

# DF-UniPi – l’X double degree learning agreement

(Department of Physics of Pisa - École Polytechnique)

## 1. DF-UniPi student study plan

### 1.1. UNIPI student at PISA “Laurea Triennale in Fisica” - 2.5 years (equivalent of “classes préparatoires”)

The DF-UniPi student that intends to apply for the double degree must be first selected by the DF-UniPi commission on the basis of his/her curriculum vitae.

First year (1° anno)		
• <b>Calculus 1 and 2</b>	[Analisi Matematica 1 e 2]	15 ECTS
• <b>Informatics</b>	[Informatica]	6 ECTS
• <b>Physics 1</b>	[Fisica 1]	15 ECTS
• <b>Linear Algebra</b>	[Geometria 1]	9 ECTS
• <b>Laboratory in Physics 1</b>	[Laboratorio di Fisica 1]	12 ECTS
• <b>Foreign Language</b>	[Abilità linguistica]	3 ECTS

Second year (2° anno)		
• <b>Calculus 3</b>	[Analisi Matematica 3]	6 ECTS
• <b>Physics 2</b>	[Fisica 2]	15 ECTS
• <b>Chemistry</b>	[Chimica Generale]	6 ECTS
• <b>Laboratory in Physics 2</b>	[Laboratorio di Fisica 2]	12 ECTS
• <b>Classical Mechanics</b>	[Meccanica Classica]	12 ECTS
• <b>Mathematical Methods 1</b>	[Metodi Matematici 1]	6 ECTS
• <b>First admission window at l’</b>		6 ECTS

Third year, first semester (3° anno, I semestre)		
• <b><u>Second admission window at</u></b>	<i>(if not done at second year)</i>	6 ECTS
• <b><u>Quantum Mechanics</u></b>	[Meccanica quantistica]	9 ECTS
• <b><u>Physics 3</u></b>	[Fisica 3]	9 ECTS
• <b><u>Mathematical Methods 2</u></b>	[Metodi Matematici 2]	6 ECTS
• <b><u>Laboratory 3</u></b>	[Laboratorio 3]	6 ECTS
• <b><u>Optional courses</u></b>	<i>to be done in Pisa or at X at choice</i>	

*Note: Before his/her departure the student must pass at least three courses of which Quantum mechanics and Laboratory 3 are mandatory.*

The remaining ECTS to complete the “Laura Triennale” will be obtained at l’X during the first and/or the second year of the curriculum “Ingénieur polytechnicien” following the study plan approved by the DF-UniPi. As soon as the ECTS are completed at l’X and approved by the DF-UniPi, the UniPi will deliver the diploma of “Laurea Triennale”. The student will then be officially enrolled in the “Laurea Magistrale” in Physics.

### 1.2. UNIPI student at POLYTECHNIQUE – 2,5 years

On leaving, the UniPi student study plan (“piano di studi”) at l’X must have been approved by the DF-UniPi. The student must reach l’X by, at latest, the end of February. The UniPi student study plan must then be approved year by year during his/her stay at l’X. Before the beginning of the official courses in April, the UniPi student will follow at l’X the preparatory semester for international students, which includes language and scientific courses.

#### First year, X1 [April to June]

X1 – April to June. All courses compulsory		ECTS
<i>Computer Science (one at choice)</i>	<ul style="list-style-type: none"> <li>• INF311 Introduction to Computer Science</li> <li>• INF321 Principles of Programming Languages</li> </ul>	4
<i>Pure Mathematics</i>	<ul style="list-style-type: none"> <li>• MAT311 Introduction to Real Analysis</li> </ul>	4

<i>(one at choice)</i>	<ul style="list-style-type: none"> <li>• MAT321 Real and Complex Analysis</li> </ul>	
<i>Applied Mathematics</i>	MAP311 Introduction to the Probability Theory	4
<i>Physics</i>	PHY311 Quantum Mechanics	4
<i>Economics</i>	ECO311 Introduction to Economics Analysis	4
<i>Foreign Language</i>	<i>English</i> <i>And</i> <i>French as a foreign language</i>	2
	Humanities and Social Sciences	2
	Sport & Personal Development	1
<b>ECTS YEAR 1</b>		<b>25</b>

**Second year, X2** [2 semesters each one split into 2 periods]

The DF-UniPi student must follow 3 scientific courses per period in at least 4 different scientific fields. One and only one scientific course must be substituted by a lab course (“modal”: 5 ECTS). In addition, the student will do a Group Scientific Project equivalent to 7 ECTS. A course in ECO, one in Social Sciences and a Management and Innovation course are mandatory as well.

I semester	X2.1 – Late August – Late January	ECTS
<b>Period 1</b>		
<i>Physics</i>	PHY430 Advanced Quantum Physics	4
<i>Mathematics</i>	MAT431 Dynamical Systems	4
<i>Applied Mathematics</i>	MAP433 Introduction to statistical methods	4
<i>Mechanics</i>	MEC430 Continuum Mechanics I	4
<i>Biology</i>	BIO452 Molecular Biology and Genetic Information	4
<i>Chemistry</i> <i>(one at choice)</i>	<ul style="list-style-type: none"> <li>• CHI411 Introduction to Molecular Chemistry</li> <li>• CHI421 Organic Chemistry</li> </ul>	4
<i>Computer Science</i> <i>(one at choice)</i>	<ul style="list-style-type: none"> <li>• INF411 Programing and Algorithm Basics</li> <li>• INF412 Foundations of Computer Science</li> </ul>	4
<i>Economy</i>	ECO431 Microeconomics	4
<b>Period 2</b>		
<i>Physics</i>	PHY431 Relativity and Variational Principles	4

