

Master Degree MATHEMATICS

Double Degree with the University of Stuttgart

Available places 3

Period year II, semester I and II

Language English or German

ECTS 60 (of which 30 for the master thesis)

Admission requirements:

- Bachelor degree: Laurea nella classe L-35/Scienze Matematiche, or an equivalent foreign degree, to be obtained by 15/10/2023
- Students are expected to have a sufficient knowledge of English to follow the courses taken in Stuttgart and to write their master thesis
- At the time of arrival at the University Stuttgart, students must have completed **40 ECTS from their first master year at University Verona.**

Coordinator Prof. Lidia Angeleri

Further information in the Annex to the agreement that can be found on the next pages.

Laurea Magistrale MATHEMATICS

Percorso di Doppio Titolo con l'Università di Stoccarda

Posti disponibili 3

Periodo I e II semestre del II anno

Lingua Inglese o tedesco

ECTS 60 (di cui 30 per la tesi)

Requisiti di ammissione:

- Laurea nella classe L-35/Scienze Matematiche (o titolo estero ritenuto equivalente) da conseguire entro il 15/10/2023
- Conoscenza della lingua inglese sufficiente a seguire i corsi offerti dalla sede di Stoccarda e a scrivere la tesi
- Conferma in itinere: 40 CFU ottenuti e regolarmente verbalizzati entro il periodo di mobilità

Coordinatrice Prof. Lidia Angeleri

Ulteriori informazioni nell'Annex all'accordo riportato nelle pagine seguenti

Annex to Addendum

The double degree follows the **Macroplan** that combines the degrees Master in Mathematics in Verona and M.Sc. Mathematics in Stuttgart. The table gives an overview; precise rules for the double degree are detailed below.

Double degree programme UNIVERSITY OF VERONA - UNIVERSITY OF STUTTGART											
STUDENTS UNIVERSITY OF VERONA					STUDENTS UNIVERSITY OF STUTTGART						
Master in Mathematics (Curriculum Applied)					Master of Science in Mathematics						
YEAR	TAF	MODULES	ECTS	ECTS VE- RONA 1st year	ECTS STUTTGART 2nd year	ECTS VE- RONA 2nd year	ECTS STUTTGART 1st year	ECTS	MODULES	YEAR	
1st	B	Functional analysis	12	36				Between 6 and 36 ECTS during 1st, 2nd , 3rd sem.	<i>Anwendungsmodule to be obtained from applied modules, for example in physics, computer science, technical kybernetics, technically oriented management studies, aerospace engineering, technical biology, technical mechanics, or in an applied project or by internships.</i>		
	B	Analytical mechanics	6								
	B	Differential geometry	6								
	B	Stochastic calculus	6								
	B	Partial differential equations	6								
1st or 2nd	B	Computational algebra	6	24	30	28	60	Between 36 and 72 ECTS during 1st, 2nd , 3rd sem.	<i>Mathematische Wahl- module to be chosen within the mathematics options, which mainly are lecture courses worth 9 ECTS (four hours of lectures a week plus two hours of problem class.</i>	1st or 2nd	
		Homological algebra									
	B	Data fitting and reconstruction	6								
		Numerical methods for Partial Differential Equations									
	C	3 modules between the following									
											Algebraic Geometry
											Advanced geometry
											Computational algebra
											Data fitting and reconstruction
											Foundations of data analysis
											Homological algebra
											Mathematical finance
											Mathematical methods for computer science
											Mathematical modelling in the applied sciences (S)
											Mathematics for decisions (S)
			Methods in representation theory (S)								
			Numerical modelling and optimization								
		Numerical methods for mathematical finance (S)									
		Numerical methods for Partial Differential Equations									
	Statistical Learning										
D	Activities to be chosen by the student	12									
1st or 2nd	F	Complementary activities	4								
2nd	B	Optimization	6					6	SQ		
2nd	E	Final exam (Master thesis)	32		30	32		30	Masterarbeit	2nd	
				120			120				

0.(a) Grade conversion table

University of Verona and University of Stuttgart both will use the following grade conversion table to convert grades into each others' system.

