Dipartimento di Matematica

Manifesto del
Corso di Laurea Magistrale in Matematica

Approvato nel Consiglio di Dipartimento del 6 maggio 2013

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

- 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 *percorso* will have different rules in the choice of courses: see below.

- 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 course on offer in a document with this name. (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.
  The Italian term (actually borrowed from French) 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 offred a different Department or is a proxy for another course held in a different Department.

- 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 Department of Mathematics 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 the a committee indicated by the *Commissione Didattica di Dipartimento*. The committee can require a personal interview (possibly on-line) with the applicants, to better evaluate their curriculum.

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 *Commissione Didattica di Dipartimento*. 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 *Commissione Didattica di Dipartimento*. 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) certficate 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, Spanish, 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.
3. 36 credits of *affini* courses, as listed below.

   Please note that once conditions 1 and 2 have been fulifilled, 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 are the ***caratterizzanti*** courses

Course	Codice	CFU	Ore attività	Settore	Semestre	Docente
Mathematical Logic	145146	6	42	MAT/01	1	Stefano Baratella
Computational Algebra	145135	6	42	MAT/02	1	Willem de Graaf
Coding Theory and Applications	145394	6	42	MAT/02	1	Massimiliano Sala
Cryptography	145321	6	48	MAT/02	1	Massimiliano Sala (Mut. DISI 0517H – cod. 145321)
Advanced Geometry	145130	9	63	MAT/03	1	Roberto Pignatelli
Algebraic Geometry I	145131	6	42	MAT/03	1	Claudio Fontanari
Stochastic Processes (I modulo)	145157	6	42	MAT/06	1	Luciano Tubaro
Integral Transforms	145143	6	42	MAT/05	1	Luciano Tubaro
Mathematical Biology	145145	9	63	MAT/05	1	Mimmo Iannelli Andrea Pugliese
Statistics of Stochastic Processes	145256	6	42	MAT/06	1	Andrea Pugliese
Advanced Analysis	145129	9	63	MAT/05	2	Francesco Serra Cassano
Advanced Topics in Biomathematics	145133	6	42	MAT/05	2	Mimmo Iannelli
Finite Fields and Symmetric Cryptography	145141	6	42	MAT/02	2	Da definire
Stochastic Differential Equations	145159	6	42	MAT/06	2	Craig Calcaterra
Mathematical Physics	145147	9	63	MAT/07	2	Valter Moretti
Numerical Methods for PDE	145152	6	48	MAT/08	2	Ana Maria Alonso Rodriguez
Scientific computing	145330	6	48	MAT/08	2	Michael Dumbser
Mathematical aspects of bioelectromagnetism and imaging	145331	6	42	MAT/08	2	Ana Alonso
Partial Differential Equations	145393	9	63	MAT/05	2	Augusto Visintin

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

Course	Codice	CFU	Ore attività	Settore	Semestre	Docente
Mathematical Finance (II modulo)	145334	3	21	SECS-S/06	1	Stefano Bonaccorsi
Stochastic Processes (II modulo)	145158	3	21	MAT/06	1	Stefano Bonaccorsi
Theoretical biomechanics	145332	9	63	ICAR/01	1-2	Davide Bigoni - Giorgio Rosatti
Introduction to Cell Biology	145389	9	70	BIO/13	1	Contratto
Models and numerical methods for blood flow	145391	9	70	MAT/08	1	Toro Eleuterio
Physiological flow and transport in porous tissues	145392	6	42	ICAR/02	2	Alberto Bellin

Course	Code	CFU	Hours	Settore	Semester	Instructor
Advanced Coding Theory and Cryptography Modulo Advanced Coding Modulo Theory and Cryptography	145395	**12** 6 6	**84** 42 42	MAT/02 MAT/03	1 2	Massimiliano Sala Edoardo Ballico
Algebraic Geometry II	145132	6	42	MAT/03	2	Marco Andreatta Claudio Fontanari Roberto Pignatelli
Data Analysis and Exploration	145136	6	42	INF/01	2	Melissa Morine
Discrete Fourier Analysis	145212	6	42	MAT/02	2	Sandro Mattarei
Set Theory	145156	6	42	MAT/01	2	Stefano Baratella
Statistical models	145333	3	21	MAT/06	2	Melissa Morine
Modelling and simulation of biological systems	145387	9	63	INF/01	2	Corrado Priami
Formal Techniques for Cryptographic Protocol Analysis	145396	6	42	INF/01	2	Roberto Zunino

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

The student can choose as **free-choice courses** all courses offered by the University, whose contents do not overlap with those of other courses already taken in the Laurea Magistrale or of previous degrees. A motivation for the choices has to be provided in the "piano degli studi"
All courses "caratterizzanti" or "affini" not previously taken can be chosen as "free-choices" and do not need a motivation. Similarly, a motivation is not required for the courses suggested in the piani di studio orientati, as well as for the courses in mathematics offered by Ph.D. schools of the university.

