MATH2 Licence en sciences mathématiques (Diploma of the Second Cycle (Licence) in Mathematical Sciences)

Programme management

MATH Département de mathématique
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Admission procedure

The regular conditions and admission procedures are detailed on the web page "Access to studies" :
http://www.ucl.ac.be/etudes/libres/acces.html

General structure of the programme

The second cycle of university studies, ("licence") programme in Mathematical Sciences offers three orientations : the classical orientation, the statistics orientation and the mathematical economics orientation. The only students entitled access to the mathematical economics orientation are those who have followed a course on mathematical economics on their MATH 12 programme.
The statistics and mathematical economics orientations are characterised by the presence of a certain number of advanced courses in the corresponding speciality ; they also foster the orientation of the thesis towards the selected speciality. All orientations lead to the same "licencié" degree in Mathematical Sciences.

Programme content

MATH21 First year

Core courses

MATH2171	Numérical analysis I A) Approximation, interpolation, integretion[22.5h+30h] (4 credits) (in French)	Alphonse Magnus
MATH2480	Differential geometry[30h+15h] (5 credits) (in French)	Yves Félix, Luc Haine, Pierre Van Moerbeke
MATH2430	Measure theory and probability[45h+30h] (9 credits) (in French)	Thierry De Pauw, Camille Debière
MATH2111	Functional analysis[30h+15h] (5 credits) (in French)	Michel Willem
SC2140	Questions of religious sciences[15h] (1 credits) (in French)	José Reding

This course will be followed in the 1st or2nd year.
The students who do not take or pass the oral expression test in English will take the following course :

ANGL2461	English - Interactive Communication Skills[30h] (2 credits)	Françoise Stas

1. Specific programme for the classical orientation
A. Compulsory courses
Besides the common courses, the students will follow the below-listed compulsory courses :

MATH2112	Topology[22.5h+15h] (4 credits) (in French)	Yves Félix, Pascal Lambrechts
MATH2120	Commutative algebra[30h+15h] (4.5 credits) (in French)	Jean-Pierre Tignol
INMA2325	Ordinary differential equations[30h+15h] (4 credits) (in French)	Patrick Habets, Jean Mawhin
PHYS2111	Introduction to non-linear dynamics[30h+22.5h] (4.5 credits) (in French)	Jean Bricmont, Luc Haine

B.Options
In addition, the students will take courses from the following list, for a total of at least 16 ECTS.

1. Algebra - Geometry - Logic

MATH2121	Galois Theory[30h] (3 credits) ∅ (in French)	Francis Borceux
MATH2391	Theory of categories (First part)[22.5h] (2.5 credits) (in French)	Francis Borceux, Enrico Vitale (coord.)
MATH2392	Theory of categories (Second part)[22.5h] (2.5 credits) (in French)	Francis Borceux, Enrico Vitale (coord.)
MATH2450	Mathematical logic[45h] (4.5 credits) (in French)	Jean-Roger Roisin
MATH2130	Riemannian geometry[22.5h] (2.5 credits) (in French)	N.

2 Analysis - Mechanics

MATH2401	Lie groups[22.5h+7.5h] (2.5 credits) Δ (in French)	N.
MATH2460	Mathematical introduction to dynamic systems[30h+15h] (3 credits) Δ (in French)	N.

3. Physics

PHYS2121	Theoretical and mathematical physics1[22.5h+15h] (3.5 credits) (in French)	Jean-Pierre Antoine, Jean Bricmont, Philippe Ruelle
PHYS2122	Theoretical and mathematical physics II[22.5h+15h] (3 credits) (in French)	Jean-Pierre Antoine, Jean Bricmont, Philippe Ruelle
PHYS2131	Sperical astronomy and mathematical astronomy[22.5h+15h] (3 credits) (in French)	Pascale Defraigne, Jean-Pascal van Ypersele de Strihou
PHYS2140	Internal geophysics[22.5h+15h] (3 credits) (in French)	Véronique Dehant
PHYS2143	General relativity and cosmology[22.5h+15h] (5 credits) (in French)	Jean-Marc Gérard

The Mathematics Department can authorise the registration of another course or seminar of the Physics "licence" on the student's programme.