Stuttgart	1,0	1,3	1,7	2,0	2,3	2,7	3,0	3,3	3,7	4,0	>4,0
Verona (30-18)	30	29/28	27	26	25/24	23	22	21/20	19	18	<18

When converting grades from the German to the Italian system, 1,3 is converted to 29, 2,3 to 25, 3,3 to 21.

The grades for the master's thesis, including presentation / colloquium, are computed separately, based on the following rules:

- (a) Both supervisors decide about the grade of the thesis.
- (b) The presentation / colloquium follows the rules of the home university and is given in presence. Online access is provided and both thesis supervisors are participating and get involved in deciding about the grade.
- (c) The Italian grading system, with pass grades from 18 to 30 is used as a bridge to determine the precise grade of thesis and presentation / colloquium. The agreed grade is chosen according to this system and then gets converted into a grade at the University of Stuttgart by using the grade conversion table above. At University of Verona, the same agreed grade gets converted into a grade between zero and five, with up to two decimal places, that serves as input for the formula used in the Master of Mathematics in Verona to compute the final grade. In addition, the University of Verona awards up to two points for particular achievements, based on the same criteria as in its Master of Mathematics.

0.(b) Doubling of courses

Courses that have been taken at the home university and got validated at the host university cannot be taken and validated a second time at the host university.

1. Students from the University of Stuttgart spending their second year in Verona:

The students' academic paths are summarised in the following table:

Stuttgart Students	I Year		II Year	
	1°	2°	3°	4°
	sem	sem	sem	sem
	Stuttgart		Verona	
	60 ECTS, subject to the rules : <ul style="list-style-type: none"> • Choice from the options available in the area of Elective Mathematics Modules. • Between 6 and 24 ECTS to be obtained in the area of Applied Modules (Anwendungsmodule). • Between 6 and 12 ECTS to be obtained 		60 ECTS , from the options available in the second year of study of the Master in Mathematics. This includes 30 ECTS for the Master's thesis.	

	<p>in the area of Scientific Methods. This has to include 6 ECTS for a seminar.</p> <ul style="list-style-type: none"> • Maximum of 24 ECTS from elective core modules or complementary modules from the module handbook of the B.Sc. Mathematics. 	
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First year of study:

The first year of study is spent at the University of Stuttgart. Students choose optional courses according to the following rules:

- Choice from the options available in the area of Elective Mathematics Modules.
- Between 6 and 24 ECTS to be obtained in the area of Applied Modules (Anwendungsmodule).
- Between 6 and 12 ECTS to be obtained in the area of Scientific Methods. This has to include 6 ECTS for a seminar.
- Maximum of 24 ECTS from elective core modules or complementary modules from the module handbook of the B.Sc. Mathematics.

Second year of study:

Two final semesters at the University of Verona in the Master in Mathematics, including the final master thesis (60 ECTS).

1.(a) Language requirements

No Italian language requirements are needed for students from Stuttgart to enter the programme. Students may follow Italian lessons in Verona during the year. Students are expected to have a sufficient knowledge of English to follow the courses taken in Verona and to write their master thesis.

1.(b) Credits and grading system at Verona University

Grades of exams are expressed in a range from 0 to 30. Maximum grade is 30 with honours (30 e lode).

For any study year, there are 4 exam sessions (2 after the first semester, 2 after the second semester) where it is possible to validate any Teaching Unit=course (Insegnamenti) of the Degree Program.

A Teaching Unit is validated if the grade obtained is larger than or equal to 18 out of 30. Students failing or wishing to improve their grade obtained in a given session may retake the exam in a subsequent session.

A study year is validated when all the Teaching Units corresponding to that year are validated.

The Master Thesis grading ranges from 0 to 7.

The Master Degree is awarded with grades ranging from 66 to 110 (with or without honours), grading is based on the average grade obtained during the Master courses and the grade obtained for the Master Thesis.

1.(c) Curriculum (subject to revision every year)

The possible curricula for students admitted to the Double Degree Programme are detailed below, focusing on the mobility period abroad. Courses taken at the University of Stuttgart will be recognised by the University of Verona. ECTS earned in Stuttgart in the first year also count for the Master in Mathematics in Verona, grades are converted according to the above conversion table.

The first semester of the second year is dedicated to elective scientific courses and complementary activities (such as programming languages, foreign languages, winter schools, seminar courses). It is possible to take some of these courses in the second semester of the mobility year.