Piani di studio orientati
The following represent suggestions to form coherent *piani di studio* with specific objectives, within the *percorso* 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 studi*, 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	Ore attività	Docente	CFU
Advanced Geometry	145130	MAT/03	Caratterizzante	1	63	Roberto Pignatelli	9
Computational Algebra	145135	MAT/02	Caratterizzante	1	42	Willem De Graaf	6
Stochastic Processes (I modulo)	145157	MAT/06	Caratterizzante	1	42	Luciano Tubaro	6
Stochastic Processes (II modulo)	145158	MAT/06	Affine	1	21	Stefano Bonaccorsi	3
Advanced Analysis	145129	MAT/05	Caratterizzante	2	63	Francesco Serra Cassano	9
Numerical methods for PDE	145152	MAT/08	Caratterizzante	2	48	Ana Maria Alonso Rodriguez	6
Mathematical Physics	145147	MAT/07	Caratterizzante	2	63	Valter Moretti	9
						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:

1st year; semester 1

Course	codice	Settore	Type	Sem	Ore attività	Docente	CFU
Computational Algebra	145135	MAT/02	Caratterizzante	1	42	Willem De Graaf	6
Coding Theory and Applications	145394	MAT/02	Caratterizzante	1	42	Massimiliano Sala	6
Cryptography	145321	MAT/02	Caratterizzante	1	48	Massimiliano Sala (Mut. DISI (0517H –cod. 145321)	6
Stochastic Processes (I modulo)	145157	MAT/06	Caratterizzante	1	42	Luciano Tubaro	6
						CFU Total	**24**

1st year; semester 2

Course	codice	Settore	Type	Sem	Ore attività	Docente	CFU
Finite Fields and Symmetric Cryptography	145141	MAT/02	Caratterizzante	2	42	Da definire	6
Scientific Computing	145330	MAT/08	Caratterizzante	2	48	Dumbser Michael	6
						CFU Total	**12**

36 CFU to be chosen among the following:

Course	codice	Settore	Type	Sem	Ore attività	Docente	CFU
Integral Transforms	145143	MAT/05	Affine	1	42	Luciano Tubaro	6
Algebraic Geometry I	145131	MAT/03	Affine	1	42	Claudio Fontanari	6
Discrete Fourier Analysis	145212	MAT/02	Affine	2	42	Sandro Mattarei	6
Communication systems	145189	ING-INF/03	Affine	2	120	Mut. DISI (0335H – cod. 140119)	12
Digital signal processing	145190	ING-INF/03	Affine	1	42	Mut. DISI (0335H – cod. 140124)	6
Data hiding	145192	ING-INF/03	Affine	2	42	Mut. DISI (0335H - cod. 140122)	6

Advanced Coding Theory and Cryptography	145395		Affine		**84**			**12**
Modulo Advanced Coding		MAT/02		1	42		Massimiliano Sala	6
Modulo Theory and Cryptography		MAT/03		2	42		Edoardo Ballico	6
Computability	145049	MAT/01	Affine	1	48		MUT da DISI (0517H - cod. 145049)	6
Security Engeneering	145298	ING-INF/05	Affine	1	48		MUT da DISI (0517H - cod. 145298)	6
Signal and Systems	145111	ING-INF/05	Affine	1	48		MUT da DISI (0517H - cod. 145111)	6
Network Security	145065	ING-INF/05	Affine	2	48		MUT da DISI (0517H - cod. 145065)	6
Formal Techniques for Cryptographic Protocol Analysis	145396	INF/01	Affine	2	42		Roberto Zunino	6

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

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.
We suggest two blocks of exams that should be chosen among the *affini*

Research-oriented exam block
- Advanced Coding Theory and Cryptography
  - Modulo Advanced Coding
  - Modulo Theory and Cryptography
- Algebraic Geometry I
- Discrete Fourier Analysis

Stage-oriented exam block
- Data hiding
- Network Security
- Communication systems
- Formal Techniques for Cryptographic Protocol Analysis

- **Free-choice/liberi**
  - Programmazione funzionale
  - Programmazione 2

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 at research centres of banks are available.