4. Probability- Statistics - Operational Research

INMA2471	Optimization models and methods[30h+22.5h] (5 credits) (in French)	François Glineur
MATH2440	Statistical analysis[30h+22.5h] (5 credits) (in French)	Ingrid Van Keilegom, Rainer von Sachs
STAT2416	Multivariate probabilities ans statistics[10h+5h] (2.5 credits) (in French)	Ingrid Van Keilegom

5. Numerical Analysis

INMA2380	Matrix theory[30h+22.5h] (5 credits) (in French)	Paul Van Dooren
INMA1170	Numerical analysis[22.5h+30h] (4 credits) (in French)	Paul Van Dooren

6. Computer Studies

INGI2101	Discrete mathematics: logical foundations of computing science[30h+15h] (4 credits) (in French)	Philippe Delsarte, Axel Van Lamsweerde (coord.)
LINF2121	Algorithmics and data structures[30h+30h] (5 credits) (in French)	Pierre Dupont (coord.), Baudouin Le Charlier, Kim Mens
LINF2125	Projet de programmation : application de gestion[0h+60h] (6 credits) (in French)	Marco Saerens

2. Specific programme for the Statistics orientation

A. Compulsory courses

Besides the courses common to the three orientations, the students will follow the compulsory courses listed below :

MATH2440	Statistical analysis[30h+22.5h] (5 credits) (in French)	Ingrid Van Keilegom, Rainer von Sachs
INMA2380	Matrix theory[30h+22.5h] (5 credits) (in French)	Paul Van Dooren
INMA2471	Optimization models and methods[30h+22.5h] (5 credits) (in French)	François Glineur
PHYS2111	Introduction to non-linear dynamics[30h+22.5h] (4.5 credits) (in French)	Jean Bricmont, Luc Haine
STAT2411	Data Analysis[22.5h+7.5h] (5 credits) (in French)	Léopold Simar
STAT2412	Linear models[22.5h+7.5h] (5 credits) (in French)	Christian Hafner
STAT2416	Multivariate probabilities ans statistics[10h+5h] (2.5 credits) (in French)	Ingrid Van Keilegom
STAT2430	Statistical computing[20h+20h] (7 credits) (in French)	Bernadette Govaerts

3. Specific programme for the Mathematical Economics orientation

Besides the courses common to the three orientations, the students will follow the compulsory courses listed below :

PHYS2111	Introduction to non-linear dynamics[30h+22.5h] (4.5 credits) (in French)	Jean Bricmont, Luc Haine
MATH2440	Statistical analysis[30h+22.5h] (5 credits) (in French)	Ingrid Van Keilegom, Rainer von Sachs
ECON2115	Micro-economics[60h+30h] (12 credits) (in French)	Pierre Dehez, Jacques-François Thisse

INMA2325	Ordinary differential equations[30h+15h] (4 credits) (in French)	Patrick Habets, Jean Mawhin
ECON2125	Macro-economics[60h+30h] (12 credits) (in French)	David De la Croix, Frédéric Docquier

MATH22 Second year

The students must present a thesis (MATH 2999). The choice of a thesis director must be approved by the Mathematics Departement by the third week of the first quadrimester of the second year, at the latest. The preparation of the thesis is equivalent to about 25 credits. The thesis readers are appointed by the Mathematics Departement by the beginning of the 2nd quadrimester of the 2nd year, at the latest. The list of thesis readers will be communicated to the jury secretary.

A. Core courses

Philosophical teachings :

SC2001	Introduction to contemporary philosophy[30h] (2 credits) (in French)	Laurent de Briey

or

SC2220	Philosophy of science[30h] (2 credits) (in French)	Michel Ghins
MATH2190	Mathematical methodology[30h] (3 credits) (in French)	Michel Willem
MATH2900	Mathematics Seminar[30h] (3 credits) (in English)	Camille Debière, Yves Félix, Alphonse Magnus

This seminar is organised in the context of the "Language plan".

SC2140	Questions of religious sciences[15h] (1 credits) (in French)	José Reding

This course will be followed in the 1st or 2nd year, according to choice..

B. Options

SC2002	Elements of mathematics and physics history[30h] (4.5 credits) (in French)	Patricia De Grave

1. Algebra - Geometry - Logic

MATH2230	Algebraical topology[45h] (5 credits) (in French)	Yves Félix, Pascal Lambrechts
MATH2380	Number theory[30h] (3 credits) (in French)	Jean-Jacques Quisquater, Jean-Pierre Tignol
MATH2350	Cryptography[22.5h] (2.5 credits) (in French)	Jean-Jacques Quisquater
MATH2220	Greater geometry[30h] (3 credits) (in French)	N.
MATH2450	Mathematical logic[45h] (4.5 credits) (in French)	Jean-Roger Roisin
MATH2121	Galois Theory[30h] (3 credits) ⌀ (in French)	Francis Borceux
MATH2130	Riemannian geometry[22.5h] (2.5 credits) (in French)	N.
MATH2391	Theory of categories (First part)[22.5h] (2.5 credits) (in French)	Francis Borceux, Enrico Vitale (coord.)
MATH2392	Theory of categories (Second part)[22.5h] (2.5 credits) (in French)	Francis Borceux, Enrico Vitale (coord.)
MATH2395	Discrete mathematics - combinatorial strucutres[30h] (3 credits) (in French)	Philippe Delsarte, Jean-Pierre Tignol