The second semester of the second year is devoted to the master's thesis. It can be done in a R&D department of a private company or in an academic laboratory. In addition to the supervisor in Verona there is a co-supervisor in Stuttgart.

Courses of the second year

28 ECTS for scientific course are to be chosen from the following options:

Course name	ECTS
Computational algebra	6
Homological algebra	6
Data fitting and reconstruction	6
Numerical methods for Partial Differential Equations	6
Algebraic Geometry	6
Advanced geometry	6
Foundations of data analysis	6
Mathematical finance	6
Mathematical methods for computer science	6
Mathematical modelling in the applied sciences (S)	6
Mathematics for decisions (S)	6
Methods in representation theory (S)	6
Numerical modelling and optimization	6
Numerical methods for mathematical finance (S)	6
Statistical Learning	6
Activities to be chosen by the student	Up to 12
Complementary activities	Up to 4
Optimization	6

(Here, S stands for seminar course.)

Here are some examples of complementary activities (up to 4 ECTS)

Course name	ECTS
Python	2
C++	2
Matlab	2
ECMI Modelling Week	4
Seminar course project	2
Foreign language (Italian, English, Spanish, Russian)	4

Second Semester of the second year

Course name	ECTS
Master thesis	32

All the course descriptions are available at:
<http://www.di.univr.it/?ent=in&cs=389&id=851>

2. Students from Verona University spending their second year in Stuttgart:

The students' academic paths are summarised in the following table:

	I Year		II Year	
	1°	2°	3°	4°
	sem	sem	sem	sem
Verona Students	Verona		Stuttgart	
	60 ECTS , from the options available in the first year of study of the Master in Mathematics, including the obligatory modules of the first year.		60 ECTS , subject to the rules: <ul style="list-style-type: none"> • Students may obtain up to 12 ECTS for modules in the area of Scientific work. At least 6 ECTS must be obtained. • Students may obtain up to 18 ECTS for internships. • Students may obtain up to 6 ECTS for key skills. 	

First year of study:

Students follow the rules for the first year of the Master in Mathematics in the University of Verona.

Second year of study:

Two final semesters at the University of Stuttgart in the Master of Sciences in Mathematics, including the final master thesis (60 ECTS).

2.(a) Language requirements

No German language requirements are needed for students from Verona to enter the programme. Students may follow German lessons in Stuttgart during the year. Students are expected to have a sufficient knowledge of English to follow the courses taken in Stuttgart and to write their master thesis.

2.(b) Credits and grading system

Grades of exams range from 1,0 (very good) over 4,0 (pass) to 5,0 (fail). A teaching unit is validated if the grade obtained is 4,0 or better.

Students failing an exam may retake the exam in a subsequent exam period. There are two exam periods per year.

60 ECTS earned in Verona count for the Master of Mathematics in Stuttgart, grades are converted according to the above conversion table.

2.(c) Curriculum

In their first year in Verona students take obligatory and optional courses according to the rules at the University of Verona. Courses taken at the University of Verona will be recognised by the University of Stuttgart. ECTS earned in Verona in the first year also count for the M.Sc. Mathematics in Stuttgart, grades are converted according to the above conversion table.

In the third semester, spent in Stuttgart, students take courses from the options in the Master of Mathematics in Stuttgart, worth in total 30 ECTS. It is possible to take some of these courses in the fourth semester.

In the fourth semester, also spent in Stuttgart, students write their master thesis, which is worth 30 ECTS in Stuttgart and 32 ECTS in Verona. In addition to the supervisor in Stuttgart, there is a co-supervisor in Verona.

The courses taken in Stuttgart, worth 30 ECTS in total, have to be chosen from:

- Elective Modules Mathematics (Mathematische Kern- und Wahlmodule) available in the Master of Mathematics in Stuttgart,
- Applied Modules (Anwendungsmodule) available in the Master of Mathematics in Stuttgart,
- Scientific Methods (Wissenschaftliches Arbeiten) available in the Master of Mathematics in Stuttgart
- Interdisciplinary Key Qualifications (Fachübergreifende Schlüsselqualifikationen, SQ) available in Stuttgart.

