



Manifesto del Corso di Laurea Magistrale in Matematica Approvato nel Consiglio di Facoltà del 11 Maggio 2011

Definitions of terms used in this document

- Laurea Magistrale in Matematica = Master of Science in Mathematics = M.Sc. in Maths

This is what this document is about.

- Laurea = Laurea Triennale

This is an Italian Bachelor's Degree, lasting three years.

- Credit = Credito formativo universitario = CFU

This is the European unit for measuring the value of activities such a course, an internship, or a thesis. One credit corresponds to about 7 hours of frontal lectures, and a total of 25 hours of work for the student. 120 credits are required for a M.Sc.

- Course type = credit type = tipo

Nation-wide Italian rules require students studying for a M.Sc. to collect a certain number of credits in various categories. Some of these categories have self-explanatory names. For instance free-choice credits (*crediti liberi*) can be taken basically arbitrarily, subject to loose rules explained below. The two more arcane categories are probably *caratterizzante* (pl. *caratterizzanti*) and *affine* (pl. *affini*). These are best defined below through explicit lists.

- Settore = Settore scientifico-disciplinare = SSD

This is a nation-wide classification of University courses, sorted out in various categories. The categories for Maths are the following:



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SSD	Italiano	English
MAT/01	Logica matematica	Mathematical Logic
MAT/02	Algebra	Algebra
MAT/03	Geometria	Geometry
MAT/04	Matematiche complementari	Miscellanea
MAT/05	Analisi matematica	Mathematical Analysis
MAT/06	Probabilità e statistica matematica	Probability and Mathematical Statistics
MAT/07	Fisica matematica	Mathematical Physics
MAT/08	Analisi numerica	Numerical Analysis
MAT/09	Ricerca operativa	Operations Research

- Consiglio di Area Matematica = CAM

A body that comprises all the people teaching courses for Mathematics students at the *Laurea* and *Laurea Magistrale* level. It is chaired by a *Coordinatore*.

- Percorso (pl. percorsi)

Within the general framework of the M.Sc. in Mathematics, it is possible to aim at gaining an in-depth knowledge and understanding of several areas of advanced Mathematics (*percorso* Mathematical Sciences) or to aim more at acquiring knowledge useful for teaching and communicating mathematics and other sciences (*percorso* Teaching and Scientific Communication). Each *percorsowill* have different rules in the choice of courses: see below.

- Piano degli studi = piano di studio = piano di studi = study plan



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Each student of the Laurea Magistrale has to spell out the choices she or he is taking among the various course on offer in a document with this name. This is going to be evaluated and approved by the *Consiglio d'Area Matematica*. Detailed rules for each *percorso* to write a valid *piano* are spelled out later in this document. (The plural of *piano* is *piani*.)

- Piano di studio orientato = suggested study plan

Examples of possible study plans centred on different aspects of mathematical studies. Such plans will be automatically approved by CAM.

- Stage

The Italian term (actually borrowed from French, so it is pronounced "stàʒ") for an internship.

- Semestre (pl. semestri) = semester = sem

Teaching is arranged in two periods, conventionally called semesters = six months, although they last only about 14 weeks each. The first *semestre* starts in mid-September and ends about a week before the end of December. The second *semestre* lasts from mid-February to the end of May/beginning of June.

- MUT = Mutuato = Corso mutuato

This is a course which is held in a different Faculty, or is a proxy for another course held in a different Faculty.

- N.A. = Not Available = Non attivato

A course that has been active in previous years, and may well be active again in the future, but is not currently offered.

"Istituzione e attivazione"

The Faculty of Science promotes the *Corso di Laurea Magistrale in Matematica* (Master of Science in Mathematics), belonging to the class "LM-40 - Matematica". The degree is activated starting from the Academic Year 2009/10 through the insertion in the *Database of the Offerta Formativa*.

Instruction language

All courses of the Laurea Magistrale in Mathematics are taught in English.