2. Analysis - Mechanics

MATH2200	Infinitesimal analysis (complements)[45h] (5 credits) (in French)	Thierry De Pauw, Thierry De Pauw
MATH2401	Lie groups[22.5h+7.5h] (2.5 credits) (in French)	N.
MATH2410	Differential topology[30h] (3 credits) (in French)	Pierre Van Moerbeke
MATH2420	Complex analytic functions[30h] (3 credits) (in French)	Pierre Van Moerbeke
MATH2421	Convex analysis and calculation of variations[30h] (3 credits) (in French)	Michel Willem
MATH2490	??? ordinary or partial differential equations[45h] (4.5 credits) (in French)	Jean Mawhin
INMA2335	Partial differential equations[30h] (3 credits) (in French)	Patrick Habets, Jean Mawhin
INMA2345	Variational methods, semi-groups[30h] (3 credits) (in French)	Patrick Habets

3. Physics

PHYS2140	Internal geophysics[22.5h+15h] (3 credits) (in French)	Véronique Dehant
PHYS2143	General relativity and cosmology[22.5h+15h] (5 credits) (in French)	Jean-Marc Gérard
PHYS2144	Universe models[15h] (1.5 credits) (in French)	Jean-Marc Gérard
PHYS2290	Quantum mechanics[30h+22.5h] (6 credits) (in French)	Jacques Weyers

4. Probability- Statistics - Operational research

MATH2370	Theory of games[22.5h] (2 credits) (in French)	Jean-François Mertens
MATH2360	Stochastic processes (statistics)[30h] (3.5 credits) (in French)	Jean-Marie Rolin
MATH2372	Stochastic processes[30h] (3 credits) (in French)	Jean-François Mertens
MATH2440	Statistical analysis[30h+22.5h] (5 credits) (in French)	Ingrid Van Keilegom, Rainer von Sachs
INMA2450	Combinatorial optimization[30h+15h] (4 credits) (in French)	Laurence Wolsey
INMA2460	Optimization : Nonlinear programming[30h+15h] (4 credits) (in French)	Yurii Nesterov
INMA2470	Discrete stochastic models[30h+22.5h] (5 credits) (in French)	Philippe Chevalier
STAT2411	Data Analysis[22.5h+7.5h] (5 credits) (in French)	Léopold Simar
STAT2412	Linear models[22.5h+7.5h] (5 credits) (in French)	Christian Hafner
STAT2416	Multivariate probabilities ans statistics[10h+5h] (2.5 credits) (in French)	Ingrid Van Keilegom

5. Numerical Analysis - Computer Studies

MATH2830	Numerical analysis seminar[30h] (2 credits) (in French)	Alphonse Magnus, Paul Van Dooren
INMA2710	Numerical algorithms[30h+15h] (4 credits) (in French)	Paul Van Dooren
INGI2123	Calculability and complexity[30h+15h] (4 credits) (in French)	Yves Deville (coord.), Pierre Dupont, Baudouin Le Charlier
INGI2131	Computer language concepts[30h+30h] (5 credits) (in French)	Baudouin Le Charlier, Peter Van Roy (coord.)
INGI2132	Languages and translators[30h+30h] (5 credits) (in French)	Baudouin Le Charlier (coord.), Peter Van Roy
SINF1252	Introduction to computer systems[30h+30h] (5 credits) (in French)	Marc Lobelle
MATH2180	Numerical analysis II[45h] (4.5 credits) (in French)	Alphonse Magnus

Specific programme for the classical orientation

Besides the core courses, the students will take a minimum of 27 credits from the list below, spread over two or three of the five course titles. The activities chosen under any course heading may not surpass 20 credits. A seminar will be subject to examination or a graded piece of work.

The Mathematics Department may authorise the registration of a course or seminar not featuring on the list below on the minimal programme of the student, equivalent to 30 hours ; this course will be of a mathematical level analogous to that of those courses. The Mathematics Department may also authorise the registering of a course or seminar chosen from the UCL programmes on the minimal programme of the student.

