis. Complex functions and analytic functions. Cauchy-Riemann equations. Laplace equation. Harmonic functions. Geometry of analytic functions. Elementary complex functions. Complex integration. Fundamental Theorem of Calculus. Cauchy's theorem and its evolution. Cauchy integral formula and applications.

NCE/13/00836 - Apresentação do pedido - Novo ciclo de estudos http://www.a3es.pt/si/iportal.php/process_form/print?processId=f1edd77de120301020131510

-Ordinary Differential Equations. Exact equations and integrating factors. Elementary equations of 1st order. 2nd order linear equations.

-Systems of ordinary differential equations. Introduction and notations. Linear systems. Systems with constant coefficients. Stability of solutions. Planar autonomous systems.

-Fourier series. Convergence and the sum of the Fourier series. Expansion in series of sines and cosines. Periodic extensions. Complex Fourier series. Fourier integrals.

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Introduction to Probability and Statistics (MAT0925L)

1. Descriptive Statistics - Brief Review
2. Basic Probability Notions - Brief Review
3. Conditional Probability and Independence
4. Discrete and Continuous Random Variables
5. Discrete Random Vectors
6. The Most Important Families of Discrete and Continuous Probabilities Distributions
7. An Introduction to Sampling Theory
8. Statistical Inference (parametric and non-parametric)
9. Introduction to Simple Linear Regression
10. Some Non-Parametric Tests (Kolmogorov-Smirnov, Chi-Square, etc.)

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Metrics and Topology (MAT0938L)

Metric and topological spaces. Open and closed sets. Cluster points and closure. Density. Hausdorff axiom. Sequences and convergence. Continuous functions. Compact spaces. Comparison of topologies. Subspaces and product of spaces. Tikhonov theorem. Complete metric spaces. Completion. Uniform continuity. Connected spaces.

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Algebra I (MAT0898L)

Generalities about operations. Groups, symmetric groups, subgroups. Symmetry. Congruences, integers modulo m , division algorithm, primes, fundamental theorem of arithmetic. Group generators. Direct product. Lagrange's theorem. Isomorphisms. Homomorphisms. Fundamental Theorems. Introduction to rings. Integral domains, characteristic.

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Numerical Analysis I (MAT0909L)

Theory of matrices in numerical analysis : triangular factorization , properties, applications . Orthogonal transformations - Givens rotations , Householder reflections . Similarity transformation . Systems of linear equations : direct methods - triangular and orthogonal factorizations ; systems with special arrays (bands , tridiagonal , sparse) ; stability of solutions . Iterative methods - methods of Jacobi , Gauss- Seidel relaxation : convergence acceleration; Krylov subspace methods , the conjugate gradient method and preconditioning . Systems of nonlinear equations : the fixed point method . Newton methods , quasi- Newton. Calculation of eigenvalues and eigenvectors : Location of eigenvalues. Rayleigh quotient . Method of forward and reverse power , Jacobi method , QR algorithm. Eigenvalues of tridiagonal matrices . Introduction to numerical methods for ODEs and PDEs : explicit and implicit methods . Finite differences , finite elements .



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Mathematical Analysis IV (MAT0908L)

First order Difference Equations. Linear higher order Difference Equations and Systems of Difference Equations with constant coefficients. Applications.

Integral transforms.

Introduction to Partial Differential Equations.

Convex Analysis in \mathbb{R}^n .

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Complements of Probability and Statistics (MAT0912L)

Complements of Probability Distributions (includes, among others, the Gamma, Beta and Weibull distributions).

- Variable Transformations.
- Moment and probability generating functions
- Characteristics functions.
- Analysis of variance (1 and 2 factor)
- Introduction to Categorical data Analysis

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Computational Logic (MAT0929L)

1. Proposicional logic

1.1 Syntax, semantics

1.2 Truth tables

1.3 Natural deduction

1.4 Semantic Tableaux

1.5 Normal forms, resolution

1.6 Metatheory

2. First-order logic

2.1 Syntax, semantics of Tarski

2.2 Natural deduction

2.3 Semantic Tableaux

2.4 Normal forms

2.5 Metatheory

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Computational Methods (MAT7735L)

The interactive programming system for symbolic and numerical computation, and data manipulation and visualization. Mathematical models, numerical algorithms and mathematical problems.

Implementation of some basic numerical algorithms.

Fundamentals of numerical computation: floating point systems, errors, conditioning, convergence, stability.

Resolution of nonlinear equations.

Solving systems of linear and nonlinear equations.

Interpolation and approximation of functions.

Derivation and numerical integration.