Goals

The Master of Science in Mathematics ("Laurea Magistrale in Matematica") is aimed at providing an in-depth knowledge and understanding of several areas of advanced Mathematics, and of its relations to other Sciences.

Admission requirements

To apply to the Laurea Magistrale in Matematica, a Bachelor's degree lasting for three years or longer is required; such a degree must provide at least the basic concepts of linear algebra and mathematical analysis. A certificate for a B1 level of English is also required.

In this section, the guidelines used to evaluate whether the Bachelor's degree satisfy these minimum requirements are discussed.

- *Laurea in Matematica (classe "L-35 – Scienze matematiche")*. Students with such a degree are automatically admitted to the Laurea Magistrale in Matematica..
- *Lauree affini*. Students that have taken at least 60 CFU in the *settori* MAT/* while working at a Bachelor's Degree (Laurea) in Physics, Computer Science, Engineering or Economics.

These students might be required to follow a particular *piano degli studi* (study plan).

- In all the other cases, a formal application request is required, including the following information:
 - a detailed study plan of the Bachelor's degree, including titles and syllabi of all the courses taken;
 - a document issued from the University that issued the Bachelor's degree reporting, in Italian or English, the list of courses, the score obtained in each of them and the final score associated to the degree;
 - work and professional experiences;
 - level of knowledge of English Language, certified by internationally recognized organizations or by the University that issued the Bachelor's degree;
 - a motivation statement, explaining why the student is willing to apply to the Corso di Laurea Magistrale in Matematica, and what he/she expects from it.

These students might be required to follow a particular *piano degli studi* (study plan).

Applications will be evaluated by a committee indicated by the *Consiglio d'Area Matematica*. The committee can require a personal interview (possibly on-line) with the applicants, to better evaluate their curriculum.



Norma transitoria: gli studenti iscritti al Corso di Laurea Specialistica in Matematica (classe 45/S) dell'Università di Trento possono richiedere il passaggio al nuovo ordinamento, con riconoscimento totale dei crediti già acquisiti.

Piano degli studi

Students have to submit a *piano degli studi* (study plan), which satisfies the requisites for one of the two *percorsi* spelled out below. Such a *piano* is subject to approval by the *Coordinatore del Consiglio d'Area Matematica*. Students are not allowed to repeat activities already taken in their earlier career.

To write a proper *piano*, a total of 120 credits have to be chosen in the following categories.

Crediti caratterizzanti

Depending on the *percorso*, whose rules are spelled out below, the students have to select a certain number of *crediti caratterizzanti*, which correspond to certain core Mathematics courses in two groups of *settori*. A list of such courses is given for each *percorso* below.

Crediti affini

Depending on the *percorso*, whose rules are spelled out below, the students have to select a certain number of *crediti affini*. A list of *settori* whose credits are considered *affini* is given below. Note that all Mathematics courses are *affini*. Also, once the proper number of *crediti caratterizzanti* has been chosen, the student can select more *caratterizzanti* courses under the *affini* label.

Crediti liberi/free-choice credits

In the *piano degli studi* students can select any course offered at the University of Trento for their free-choice credits (*crediti liberi*), subject to approval by the *Coordinatore del Consiglio d'Area Matematica*. Students are required to give a detailed motivation for these choices in the *piano di studi*.

Note that further *caratterizzanti* and *affini* courses can be taken under this label.

Language Skills

Students are required to get a B2 (or higher) certificate of English for 3 credits of *Language Skills*. Students who have already used such a certification earlier in their career may alternatively get these 3 credits by getting a higher level certificate of English, or a B1 level in French, German, Chinese or Russian.



Stage/Internship and Thesis/tesi

Several internships at companies and institutions are available. An internship has a default credit value of 12.

The thesis has a credit value of 18. Students can choose to take a special *internal internship (tirocinio interno)*, if they wish to write a thesis for $12 + 18 = 30$ credits.

"Percorsi"and "Orientamenti"

The course is organized into two *percorsi*:

- **Mathematical Sciences,** and
- **Teaching and Scientific Communication.**



The *percorso* of **Mathematical Sciences** comprises several recommended *orientamenti*.

