

Faculty of Applied Sciences



MAP 2

**Ingénieur civil en mathématiques appliquées (Diploma of the Second Cycle
(Ingénieur civil) in Applied Mathematics)**



Programme management

INMA Département d'ingénierie mathématique

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Study objectives

Mathematical Engineering is the domain of Engineering Sciences aimed at creating, analysing and applying mathematical models for the engineering of complex systems in the industrial or organisational world and for elaborating efficient strategies for optimising their performance.

Admission conditions

The programme leading to a degree in Civil Engineering-Applied Mathematics is accessible to all students holding the first study cycle diploma ("candidature") in Civil Engineering. Industrial engineers and certain university degree holders in subjects relating to the Exact Sciences may also be entitled access, as may students with a foreign degree judged as being equivalent.

Admission procedure

The University admission and enrolment procedures are detailed in the section : "Access to studies" on the web page : <http://www.ucl.ac.be/etudes/libres/acces.html>

General structure of the programme

Mathematical engineering is by nature interdisciplinary and the programme therefore comprises a wide range of semi-optional courses in the subjects which form the basis of these studies : algebra and geometry, algorithmics and discrete mathematics, optimisation and operational research, automatics and theory of dynamic systems, numerical analysis, statistics and probability, analysis and theory of differential equations, mathematical modelling of physical phenomena.

Programme content

1. Programme composition

To obtain the degree in **Civil Engineering - Applied Mathematics**, the student must have already followed the programme below :

General and polyvalent courses

General courses :

<u>FSA2300</u>	Religious Science Questions[15h] (2 credits) (in French)	Bernard Van Meenen
<u>FSA2323</u>	none[30h+15h] (4 credits) (in French)	Jean-Pierre Hansen, Yves Smeers
<u>FSA2240</u>	Gestion financière et comptable[30h+15h] (4 credits) (in French)	Philippe Grégoire

Polyvalent courses:

<u>ELEC2751</u>	Electrical circuits and measurements[15h+15h] (3 credits) (in French)	Christian Eugène
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<u>INGI2716</u>	Computer science 3[30h+30h] (5 credits) (in French)	Marc Lobelle
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As well as 12 ECTS from among the following courses :

<u>ELEC2752</u>	Electronics[30h+15h] (4 credits) (in French)	Hervé Buyse
<u>ELEC2753</u>	POWER ELECTRICAL ENGINEERING[30h+30h] (5 credits) (in French)	Hervé Buyse, Francis Labrique, Ernest Matagne

<u>FSA2220</u>	Introduction to life science[60h] (6 credits) (in French)	Spyridon Agathos, Georges Bastin, Jean Lebacq, Philippe Lefevre (coord.), Vincent Legat, Yves-Jacques Schneider
<u>MAPR2805</u>	Introduction to materials science[45h] (4 credits) (in French)	Jean-Christophe Charlier, Roger Legras (coord.), Thomas Pardoen
<u>MAPR2806</u>	Introduction to process engineering[30h] (3 credits) (in French)	Denis Dochain
<u>MECA2855</u>	Thermodynamics and energetics.[45h+30h] (6 credits) (in French)	Michel Giot, Hervé Jeanmart, Miltiadis Papalexandris
<u>MECA2100</u>	Deformable solid mechanics.[45h+45h] (7 credits) (in French)	Issam Doghri
<i>The students will only follow a part of this course [30 hours + 30 hours]</i>		
<u>MECA2953</u>	Kinematics and dynamics of machinery.[22.5h+7.5h] (3 credits) (in French)	David Johnson
<u>ELEC2930</u>	Introduction to telecommunication[30h+15h] (4 credits) (in French)	Auguste Laloux
<u>BIR1312</u>	Introduction to analytical chemistry[30h] (2.5 credits) (in French)	Joseph Dufey, Yves Dufrêne, Yves Dufrêne

Specialised courses**Subjects :**

Each MAP student will take the compulsory courses of the 8 following subjects as well as a semi-optional course in 6 out of the 8 subjects, in line with the programme rules defined by the MAP degree programme Management Committee, communicated to the students at the beginning of the academic year (<http://www.inma.ucl.ac.be/etudes>).