Numerical methods of optimization.

Introduction to numerical solution of ordinary differential equations.



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History and Philosophy of Mathematics (MAT0924L)

1. Numerical notations
2. The ethnomathematical thesis
3. Arithmetics and geometry from Thales to Diophantus
4. The great discoverers: Pythagoras Eudoxus Euclid Archimedes Appolonius
5. Perplexities of the algebrists of the Renaissance
6. The taming of the infinite through the indivisibles: de Cavalieri, Pascal, Galileu, Kepler e Torricelli
7. Analytic geometry ,the first great synthesis
8. The beginning of calculus and the use of series: Wallis, Newton, Leibniz, os Bernoulli, M de L'Hospital, Euler. Gauss, complex numbers and number theory
9. Non euclidean geometry as a revolution in the axiomatic methodology
10. Birth of modern algebra: Lagrange, Abel, Galois.
11. The rigorization of calculus in the XIXth century and set theory (Cantor, Dedekind)
12. Logic and mathematics in the XXth century
13. The rising of applied mathematics.

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Mathematical Statistics (MAT0918L)

1. Review of basic concepts of probability and statistical inference. Statistics of order.
2. Point estimation and properties of the estimators.
3. Classical estimation methods
 - 3.1 Method of Moments
 - 3.2 Method of Least Squares
 - 3.2 Method of Maximum Likelihood
4. Bayesian estimation methods.
5. Estimation of confidence intervals (building via key variable).
6. Estimation of credibility intervals (Bayesian).
7. Hypothesis testing.
8. Simulation techniques.
9. Resampling methods.
10. Elements of the general theory of linear additive models.
 - 10.0 Definitions, Exponential Family and their properties, Link Function, Design Matrix.
 - 10.1 Generalized linear models (Poisson and Binomial Regression ...)
 - 10.2 General Linear Models (Regression, Analysis of Variance and Covariance)

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Complex Analysis (MAT0903L)

Cauchy theorem, Cauchy integral formula, maximum module theorem, harmonic functions. Series representation of analytic functions, Taylor series, Laurent series, singularities. Fundamental Theorem of Algebra. Calculation and residue theorem. Conformal mapping, linear fractional mapping, applications. Analytic extension and elementary Riemann surfaces.



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Number Theory and Cryptography (MAT0942L)

1. Introduction of the objectives, Notion of symmetric cipher, Notion of Public-key: ciphers, signatures and protocols.

2. Number theory and cryptography. Prime divisibility, Numbers and factorization, congruences and residue class rings, function of Euler-Phi, Fermat's little theorem, and Chinese theorem of, Cyclic Groups and discrete Logarithms.

3. Symmetrical ciphers. Study of the ciphers guided to the computational efficiency, sequential ciphers for processing of information in real time, ciphers for blocks; its ways and standards: DES and AES, linear Cryptoanalysis.

4. Cryptography of public key (based in the integer factorization and the Problem of the Discrete Logarithms). The techniques RSA, Rabin and ElGamal. Digital ciphers, signatures (RSA, ElGamal and DSA), the protocol of Diffie-Hellman.

5. Cryptography based in public key in elliptic curves.

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Functional Optimization (MAT0939L)

Historical introduction.

Weak and strong variations.

Proof of validity of the Euler-Lagrange equation for simple integrals with C^1 lagrangian in spaces of functions in competition of class C^1 .

Generalizations of the Euler-Lagrange equation: simple integrals containing n -th order derivatives of the functions in competition; double integrals; piecewise C^1 functions in competition (Weierstrass-Erdmann corner point conditions).

Sufficient conditions for existence of minimum for integrals with lagrangean depending only on the velocity variable: weak and strong minima.

Necessary conditions for the existence of minimum under isoperimetric conditions.

Special important examples: geodesics, brachistochrone, minimal surfaces of revolution.

Control theory. Controlability. Optimal control.

Minimal time linear autonomous problems: existence of an optimal control and extremal controls; normality and uniqueness of the optimal control.