Percorso “Mathematical Sciences”

A *piano degli studi* for this *percorso* must obey the following rules

Type	CFU	Settori
Caratterizzanti	24	MAT/01-05
Caratterizzanti	12	MAT/06-09
Affini	36	
Liberi/free-choice	15	
Language skills	3	
Stage/internship	12	
Tesi/thesis	18	
CFU Total	120	

In other words, to write down a valid *piano* for this *percorso*, a student has to choose:

1. 24 credits of *caratterizzanti* courses (see the list below) in the *settori* MAT/01 to 05.
2. 12 credits of *caratterizzanti* courses (see the list below) in the *settori* MAT/06 to 09.



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3. 36 credits of *affini* courses, as listed below.

Please note that once conditions 1 and 2 have been fulfilled, further *caratterizzanti* courses may well be taken under the *affini* label. You will find examples of this in some *orientamenti* below.

4. 15 *free-choice* credits (*crediti liberi*), see above.

Please note that once conditions 1, 2 and 3 have been fulfilled, further *caratterizzanti* and *affini* courses may well be taken under the *free-choice* label.

5. For the language skills requirements, see above.
6. For thesis and internship, see above.



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The following are the *caratterizzanti* courses

Course	Codice	CFU	Settore	Semestre	Docente
Mathematical Logic	145146	6	MAT/01	1	Stefano Baratella
Computational Algebra	145135	6	MAT/02	1	Willem de Graaf
Coding Theory	145134	12	MAT/02	1	Massimiliano Sala
Advanced Geometry	145130	9	MAT/03	1	(tace nel 2011/12)
Algebraic Geometry I	145131	6	MAT/03	1	Marco Andreatta
Advanced Analysis	145129	9	MAT/05	1	Francesco Serra Cassano
Integral Transforms	145143	6	MAT/05	1	Luciano Tubaro
Mathematical Biology	145145	9	MAT/05	2	Mimmo Iannelli / Andrea Pugliese
Stochastic Processes (primo modulo)	145157	6	MAT/06	2	Luciano Tubaro
Stochastic Differential Equations	145159	6	MAT/06	1	Stefano Bonaccorsi
Mathematical Physics	145147	9	MAT/07	2	Valter Moretti
Numerical Methods for PDE	145152	6	MAT/08	2	Vincenzo Casulli



List of *affini* courses offered for the Laurea Magistrale in Mathematics

Course	Codice	CFU	Settore	Sem.	Docente
Elliptic Curves and Cryptography	145140	6	MAT/03	1	Edoardo Ballico
Advanced Topics in Biomathematics	145133	6	MAT/05	1	Miimo Iannelli
Stochastic Processes (secondo modulo)	145158	3	MAT/06	2	Stefano Bonaccorsi
Statistics of Stochastic Processes	145193	6	MAT/06	1	Andrea Pugliese
Numerical Methods for Finance	145255	6	MAT/08	2	da definire
Mathematical Finance I	145187	6	SECS-S/06	1	mutuato da "Quantitative methods (1 ^o modulo)" del Master in International Management
Mathematical Finance II	145257	6	SECS-S/06	1	supplenza

Discrete Fourier analysis (MAT/02) (6 CFU) is not offered this year, but will be offered in 2012/13.

Data analysis and exploration (MAT/06) (6 CFU) is not offered this year, but will be offered in 2012/13.

Statistics of stochastic processes is offered this year, and will probably not be offered in 2012/13.

The student can choose as *affini* courses between these courses, the caratterizzanti not already chosen and all courses offered in the University of Trento in the settori listed below. These have to be listed in a study plan (piano di studi) that has to be approved by the committee. All study plans, listed below as "orientamenti", will be automatically approved.



Settori of affini courses.