70.01. Automatics and Systems.

70.02. Algebra and Geometry

70.03. Analysis, Equations Differentials.

70.04. Numerical Analysis.

70.05. Mathematical Modelling of Physical Phenomena.

70.06. Discreet Mathematics and Algorithmics.

70.07. Optimisation and Operational Research.

70.08. Statistics and Probability.

Seminars :

The students will also follow a second cycle seminar, to be chosen from among :

INGI2750 A préciser (in French)

INMA2494 Operations research seminar[30h] (2 credits) (in French)

Yves Smeers

MATH2830 Numerical analysis seminar[30h] (2 credits) (in French)

Alphonse Magnus, Paul Van Dooren

or a seminar from the third study cycle, recommended in the context of the thesis.

Options :

Each student will complete his programme with a choice of optional courses leading to a programme comprising at least 60 credits in the first and second year and at least 180 credits over the three years. The end of course thesis counts for 30 credits. All the optional courses from group 70 are to be recommended, as well as the following :

ELEC2870 Artificial neural networks[30h+30h] (5 credits) (in French)

Michel Verleysen

ELEC2875 SYSTEM IDENTIFICATION[30h+30h] (5 credits) (in French)

Michel Gevers

INIS2980 Modélisation des systèmes biologiques[45h] (5 credits) (in French)

Philippe Lefevre, Pierre Willems

INMA2491 Operations research for production and logistics[30h+22.5h] (5 credits) (in French)

Yves Pochet, Laurence Wolsey

INMA2720 Computing techniques for applied mathematics[30h+15h] (4 credits) (in French)

Georges Bastin (supplée Vincent Blondel), Vincent Blondel, Etienne Huens N.

MATH2130 Riemannian geometry[22.5h] (2.5 credits) (in French)

MATH2360 Stochastic processes (statistics)[30h] (3.5 credits) (in French)

Jean-Marie Rolin

MECA2170 Mechanical computer-aided design.[30h+30h] (5 credits) (in French)

Vincent Legat

MECA2322 Fluid mechanics and transfer II.[30h+30h] (5 credits) (in French)

Michel Giot, Grégoire Winckelmans

MECA2323 Aerodynamics of external flows.[30h+30h] (5 credits) (in French)

François Dupret, Grégoire Winckelmans

MECA2620 Simulation of transfer phenomena in industrial processes.[30h+10h] (4 credits) (in French)

François Dupret

MECA2646 Reliability and probabilistic risk analysis.[30h] (3 credits) (in

Ernest Mund, Yves Smeers

	French)	
<u>MECA2853</u>	Turbulence.[30h+15h] (4 credits) (in French)	Guy Schayes, Grégoire Winckelmans
<u>STAT2410</u>	Discrete data analysis.[22.5h+7.5h] (5 credits) (in French)	Patrick Bogaert, Jean-Marie Rolin
<u>STAT2411</u>	Data Analysis[22.5h+7.5h] (5 credits) (in French)	Léopold Simar
<u>STAT2412</u>	Linear models[22.5h+7.5h] (5 credits) (in French)	Christian Hafner
<u>STAT2413</u>	Non parametric statistics[22.5h+7.5h] (5 credits) (in French)	Ingrid Van Keilegom
<u>STAT2510</u>	Statistical quality control.[15h] (2 credits) (in French)	Bernadette Govaerts

The student may also complete his programme with any course featuring on the University programme, subject to the agreement of the programme Management Committee.

Optional projects :

The students may include the integrated project in mathematical engineering (INMA 2375) on their course options programme.

On the other hand, they also have the possibility to replace two of the courses from the "22" programme by a long-term project spread over two quadrimesters. The procedures to be applied will be specified by the programme Management Committee at the beginning of the academic year.

Communication training workshop :

A workshop in oral and audiovisual communication is organised for the students of the final year. Participation in this workshop is obligatory but does not give rise to any marks.