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Introduction to Stochastic Processes (MAT0927L)

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Multivariate Statistics (MAT0919L)

Exploratory Analysis of Multivariate Data

Multivariate techniques of dependence and interdependence

Populations and samples and Multivariate Multivariate Normal Distribution

Principal Component Analysis and Factor Analysis

Cluster Analysis

Discriminant Analysis

Introduction to Regression Trees

Software: SPSS and R



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Algorithms and Data Structures I (INF0868L)

1. Introduction to algorithms analysis

- Spatial and Temporal Complexity
- Best case, worst case and expected case
- notations Big-O, Omega and Theta
- Analysis of iterative and recursive algorithms

2. Abstract data types

- Lists, Stacks, Queues
- Trees
- Binary trees, binary trees traversals
- Binary search trees
- Perfectly balanced and balanced trees
- AVL Trees
- Priority queues: binary heaps, construction of a heap from a vector
- Hash tables: Collisions and its resolution

3. The sorting problem

- Presentation, analysis and comparison of the behavior of some sorting algorithms: BubbleSort, Insertion sort, Mergesort, Heapsort, Quicksort and Bucketsort

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Databases (INF0864L)

Introduction: Management System Database, Data Model, Languages of Databases.

Entity Relationship Model: Basic concepts (entity and relationship); Design of ER Model; constraints mapping; Clark, ER Diagram, Weak Entity; Extensions to the ER model; Model Reduction of an ER schema tables.

Relational Model: Structure of Relational Databases, Relational Algebra (operators) Extensions of Relational Algebra. Modification of the Database.

Languages manipulation of databases (SQL): Basic structure and set of SQL operations, Aggregate Functions, Modification of the base data and views, data definition language.

Database Integrity: Domain Restrictions, referential integrity, assertions and triggers, functional dependencies.

Database Normalization: Functional dependencies, Boyce-Cood, normal form and 3rd normal form.

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Declarative Programming (INF0879L)

Introduction and motivation

Logic Programming: Concepts, Prolog language, Logic Programming techniques

Introduction to functional programming: Basic types and definitions, Designing and writing programs, Data types

Programming with lists, Defining functions over lists, Generalization: patterns of computation, Functions as values.

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Measure, Probability and Integration (MAT0936L)

Jordan and Lebesgue measure in a finite dimensional space. Measurable sets. Abstract measure. Extension and completion. Measurable functions. Lebesgue integral. Convergence almost everywhere and by measure. Convergence theorems. Product of measures. Fubini theorem. Sign measures. Radon-Nikodym theorem. Probabilistic interpretation



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Project in Mathematics (MAT0940L)

The student chooses one of the following options:

- Small period of training in a enterprise in professional context.
- Small monograph.
- Development of a mathematical application integrated in the consulting structure in Statistics and Mathematical Modelling of the Department of Mathematics (integrated in the OTIC, the Tecnological Transfer Interface of the University).

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Fundamentals of Operations Research (MAT0920L)

- 1 - Introduction to Operations Research methodology
- 2 - Problem Formulation
- 3 - Linear Programming
- 4 ? Duality; Shadow Prices and Opportunity Costs
- 5 - Optimization in networks and graphs
- 6 - Project Management

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Introduction to Quality Control and Reliability (MAT0926L)

Basic Concepts in Quality Control and Reliability.

Control charts for variables.

Control charts for attributes.

Process capability analysis.

Acceptance sampling. Different sampling plans. MIL STD tables.

Sampling methods in quality control.

Optimization in quality control.

Reliability and survival.

Series and parallel systems.

Inspection systems policies.

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Sampling (MAT0902L)

1. Basic notions on sampling and estimation.
2. Main steps about planning a sampling design and selection of sampling units.
3. Methods for data collection in survey sampling.
4. Simple random sampling.
5. Estimation of totals, means, proportions and ratios.
6. Ratio and regression estimation.
7. Stratified sampling.
8. Cluster and multi-step sampling designs.
9. Unequal probability sampling.



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Computer and Systems Architecture I (INF0862L)

General computer organization (cpu, memory, storage, peripheral devices).
Memory organization and representation (bits, bytes, words, addresses, endianness).
Instruction set architecture (ISA) of the MIPS processor.
Low level programming (MIPS assembly).
Program structure (text segment, data segment, heap, stack, etc).
MIPS conventions (registers, functions, arguments, etc).
Machine code.
Integer and floating point (IEEE754) numbers.
Introduction to virtual memory and memory hierarchy.
Laboratory project: development of a MIPS assembly project.

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Programming Languages (INF0872L)

1. Computability and programming languages
2. Lambda calculus
3. Denotational semantics
4. Systems and type inference
5. Activation records
6. Exceptions
7. Concepts of object oriented languages: inheritance and subtypes
8. Implementation of object oriented languages

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Computer Graphics (INF0866L)

Context of Computer Graphics
Computer Graphic 2D - Bases
Computer Graphic 2D - Rendering
Computer Graphic 3D - Bases
Computer Graphic 3D - Contents
Computer Graphic 3D - Geometric Transformations
Computer Graphic 3D - Visualization
Computer Graphic 3D - Illumination and Textures