BIO/*	Biologia
FIS/*	Fisica
ICAR/01	Idraulica
ICAR/02	Costruzioni idrauliche e marittime e idrologia
ICAR/07	Geotecnica
INF/01	Informatica
ING-IND/*	Ingegneria Industriale
ING-INF/*	Ingegneria Informatica
M-FIL/02	Logica e filosofia della scienza
M-FIL/05	Filosofia e teoria dei linguaggi
M-PED/01	Pedagogia generale e sociale
M-PED/02	Storia della pedagogia
M-PED/03	Didattica e pedagogia speciale
M-PED/04	Pedagogia sperimentale
M-PSI/01	Psicologia generale
M-PSI/02	Psicobiologia e psicologia fisiologica
M-PSI/03	Psicometria
M-PSI/04	Psicologia dello sviluppo e psicologia dell'educazione
MAT/*	Matematica



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MED/01	Statistica medica
SECS-P/*	Economia
SECS-S/*	Statistica

List of *free-choice* courses offered for the Laurea Magistrale in Mathematics

Course	Codice	CFU	Settore	Sem.	Docente
Set Theory	145156	6	MAT/01	2	Stefano Baratella
Finite Fields and Symmetric Cryptography	145141	6	MAT/02	2	Sandro Mattarei
Algebraic Geometry II	145132	6	MAT/03	2	Edoardo Ballico/Wisniewski
Geometric Measure Theory	145258	6	MAT/05	2	Raul Serapioni
Mathematical control theory	145259	6	MAT/05	2	Fabio Bagagiolo
Partial Differential Equations	145181	6	MAT/05	2	Augusto Visintin
Differential Geometric Aspects in Mathematical Physics	145138	6	MAT/07	1	Enrico Pagani

Mathematical Physics of Quantum Relativistic Theories (MAT/07) (6 CFU) is not offered this year, but will be offered in 2012/13.

Finite Fields and Symmetric Cryptography

Geometric Measure Theory



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Differential Geometric Aspects in Mathematical Physics

Are offered this year, and will probably not be offered in 2012/13.

The student can choose as free-choice courses also those offered by Ph.D. schools. In particular, the following are recommended:

- Numerical methods for free-surface hydrodynamics;

Piani di studio orientati

The following represent suggestions to form coherent *piani di studio* with specific objectives, within the *percorsi* of Mathematical Sciences.

Please note that if the number of *caratterizzanti* credits higher than the $24 + 12 = 36$ spelled out in the general rules above. In the *piano di studio*, the student will simply enter the *caratterizzanti* credits beyond the required $24 + 12 = 36$ under the *affini* label.



Piano orientato ad un'ampia formazione culturale/Higher Mathematics

This is aimed especially at students wishing to pursue a PhD in Mathematics.

Students take the following courses:

Course	codice	Settore	Type	Sem	CFU
Advanced Analysis	145219	MAT/05	Caratterizzante	1	9
Advanced Geometry	145130	MAT/03	Tace nel 2011/12	1	9
Computational Algebra	145135	MAT/02	Caratterizzante	1	6
Stochastic Processes (primo modulo)	145157	MAT/06	Caratterizzante	2	6
Numerical methods for PDE	145152	MAT/08	Caratterizzante	2	6
Mathematical Physics	145147	MAT/07	Caratterizzante	2	9
Stochastic Processes (secondo modulo)	145256	MAT/06	Affine	2	3
CFU Total					48

Please note that Mathematical Physics will have to be entered under the *affini* label in the *piano di studi*, to satisfy the general rules.

Students also take the following credits:



Type	CFU
Affini	24
Free-choice/liberi	15
Language Skills	3
Internship/stage	12
Thesis/tesi	18
CFU Total	72

Please note that any *caratterizzante* course beyond the ones required above can be taken also as an *affine*, and that any *caratterizzante* or *affine* can be taken as free-choice.



Piano orientato all'Algebra Computazionale, Crittografia e Codici a Correzione d'Errore / Computational Algebra, Cryptography and Error-Correcting Codes

An introduction to modern methods in Computational Algebra, both commutative and non-commutative, and to advanced algebraic and geometric methods in cryptography and coding theory. Internship at leading companies and organizations working in these areas are available.