Language course :

During the second cycle, the students may follow various language courses, organised by the ILV. These courses represent a minimum of 30 hours (3 credits) of the total volume of the optional part of their programme.

A specific course aimed at improving the linguistic skills and professional interactive communication capacities of the students, is especially organised for the FSA students.

<u>ANGL2470</u>	English communication skills for engineers[30h] (3 credits)	Ahmed Adriouche, Henri November, Severine Schmit
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Stage:

The students are encouraged to do an apprenticeship in an enterprise for a minimal duration of three weeks during their second study cycle. This apprenticeship represents 3 credits (30 hours) of the overall volume of their programme. It is subject to the prior approval of the degree programme Management Committee and concludes with a report. It will be ratified by an evaluation specifying "has/has not satisfied the requirements".

End of course thesis.

This piece of work, completed in the third year, travail, represents 30 credits (c.f. instructions on the end of course project work for the MAP degree programme).

"Economics" orientation

The students can obtain the degree in Civil Engineering-Applied Mathematics, in the "Economics" orientation. This orientation comprises a total of nine courses, including the five following compulsory ones :

<u>ECON2125</u>	Macro-economics[60h+30h] (9 credits) (in French)	David De la Croix, Frédéric Docquier
<u>ECON2135</u>	Econometrics: methods and applications[45h+45h] (9 credits) (in French)	Luc Bauwens, Fatemeh Shadman Valavi
<u>ECON2151</u>	Economics and monetary institutions[30h+15h] (4.5 credits) (in French)	Chantal Kegels
<u>ECON2152</u>	Economics and Public Finances[30h+15h] (4.5 credits) (in French)	Jean Hindriks
<u>INMA2415</u>	Computation of economic equilibria[30h+30h] (5 credits) (in French)	Yves Smeers

and four courses to be chosen from among the following :

<u>ECON2208</u>	International Trade[30h+15h] (6 credits) (in French)	Philippe Monfort
<u>ECON2238</u>	Financial economics[30h] (3 credits) (in French)	Pierre Giot
<u>ECON2242</u>	Conjunctural Fluctuations and Cycles[30h] (4 credits) (in French)	N.
<u>ECON2243</u>	Game and Information Theory[30h] (3 credits) (in French)	Hylke Vandenbussche
<u>ECON2244</u>	General Equilibrium Theory[30h] (3 credits) (in French)	François Maniquet
<u>ECON2245</u>	Econometrics[30h+15h] (4 credits) (in French)	Luc Bauwens
<u>ECON2251</u>	History of Economic Theories[30h] (3 credits) (in French)	Michel De Vroey
<u>ECON3510</u>	Public Economics[30h] (3 credits) (in French)	Jean Hindriks
<u>FSA2245</u>	Environnement et entreprise[30h] (3 credits) (in French)	Thierry Bréchet

The student's programme must first receive the agreement of one of the course lecturers and then be approved by the MAP programme Management Committee.

Degree holders in Civil Engineering-Applied Mathematics, Economics orientation, may have direct access to the next study cycle ("maîtrise") in Economic Sciences or to the 'Master of Arts in Economics', organised by the Economic Sciences Department (cf. UCL, study programme, ESPO Faculty), on condition that they obtained at least one distinction during their

engineering studies (2nd cycle) and followed 5 core courses in Economic Sciences in the 2nd year. If these courses have not been taken, they will have to be added to the "Maîtrise" or 'Master's' programme..

These same engineers will be able to benefit from special access conditions as well as from the exchange programme with the Universities of Chicago and Cornell.

The students who have followed the complete 70.08 " Statistics and Probability " module, as well as at least two options from the same module, are entitled access, in one year, to the DEA in Statistics. Civil engineers in Applied Mathematics are entitled access to the DEA in Mathematics.

2. Programme per year of studies.

The programmes listed below, only present the compulsory courses.

In addition to the compulsory courses, the student will complete his programme with options in line with the reglementation of the MAP2 programme. His choice will have to be approved by the MAP programme Management Committee.

MAP 21 First year

Compulsory courses

The total of the credits for the MAP 21 year must at least equal 60.