Students take the following courses:

1st year; semester 1

Course	codice	Settore	Type	Sem	Ore attività	Docente	CFU
Stochastic Processes (I modulo)	145157	MAT/06	Caratterizzante	1	42	Luciano Tubaro	6
Stochastic Processes (II modulo)	145158	MAT/06	Affine	1	21	Stefano Bonaccorsi	3
Matematica finanziaria progredito (*)	145397	SECS-S/06	Affine	1	42	Mut. Dip. Economia e Management (0122H cod. 121136)	6
Financial markets and economic activity	145335	SECS-P/01	Affine	2	56	Mut. Dip. Economia e Management (0119H cod. 121008)	8
Language skills						CIAL	3
						CFU Total	**26**

1st year; semester 2

Course	codice	Settore	Type	Sem	Ore attività	Docente	CFU
Integral Transforms	145143	MAT/05	Caratterizzante	1	42	Luciano Tubaro	6
Statistical models	145333	MAT/06	Affine	2	21	Melissa Morine	3
Laboratorio: simulazioni finanziarie*	145339	SECS-S/03	Affine	2	42	Mut. Dip. Economia e Management (0122H cod. 121184)	6
Stochastic Differential Equations	145159	MAT/06	Caratterizzante	2	42	Craig Calcaterra	6
Partial Differential Equations	145393	MAT/05	Caratterizzante	2	63	Augusto Visintin	9
Data Analysis and Exploration	145136	INF/01	Affine	2	42	Melissa Morine	6
						CFU Total	**36**

2 st year; semester 1

Course	codice	Settore	Type	Sem	Ore attività	Docente	CFU
Mathematical Finance (IImodulo)	145334	SECS-S/06	Affine	1	21	Stefano Bonaccorsi	3
Statistics of stochastic processes	145256	MAT/06	Affine	1	42	Andrea Pugliese	6
						CFU Total	**9**

* Course given in Italian with notes in English; alternatives will be offered to students not proficient enough in Italian.

Students must also take 9 credits in courses *caratterizzanti* in the *settori* MAT/01 to 05: suggested the course of Advanced Analysis
Students must also take **10 credits in free courses**
Students must also take **12 credits for internship/stage; 18 credits for thesis**.

Note: students in their 2nd year in 2013-14 will follow the scheme presented in 2012-13.

Note: courses advised as free-choice:
- Strumenti di investimento e derivati 11 crediti from LM in Finanza*
- Modelli statistici per l'economia e la finanza, 6 crediti from LM in Finanza*
- Microeconomics and game theory 10 crediti from LM Economics;

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 must inform in advance the Coordinator of their intention to attend these courses (in Italian), in order to set up the logistic arrangements with the Department of Economics and Management

Piano orientato a Modelli, statistica ed analisi di biosistemi / Modelling, statistics and analysis of biosystems

An introduction to modern mathematical methods in areas of biology as ecology, epidemiology, molecular networks. Internships at leading companies and research centres are available.

Students take the following courses:

1st year; semester 1

Course	codice	Settore	Type	Sem	Ore attività	Docente	CFU
Introduction to Cell Biology	145389	BIO/13	Affine	1	70	Contratto	9
Mathematical Biology	145145	MAT/05	Caratterizzante	1	63	Mimmo Iannelli Andrea Pugliese	9
Stochastic Processes (I modulo)	145157	MAT/06	Caratterizzante	1	42	Luciano Tubaro	6
Stochastic Processes (II modulo)	145158	MAT/06	Affine	1	21	Stefano Bonaccorsi	3
Language skills						CIAL	3
						CFU Total	**30**

1st year; semester 2

Course	codice	Settore	Type	Sem	Ore attività	Docente	CFU
Modelling and simulation of biological systems	145387	INF/01	Affine	2	63	Corrado Priami	9
Statistical models	145333	MAT/06	Affine	2	21	Melissa Morine	3
Data analysis and exploration	145136	INF/01	Affine	2	42	Melissa Morine	6
Advanced topics in biomathematics	145133	MAT/05	Caratterizzante	2	42	Mimmo Iannelli	6
Partial Differential Equations	145393	MAT/05	Caratterizzante	2	63	Augusto Visintin	9
						CFU Total	**33**

Students must take 6 credits choosing among the courses *caratterizzanti*
-    Mathematical aspects of bioelectromagnetism and imaging (6 CFU)
-    Statistics of Stochastic Processes (6 CFU)
-    Stochastic Differential Equations (6 CFU)
-    Scientific computing (6 CFU)

Students must take 6 credits in this list or in the courses from the previous list not already chosen:
-    Integral transforms (6 CFU)
-    Laboratory of biological data mining (6 CFU) Mutuato da DISI (0517H – 145053)
-    Machine learning (6 CFU) Mutuato Mutuato da DISI (0517H – 145062)

Students must take **15 credits among free-choice courses**
It is suggested to take exams from the previous lists not already chosen.

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

For students missing some prerequistes 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.

