UNIVERSITÀ DEGLI STUDI DI TRENTO
Facoltà di Scienze Matematiche,
Fisiche e Naturali

Manifesto del
Corso di Laurea Magistrale in Matematica
Approvato nel Consiglio di Facoltà del 28 aprile 2010

1. 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. a*ffini*). 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:

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 Analisys
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*.

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

  Each student of the Laurea Magistrale has to spell out the choices she or he is taking among the various courses on offer in a document with this name. This is going to be

evaluated and approved by the *Coordinatore del Consiglio d'Area Matematica*. Detailed rules to write down a valid *piano* are spelled out later in this document. (The plural of *piano* is *piani*.)

- Percorso (pl. percorsi), orientamento (pl. orientamenti)

  Two levels of expressing sets of possible choices for a *piano di studi*. A *percorso* may comprise several *orientamenti*. See below.

- 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.

2. "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*.

3. Instruction language

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

4. 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.

5. 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.

6. 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.

6.1 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.

6.2 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.

6.3 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.

6.4 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.

6.5 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 (*stage interno*), if they wish to write a thesis for 12 + 18 = 30 credits.

7. "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*.

7.1 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.

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.

The following is a list of *caratterizzanti* courses

Course	CFU	Settore	Type
Mathematical Logic	6	**MAT/01**	Caratterizzante
Computational Algebra	6	**MAT/02**	Caratterizzante
Coding Theory	12	**MAT/02**	Caratterizzante
Advanced Geometry	9	**MAT/03**	Caratterizzante
Algebraic Geometry I	6	**MAT/03**	Caratterizzante
Advanced Analysis	9	**MAT/05**	Caratterizzante
Integral Transforms	6	**MAT/05**	Caratterizzante
Mathematical Biology	9	**MAT/05**	Caratterizzante
Stochastic Processes (primo modulo)	6	**MAT/06**	Caratterizzante
Stochastic Differential Equations	6	**MAT/06**	Caratterizzante

Mathematical Physics	9	**MAT/07**	Caratterizzante
Numerical Methods of PDE	6	**MAT/08**	Caratterizzante

Affini courses can be taken in the following *settori*. **Please note** that, as already mentioned above, any *caratterizzante* course can also be taken as an *affine*.

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

Orientamenti

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

Please note that some *orientamenti* may appear to show a number of *caratterizzanti* credits higher than the 24 + 12 = 36 spelled out in the general rules above. In the *piano di studi*, the student will simply enter the *caratterizzanti* credits beyond the required 24 + 12 = 36, as clearly indicated in each case, under the *affini* label.

Orientamento di ampia formazione culturale/Higher Mathematics

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

Students take the following courses, to be listed as *caratterizzante* in the *piano di studio*:

Course	Settore	Sem	CFU
Advanced Analysis	**MAT/05**	1	9
Advanced Geometry	**MAT/03**	1	9
Computational Algebra	**MAT/02**	1	6
Stochastic Processes (primo modulo)	**MAT/06**	2	6
Numerical methods for PDE	**MAT/08**	2	6

Students take the following courses, to be listed as *affine* in the *piano di studio*:

Course	Settore	Sem	CFU
Mathematical Physics	**MAT/07**	2	9
Stochastic Processes (secondo modulo)	**MAT/06**	2	3

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.

Orientamento di 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. Internships at leading companies and organizations are available.

Students take the following courses, to be listed as *caratterizzante* in the *piano di studio*:

Course	Settore	Sem	CFU
Computational Algebra	**MAT/02**	1	6
Coding Theory	**MAT/02**	1	12
Integral Transforms	**MAT/05**	1	6
Stochastic Processes (primo modulo)	**MAT/06**	2	6
One more *caratterizzante* course in the *settori* MAT/06 to 09 for (at least) 6 CFU	**MAT/06 to /09**		6

36 CFU to be chosen among the following, to be listed as *affine* in the *piano di studio*:

Course	Settore	Sem	CFU
Discrete Fourier Analysis	**MAT/02**	2	6
Elliptic Curves and Cryptography	**MAT/03**		6
Finite Fields and Symmetric Cryptography	**MAT/02**	N.A.	6
Communication systems	**ING-INF/03**	MUT	12
Digital signal processing	**ING-INF/03**	MUT	6
Computer Vision	**ING-INF/03**	MUT	6
Data hiding	**ING-INF/03**	MUT	6

Please note that the course of *Comunicazioni elettriche,* from the Laurea 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.