The content of the MATH2392 and MATH2450 courses changes each year. These courses feature on the programme of the first and second year. They may be taken as options both in the first and the second year of the programme.

Specific programme for the Statistics orientation

A. Compulsory courses

Besides the common courses, the students will take the following compulsory courses :

MATH2360	Stochastic processes (statistics)[30h] (3.5 credits) (in French)	Jean-Marie Rolin
STAT2410	Discrete data analysis.[22.5h+7.5h] (5 credits) (in French)	Patrick Bogaert, Jean-Marie Rolin
STAT2413	Non parametric statistics[22.5h+7.5h] (5 credits) (in French)	Ingrid Van Keilegom
STAT2414	Times series[22.5h+7.5h] (5 credits) (in French)	Rainer von Sachs

B. Free-choice courses

7 credits, from among :

ACTU2111	Non life Insurance I[30h+15h] (4.5 credits) (in French)	Michel Denuit
INMA2470	Discrete stochastic models[30h+22.5h] (5 credits) (in French)	Philippe Chevalier
MATH2372	Stochastic processes[30h] (3 credits) (in French)	Jean-François Mertens
STAT2415	Introduction to Bayesian statistics.[15h] (2.5 credits) (in French)	Philippe Lambert
STAT2510	Statistical quality control.[15h] (2.5 credits) (in French)	Bernadette Govaerts
STAT2520	Design of experiment.[22.5h+7.5h] (5 credits) (in French)	Bernadette Govaerts, Eric Le Boulengé
STAT2530	Statistics in clinical trials.[22.5h+7.5h] (5 credits) (in French)	Philippe Lambert, Annie Robert
STAT2540	Survey and Sampling[15h] (2.5 credits) (in French)	Yves Berger
STAT2550	Data Mining[15h+15h] (5 credits) (in French)	Libei Chen

C. Options

The minimum option is for 6 credits, to be chosen from one or two of the four following titles :

1. Algebra, Geometry - Logic

2.Analysis - Mechanics

3.Physics

5. Numerical Analysis - Computer Studies

Specifc programme for the Mathematical Economics orientation

A. Compulsory courses

Besides the common courses, the students will take the following compulsory courses :

MATH2421	Convex analysis and calculation of variations[30h] (3 credits) (in French)	Michel Willem
ECON2135	Econometrics: methods and applications[45h+45h] (12 credits) (in French)	Luc Bauwens, Fatemeh Shadman Valavi
ECON2238	Financial economics[30h] (4 credits) (in French)	Pierre Giot
ECON2243	Game and Information Theory[30h] (4 credits) (in French)	Hylke Vandenbussche

B. Free-choice courses

One course to be chosen from among :

ECON2244	General Equilibrium Theory[30h] (4 credits) (in French)	François Maniquet
ECON2245	Econometrics[30h+15h] (4 credits) (in French)	Luc Bauwens
ECON2247	Growth and Development[30h] (4 credits) (in French)	Raouf Boucekkine
MATH2360	Stochastic processes (statistics)[30h] (3.5 credits) (in French)	Jean-Marie Rolin
MATH2372	Stochastic processes[30h] (3 credits) (in French)	Jean-François Mertens

C. Options

The minimum option is for 6 credits, to be chosen from one or two of the four following courses :

1.Algebra - Geometry - Logic

2. Analysis - Mechanics

3. Physics

5. Numerical Analysis - Computer Studies

Positioning of the degree within the University cursus

The three orientations may be prolonged by third study cycle (masters) programmes, extended study diplomas and PhDs, either in the same speciality or in a complemetary speciality. For example :

- the DEA in Pure and Applied Mathematics (for research in mathematics)
- the master's programme in statistics, the DES and DEA programmes in Statistics (for an initiation or perfection in the domain of statistics)
- the master's programme in Actuarial Sciences
- the DES in Applied Sciences, orientation : Computer Studies
- the DEA in Economic Sciences, the DES in Econometrics, and the DES in Financial Economics, for "licence" diploma holders in Mathematics coming from the Mathematical Economics orientation.

The "licence" diploma holders in Mathematical Sciences from the Statistics orientation may, in addition, obtain the DES in Statistics in one year instead of two.

The "licence" diploma holders in Mathematical Sciences who have added a certain number of Computer Studies courses to their programme, are entitled access to the second year of the "licence" programme in Computer Studies (orientation : General Computer Studies) in line with certain procedures still to be specified (please address the secretary's office of the MATH Department or the programme manager for the "licence" in Computer Studies).