First quadrimester

<u>ELEC2751</u>	Electrical circuits and measurements[15h+15h] (3 credits) (in French)	Christian Eugène
<u>MECA2901</u>	Continuum mechanics.[30h+30h] (5 credits) (in French)	François Dupret
<u>INMA2315</u>	Methods of analysis for differential and integral equations[30h+22.5h] (5 credits) (in French)	Luc Haine
<u>INMA2701</u>	Applied mathematics : Signals and systems[30h+30h] (5 credits) (in French)	Luc Vandendorpe, Vincent Wertz
<u>INMA2702</u>	Applied mathematics : Optimization[30h+15h] (4 credits) (in French)	Vincent Blondel, François Glineur (supplée Vincent Blondel)

Second quadrimester

<u>FSA2323</u>	none[30h+15h] (4 credits) (in French)	Jean-Pierre Hansen, Yves Smeers
<u>INMA2691</u>	DISCRETE MATHEMATICS - GRAPH THEORY AND ALGORITHMS (in French)	
<u>INGI2716</u>	Computer science 3[30h+30h] (5 credits) (in French)	Marc Lobelle
<u>INMA2471</u>	Optimization models and methods[30h+22.5h] (5 credits) (in French)	François Glineur
<u>INMA2325</u>	Ordinary differential equations[30h+15h] (4 credits) (in French)	Patrick Habets, Jean Mawhin
<u>MATH2172</u>	Analyse numérique Ib Résolution numérique des équations (in French)	

Options, general courses

In this category, the student must at least total 12 credits over the three years..

Speciality courses

In this category, the student must at least follow one course in 6 of the 8 subjects constituting the 70.XX group, over the three years of studies. He will complete his programme with options (c.f. above).

MAP 22 Second year

The second year programme comprises at least 60 credits. This total includes the options to be chosen in line with the MAP programme reglementation. In order to allow a certain flexibility in the composition of the study programmes, the students are authorised, subject to the agreement of the MAP programme Management Committee, to transfer the FSA2240 course from the second year to the third.

Compulsory courses

The total number of credits for MAP 21 + MAP 22 must at least be equal to 120.

First quadrimester

<u>INMA2370</u>	Modelling and analysis of dynamical systems[30h+30h] (5 credits) (in French)	Georges Bastin, Vincent Wertz
<u>INMA2470</u>	Discrete stochastic models[30h+22.5h] (5 credits) (in French)	Philippe Chevalier

Second quadrimester

<u>FSA2240</u>	Gestion financière et comptable[30h+15h] (4 credits) (in French)	Philippe Grégoire
<u>INMA2380</u>	Matrix theory[30h+22.5h] (5 credits) (in French)	Paul Van Dooren
<u>MATH2171</u>	Numérique analysis I A) Approximation, interpolation,	Alphonse Magnus

integretion[22.5h+30h] (4 credits) (in French)

Options, general courses

In this category, the student must total at least 12 credits, over the three years.

Speciality courses

In this category, the student must follow at least one course in 6 of the 8 subjects constituting the 70.XX group, over the three years of studies. He will complete his programme with courses taken from the list of options (cfr. above).

MAP 23 Third year

The total volume of courses and seminars for the three years must represent at least 150 credits. The end of course thesis represents 30 credits. In order to allow a certain flexibility in the composition of the study programmes, the students are authorised, subject to the agreement of the MAP programme Management Committee, to transfer the FSA2300 course from the third year to the second year.

Compulsory courses

The total of credits at the end of the MAP 23 year, must at least be equal to 180.

First quadrimester

FSA2300 Religious Science Questions[15h] (2 credits) (in French) Bernard Van Meenen

Second quadrimester

a seminar (2 credits) and the thesis (30 credits)

Options, general courses

In this category, the student must total at least 12 credits, over the three years.

Speciality courses

In this category, the student must follow at least one course in 6 of the 8 subjects constituting the 70.XX group, over the three years of studies. He will complete his programme with courses taken from the list of options (cfr. above).