Orientamento di Matematica per l'Economia e la Finanza / Mathematics for Economy and Finance

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

Students take the following courses, to be listed as *caratterizzante* in the *piano di studio*:

Course	Settore	Sem	CFU
Advanced Analysis	**MAT/05**	1	9
Integral Transforms	**MAT/05**	1	6
Mathematical Biology	**MAT/05**	2	9
Stochastic Processes (primo modulo)	**MAT/06**	2	6
Stochastic Differential Equations	**MAT/06**	1	6

Students take the following courses, to be listed as *affine* in the *piano di studio*:

Course	Settore	Sem	CFU
Stochastic Processes (secondo modulo)	**MAT/06**	2	3
Statistics of Stochastic Processes	**MAT/06**	1	6
Data analysis and exploration	**MAT/06**	1	6
Mathematical Finance I	**SECS-S/06**	1/MUT	6
Mathematical Finance II	**SECS-S/06**	1	6
Numerical Methods for Finance	**MAT/08**	2	6

Students also take the following credits:

Type	CFU
Affini	3
Free-choice/liberi	15
Language Skills	3
Internship/stage	12
Thesis/tesi	18
CFU Total	**51**

It is strongly reccommended to take among the affini/free-choice courses some of the following courses, not already taken earlier in the career. English-language alternatives are available: please consult the *Coordinatore*.

Please note that the first course in the list can only be taken as a *libero*.

Course	Settore	CFU

Economia e misurazione aziendale	**SECS-P/08**	8
Modelli di decisione finanziaria e d'investimento	**SECS-P/09**	8
Introduzione all'economia	**SECS-P/01**	12
Microeconomia	**SECS-P/01**	12
Macroeconomia	**SECS-P/01**	8

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.

Orientamento di 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, to be listed as *caratterizzante* in the *piano di studio*:

Course	Settore	Sem	CFU
Advanced Analysis	MAT/05	1	9
Integral Transforms	MAT/05	1	6
Mathematical Biology	MAT/05	2	9
Stochastic Processes (primo modulo)	MAT/06	2	6
Stochastic Differential Equations	MAT/06	1	6

Students take the following courses, to be listed as *affine* in the *piano di studio*:

Course	Settore	Sem	CFU
Simulation of biological systems	INF/01	2	6
Data analysis and exploration	MAT/06	1	6
Advanced topics in biomathematics	MAT/05	1	6
Statistics of Stochastic Processes	MAT/06	1	6

Students choose **12 credits** among the following courses, to be listed as *affine* in the *piano di studio*:

Course	Settore	Sem	CFU
Biology	BIO/13	1	12
Data mining for biological data	ING-INF/05	1	6
Machine learning	INF/01	1	6

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.

The following course is strongly recommended.

Course	Settore	Sem	CFU
Stochastic Processes (secondo modulo)	MAT/06	2	3

7.2 Percorso "Teaching and Scientific Communication"

The rules for this *percorso* are the following.

Students take the following courses, to be listed as *caratterizzante* in the *piano di studio*:

Course	Settore	Sem	CFU
Foundations of Geometry	MAT/03	2	6
Elementary Mathematics from a higher Viewpoint I	MAT/04	1	6
Elementary Mathematics from a higher Viewpoint II	MAT/04	2	6
Laboratory of Didactics of Mathematics	MAT/04	1	6
Foundations of Analysis	MAT/05	1	6
Mathematical models for the Physical, Natural and Social Sciences	MAT/06	2	6

Students take the following courses, to be listed as *affine* in the *piano di studio*:

Course	Settore	Sem	CFU
Experimental Mathematics Laboratory at High School Level	MAT/04	2	6
Experimental Physics Laboratory at High School Level I	FIS/08	2	6
Experimental Physics Laboratory at High School Level II	FIS/08	1	6
Modern Physics	FIS/08	1	12
Didactics of Computer Science	INF/01		6

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 ca*n be taken as free-choice.

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

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

8. Allegato A: Docenti di cui all'art. 1, comma 9 dei D.M. 16 marzo 2007

Course	Teacher	Settore	CFU
Computational Algebra	Willem de Graaf	**MAT/02**	6
Finite Fields and Symmetric Cryptography	Sandro Mattarei	**MAT/02**	6
Laboratory of Didactics of Mathematics	Silvano Delladio	**MAT/04**	6
Algebraic Geometry I	Marco Andreatta	**MAT/02**	6
Stochastic Processes (primo modulo)	Luciano Tubaro	**MAT/06**	6
Numerical methods for free-surface hydrodynamics	Vincenzo Casulli	**MAT/08**	6
Mathematical Logic	Stefano Baratella	**MAT/01**	6
Differential Geometric Aspects in Mathematical Physics	Enrico Pagani	**MAT/07**	6
Advanced Topics in Biomathematics	Mimmo Iannelli	**MAT/05**	6
Foundations of Analysis	Italo Tamanini	**MAT/05**	6
Totale			60