Piano orientato a Modelling and Simulation for Biomedical Applications

A study plan yielding competences in mathematics, numerical computation, physics, physiology, applicable to a range of disciplines in medicine, pharmaceutical industry, sanitary services.

1st year; semester 1

Course	codice	Settore	Type	Sem	Ore attività	Docente	CFU
Mathematical biology	145145	MAT/05	Caratterizzante	1	63	Mimmo Iannelli Andrea Pugliese	9
Integral transforms	145143	MAT/05	Caratterizzante	1	42	Luciano Tubaro	6
Molecular and Cellular Biophysics	145235	BIO/10	Affine	1	48	Mutuato Dip. Fisica (0518H cod. 145235)	6
Theoretical Biomechanics	145332	ICAR/01	Affine	1-2	63	Davide Bigoni Giorgio Rosatti	9
						CFU Total	**30**

1st year; semester 2

Course	codice	Settore	Type	Sem	Ore attività	Docente	CFU
Scientific computing	145330	MAT/08	Caratterizzante	2	42	Dumbser Michael	6
Mathematical aspects of bioelectromagnetism and imaging	145331	MAT/08	Caratterizzante	2	42	Ana Maria Alonso Rodriguez	6
Partial differential equations	145393	MAT/05	Caratterizzante	2	63	Augusto Visintin	9
Statistical models	145333	MAT/06	Affine	2	21	Melissa Morine	3
Bio-medical imaging	145338	FIS/07	Affine	2	42	Mutuato Dip. Fisica (0518H cod. 145338)	6
Language skills						CIAL	3
						CFU Total	**33**

2nd year; semester 1

Course	codice	Settore	Type	Sem	Ore attività	Docente	CFU
Models and numerical methods for blood flow	145391	MAT/08	Affine	1	70	Toro Eleuterio	9
Physiological flow and transport in porous tissues	145392	ICAR/02	Affine	2	42	Alberto Bellin	6
						CFU Total	**15**

12 credits of free-choice courses; strongly advised Biomedical applications of mathematics (6 CFU – settore MAT/08 – cod. 145398 – Prof. Alberto Valli) and Numerical methods for partial differential equations (6 CFU – settore MAT/08 – cod. 145152 – Prof.ssa Ana Alonso).

Percorso "Teaching and Scientific Communication"

The rules for this *percorso* are the following.

Students must take 30 credits among the following courses *caratterizzanti:*

Course	codice	Settore	Type	Sem	Ore attività	Docente	CFU
Elementary Mathematics from a higher Viewpoint I	145149	MAT/04	Caratterizzante	1	42	Beretta Lucia	6
Foundations of Analysis	145142	MAT/05	Caratterizzante	1	42	Bagagiolo Fabio	6
Laboratory of Didactics of Mathematics	145144	MAT/04	Caratterizzante	1	42	Delladio Silvano	6
Foundations of Geometry	145253	MAT/03	Caratterizzante	2	42	Beretta Lucia	6
Elementary Mathematics from a higher Viewpoint II	145150	MAT/04	Caratterizzante	2	42	Andreatta Marco	6
Experimental Mathematics Laboratory at High School Level	145154	MAT/04	Caratterizzante	2	42	Anzellotti Gabriele	6

Students must take the following course

Course	codice	Settore	Type	Sem	Ore attività	Docente	CFU
Mathematical models for the Physical, Natural and Social Sciences	145151	MAT/06	Caratterizzante	2	42	Bonaccorsi Stefano	6

Students must take the following courses *affini:*

Course	codice	Settore	Type	Sem	Ore attività	Docente	CFU
Modern Physics	145155	FIS/08	Affine	1	84	Oss Stefano	12
Didactics of Computer Science	145211	INF/01	Affine	2	42	Mich Luisa	6
Experimental Physics Laboratory at High School Level I	145153	FIS/08	Affine	1	56	Mut. Dip. Fisica (0518H cod. 145153)	6
Experimental Physics Laboratory at High School Level II	145215	FIS/08	Affine	2	56	Mut. Dip. Fisica (0518H cod. 145215)	6

Students must also take 6 credits *affini* among all courses *caratterizzanti* or *affini* of area MAT or FIS not chosen from the previous lists, or listed for the percorso Mathematical Sciences, or the course **"Physical Science Communication and Teaching methods"** cod. 145193 Mut. dal Dip. Fisica (0518H cod. 145193)**.**

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
Thesis/tesi	30
CFU Total	**48**

Please note that any *caratterizzante* or *affine* course not already chosen can be taken as free-choice. The courses "Mathematical logic" and "Physical Science Communication and Teaching methods" are recommended for the 6 credis affini and for the free-choiuce courses.