Students take the following courses:

Course	codice	Settore	Type	sem	CFU
Computational Algebra	145135	MAT/02	Caratterizzante	1	6
Coding Theory	145134	MAT/02	Caratterizzante	1	12
Integral Transforms	145143	MAT/05	Caratterizzante	1	6
Stochastic Processes (primo modulo)	145157	MAT/06	Caratterizzante	2	6
One more <i>caratterizzante</i> course in the <i>settori</i> MAT/06 to 09 for at least 6 CFU		MAT/06 to /09	Caratterizzante		6
	CFU Total				36



36 CFU to be chosen among the following:

Course	codice	Settore	Type	sem	CFU
Discrete Fourier Analysis	145212	MAT/02	Affine	Tace nel 2011/12.	6
Elliptic Curves and Cryptography	145140	MAT/03	Affine	1	6
Finite Fields and Symmetric Cryptography	145141	MAT/02	Affine	2	6
Communication systems	145189	ING- INF/03	Affine	MUT da Ing. cod. 140119	12
Digital signal processing	145190	ING- INF/03	Affine	MUT da Ing. Cod. 140124	6
Multimedia signal processing and communication		ING- INF/03	Affine	MUT	6
Data hiding	145192	ING- INF/03	Affine	MUT da Ing. Cod. 140278	6

Please note that the course of *Comunicazioni elettriche*, from the Laurea (triennale) in Ingegneria delle Telecomunicazioni, is recommended as a prerequisite to *Communication systems*.



Students also take the following credits:

Type	CFU
Free-choice/liberi	15
Language Skills	3
Internship/stage	12
Thesis/tesi	18
CFU Total	48

Please note that any *caratterizzante* course beyond the ones required above can be taken also as an *affine*, and that any *caratterizzante* or *affine* can be taken as free-choice.



Piano orientato alla Matematica per l'Economia e la Finanza / Mathematics for Economy and Finance

Aims at preparing students to a career in financial institutions. Internships such as at research centres of banks are available.

Students take the following courses:

1st year; semester 1

Course	Codice	Settore	Type	Sem	CFU
Advanced Analysis	145129	MAT/05	Caratterizzante	1	9
Integral Transforms	145143	MAT/05	Caratterizzante	1	6
Mathematical Finance I	145187	SECS-S/06	Affine	1/MUT Da Economia Master in International Mangament Quantitative methods (I modulo)	6
Language skills					3
Free-choice course				1	6



1st year; semester 2

Course	Codice	Settore	Type	Sem	CFU
Mathematical Biology	145145	MAT/05	Caratterizzante	2	9
Stochastic Processes (primo modulo)	145157	MAT/06	Caratterizzante	2	6
Stochastic Processes (secondo modulo)	145158	MAT/06	Affine	2	3
Financial markets and economic activity		SECS-P/01	Affine	2 MUT Economia (from Master in International Management)	8
Free-choice course				2	6

2nd year; semester 1

Course	Codice	Settore	Type	Sem	CFU
Statistics of Stochastic Processes	145256	MAT/06	Affine	1	6
Stochastic Differential Equations	145159	MAT/06	Caratterizzante	1	6



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Mathematical Finance II	145257	SECS-S/06	Affine	1	6
Affine course				1	4+

2nd year; semester 2

Course		Settore	Type	Sem	CFU
Numerical Methods for Finance	145255	MAT/08	Affine	2	6

Students must also take 12 credits for internship/stage; 18 credits for thesis.

Note: courses advised as free-choice or undetermined affine course:

- Microeconomics and game theory (10 CFU) (1st sem.) from Master in Economics;
- Laboratorio: simulazioni finanziarie (6 CFU) (2nd sem.) from Laurea Magistrale in Finanza
- Mathematical control theory (6 CFU).(2nd sem.)

For students missing some prerequisites in mathematical analysis or probability theory, it is possible to include appropriate courses (in Italian) from Bachelor's degree (Laurea triennale) among free-choice courses.