These modules, except for Schlüsselqualifikationen, are listed in the module handbook under the headings „Mathematische Kern- und Wahlmodule“, „Anwendungsmodule“ and „Wissenschaftliches Arbeiten“. What is on offer in the coming semester and what is planned for the near future can be found on the departmental webpage <https://www.f08.uni-stuttgart.de/en/mathematics/students/lectures/>

Here are some explanations on the four kind of courses:

- Elective Modules Mathematics: The mathematics options are lecture courses in mathematics consisting of lectures and problem classes, worth in total 6 or, mostly, 9 ECTS.
- Applied modules: The application options are lecture courses in mathematics or related subjects including physics, computer science, technical cybernetics, technically oriented management studies, aerospace engineering, technical biology, technical mechanics - consisting of lectures and problem classes, each worth in total 6 or 9 ECTS. Applied modules also include application projects, up to 6 ECTS, and internships. Internships can be worth 6, 12 or 18 ECTS.
- Scientific Methods: The scientific work options are seminars or work with mathematical literature / reading courses or computer projects or research projects, worth 6 ECTS each.
- Interdisciplinary Key Qualifications cover a wide range of topics in various formats.

Projects as mentioned above (computer project, applied project, research project) are individually supervised or carried out in small groups of students, and need to be agreed with a supervisor. Internships also are chosen individually. All other courses available can be found in the C@mpus information system of the University of Stuttgart and are also announced on the web site of the department of mathematics.

The choice of courses is subject to the following rules:

- During the year in Stuttgart, students may obtain up to 12 ECTS for modules in the area of Scientific work. At least 6 ECTS must be obtained.
- During the year in Stuttgart, students may obtain up to 18 ECTS for internships.
- During the year in Stuttgart, students may obtain up to 6 ECTS for key skills.

2.(d) Sample paths

The Master of Mathematics in Stuttgart offers a wide variety of choices according to students' interests and career plans. Here are **four sample paths** students may take to organise their studies in the double degree when starting in Verona and then moving to Stuttgart:

Semesters 1 and 2, in Verona: 60 ECTS	Semester 3 in Stuttgart: 30 ECTS	Semester 4 in Stuttgart: 30 ECTS
Obligatory courses in Verona must be taken. Additional ECTS must be taken from the list of options available in Verona.	<ul style="list-style-type: none"> • two lecture courses with problem classes, worth 9 ECTS each, from the list of options (elective modules mathematics or applied modules) • two seminars worth 6 ECTS 	Master thesis 30 ECTS

Semesters 1 and 2, in Verona: 60 ECTS	Semester 3 in Stuttgart: 30 ECTS	Semester 4 in Stuttgart: 30 ECTS
Obligatory courses in Verona must be taken. Additional ECTS must be taken from the list of options available in Verona.	<ul style="list-style-type: none"> • two lecture courses with problem classes, worth 9 ECTS each, from the list of options (elective modules mathematics or applied modules) • one seminar worth 6 ECTS • one computer project or research project or reading course, each worth 6 ECTS 	Master thesis 30 ECTS

Semesters 1 and 2, in Verona: 60 ECTS	Semester 3 in Stuttgart: 30 ECTS	Semester 4 in Stuttgart: 30 ECTS
Obligatory courses in Verona must be taken. Additional ECTS must be taken from the list of options available in Verona.	<ul style="list-style-type: none"> • two lecture courses with problem classes, worth 9 ECTS each, from the list of options (elective modules mathematics or applied modules) • one seminar worth 6 ECTS • one internship worth 6 ECTS 	Master thesis 30 ECTS

Semesters 1 and 2, in Verona: 60 ECTS	Semester 3 in Stuttgart: 30 ECTS	Semester 4 in Stuttgart: 30 ECTS
Obligatory courses in Verona must be taken. Additional ECTS must be taken from the list of options available in Verona.	<ul style="list-style-type: none"> • one lecture course with problem classes, worth 9 ECTS, from the list of options (elective modules mathematics or applied modules) • one internship worth 12 ECTS • one seminar worth 6 ECTS • one key skills course worth 3 ECTS 	Master thesis 30 ECTS

Other paths are possible, too.

Both parties, Verona and Stuttgart offer advice to the students in the double degree, and students are strongly encouraged to discuss their plans with the advisors.

More detailed information will be published in due course through a website or leaflets.