Students at 1st year in 2011-12 will take "Data analysis and exploration" instead of "statistics of stochastic processes" in their 2nd year.



Piano orientato alla Matematica per la Biologia / Mathematics for Biology

An introduction to modern mathematical methods in areas like modelling of epidemics. Internships at leading companies and research centres are available.

Students take the following courses:

1st year; semester 1

Course	Settore	Type	Sem	CFU
Advanced Analysis	MAT/05	Caratterizzante	1	9
Integral Transforms	MAT/05	Caratterizzante	1	6
Biology (6 crediti biologia cellulare; 6 crediti Biologia degli organismi)	BIO/13	Affine	1 e 2	12
Language skills				3

1st year; semester 2

Course	Settore	Type	Sem	CFU
Mathematical Biology	MAT/05	Caratterizzante	2	9
Stochastic Processes (primo modulo)	MAT/06	Caratterizzante	2	6
Stochastic Processes (secondo modulo)	MAT/06	Affine	2	3
Simulation of biological systems	INF/01	Affine	2	6
Free-choice course			2	6



2nd year; semester 1

Course	Settore	Type	Sem	CFU
Statistics of Stochastic Processes	MAT/06	Affine	1	6
Stochastic Differential Equations	MAT/06	Caratterizzante	1	6
Advanced topics in biomathematics	MAT/05	Affine	1	6
Free-choice course			1	6
Affine course		Affine	1	6

2nd year; semester 2

Course	Settore	Type	Sem	CFU
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Students must also take 12 credits for internship/stage; 18 credits for thesis.

Notes:

Courses advised as free-choice:

- Data mining for biological data (6 CFU) (1st sem.);
- Machine learning (6 CFU) (1st sem.)
- Numerical methods for PDE (6 CFU) (2nd sem.)
- Partial differential equations (6 CFU) (2nd sem.)

For students missing some prerequisites in mathematical analysis or probability theory, it is possible to include appropriate courses (in Italian) from Bachelor's degree (Laurea triennale) among free-choice courses.

Students at 1st year in 2011-12 will take "Data analysis and exploration" instead of "Statistics of stochastic processes" in their 2nd year.



Percorso "Teaching and Scientific Communication"

The rules for this *percorso* are the following.

Students take the following courses:

Course	Settore	Type	Sem	CFU	Docente
Foundations of Geometry	MAT/03	Caratterizzante	2	6	Domenico Luminati
Elementary Mathematics from a higher Viewpoint I	MAT/04	Caratterizzante	1	6	Lucia Beretta
Elementary Mathematics from a higher Viewpoint II	MAT/04	Caratterizzante	2	6	Giuseppe Vigna Suria
Laboratory of Didactics of Mathematics	MAT/04	Caratterizzante	1	6	Silvano Delladio
Foundations of Analysis	MAT/05	Caratterizzante	1	6	Italo Tamanini
Mathematical models for the Physical, Natural and Social Sciences	MAT/06	Caratterizzante	2	6	Stefano Bonaccorsi
Experimental Mathematics Laboratory at High School Level	MAT/04	Affine	2	6	Italo Tamanini
Experimental Physics Laboratory at High School Level I	FIS/08	Affine	1	6	Luigi Gratton
Experimental Physics Laboratory at High School Level II	FIS/08	Affine	2	6	Luigi Gratton
Modern Physics	FIS/08	Affine	1	12	Stefano Oss
Didactics of Computer Science	INF/01	Affine	2	6	Luisa Mich
CFU Total				72	



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Students also take the following credits, following the general rules spelled out earlier in this document:

Type	CFU
Free-choice/liberi	15
Language Skills	3
Internship/stage	12
Thesis/tesi	18
CFU Total	48

Please note that any *caratterizzante* or *affine* course beyond the ones required above can be taken as free-choice.

The following courses are **recommended** among the free-choice ones:

Course	Settore	Sem	CFU
Mathematical Logic	MAT/01	1	6
Comunicazione delle scienze	MAT/04		6