<i>Mathematics</i> (one at choice)	<ul style="list-style-type: none"> <li>• MAT432 Fourier Analysis, Spectral Theory and PDEs</li> <li>• MAT433 Distributions and PDEs</li> </ul>	4
<i>Applied Mathematics</i>	MAP411 Numerical Approximation and Optimization	4
<i>Mechanics</i>	MEC431 Continuum Mechanics 2	4
<i>Biology</i>	BIO451 The Cell, Living Unit	4
<i>Chemistry</i>	CHI431 Foundations of Molecular Chemistry and Materials	4
<i>Computer Science</i>	INF421/ Design and Analysis of Algorithms	4
<i>Economy</i> (one at choice)	<ul style="list-style-type: none"> <li>• ECO432 Macroeconomics</li> <li>• ECO433 Introduction to Econometrics</li> </ul>	4

II semester	X2.2 – Late January – Mid June	ECTS
<b>Period 3</b>		
<i>Physics</i> (one at choice)	<ul style="list-style-type: none"> <li>• PHY432 Electromagnetism</li> <li>• PHY433 Statistical Physics 1</li> </ul>	4
<i>Mathematics</i>	MAT451 Algebra and Galois Theory	4
<i>Applied Mathematics</i> (one at choice)	<ul style="list-style-type: none"> <li>• MAP431 Variational methods for PDE</li> <li>• MAP432 Random Phenomena Modeling</li> </ul>	4
<i>Mechanics</i>	MEC432 Fluids Mechanics	4
<i>Biology</i>	BIO431 Ecology and Biodiversity	4
<i>Chemistry</i>	CHI441 Coordination Chemistry	4
<i>Computer Science</i>	INF431 Algorithms and Programming	4
<i>Economy</i>	ECO434 International Economics	4
<b>Period 4</b>		
<i>Physics</i>	PHY434 Statistical Physics 2	4
<i>Mathematics</i>	MAT452 Introduction to Differential Geometry	4
<i>Applied Mathematics</i>	MAP434 Dynamic Model Control	4
<i>Mechanics</i> (one at choice)	<ul style="list-style-type: none"> <li>• MEC435 Industrial Application in Mechanics</li> <li>• MEC433 Dynamics of the Atmosphere and Oceans</li> </ul>	4
<i>Biology</i>	BIO432 Human Biology and Pathology	4
<i>Chemistry</i>	CHI451 Materials Chemistry	4

<i>Computer Science</i> (one at choice)	<ul style="list-style-type: none"> <li>• INF441 Advanced Programming</li> <li>• INF442 Mass Data Processing</li> </ul>	4 4
<i>Economy</i>	ECO435 Business Economics	4
<b>Other subjects</b>		<b>ECTS</b>
<i>Foreign Language</i>	English And French as a foreign language	6
	Management of Innovation and Entrepreneurship	2
	Humanities and Social Sciences (courses and seminars)	8
	Group Scientific Project	7
	Sport	4
	Company Internship	2
<b>TOTAL FOR YEAR 2</b>		<b>78</b>

### Third year, X3

The 3<sup>rd</sup> year is divided into 3 terms following one of the X-curriculum in Physics listed below. During the first two terms, the student is required to choose 4 scientific courses per term according to the scientific curriculum they have chosen and should complement it with a course in Humanities and Social Sciences, two foreign languages and sport. In parallel to the scientific classes, the student has to conduct a scientific project, equivalent to 8 ECTS. The 3<sup>rd</sup> year is completed during the 3<sup>rd</sup> term by an up to Six-Month Research Internship which takes place either in a public research organization or in a company's R&D center in France or abroad. The DF-UniPi commission must validate, if requested, the Internship as equivalent to a laboratory course. In the case that the Internship cannot be considered as such, the student must follow the laboratory course next year in Pisa before completing his/her "Laurea Magistrale".

1st & 2nd Term Early September – Mid-March	ECTS
<b>Scientific specialization for the "double diploma" with UNIPI</b>	
<b>Physics (mandatory)</b>	32
<b>Scientific Project</b>	8
<b>Research Internship – 3rd Term – March to August</b>	20
<b>Management of Innovation and Entrepreneurship</b>	2
<b>Foreign Language</b>	6
<b>Humanities &amp; Social Science</b>	3
<b>Sport</b>	4
<b>Total for year 3</b>	<b>75</b>

### Options for the curriculum in Physics at X:

- Fundamental Concepts of Physics;
- Laser, Optics, Matter;
- High-energy physics;
- Nano sciences;
- Materials and Nano-Objects Science;
- Fusion Sciences;
- Quantum Devices.

### **1.3. Forth year, second year of “Laurea Magistrale” at DF-UniPi**

The DF-UniPi student will complete the double diploma by coming back to Pisa after X3 and concluding his/her road map by obtaining the remaining ECTS from the available courses at “Laurea Magistrale” including 45 ECTS for the Master Thesis, in agreement with the approved study plan (“piano di studi”). The Master Thesis will be defended at DF-UniPi following the rules of DF-UniPi.

## **2. Student from l'X: study plan**

The X-student road map to obtain the double diploma starts with the admission at “*Laurea Magistrale*” at UniPi during the third year of the “ingenieur polytechnicen” programme (X3), after having completed the first two years of the programme (X1, X2).

The student from l'X is admitted to “*Laurea Magistrale*” by the DF-UniPi commission on the basis of his/her curriculum vitae. The first year of “*Laurea Magistrale*” will be done at l'X (X3). If necessary, an interview using electronic devices (e.g. skype) can be asked to candidates from l'X by the DF-UniPi commission. Upon successful completion of X3, the student from l'X will come to Pisa where the DF-UniPi commission will assign to him/her a number of ECTS ranging from 45 to 60 depending on his/her study plan at l'X (X3).

The DF-UniPi commission must approve the study program (“piano di studi”) presented by the student. As stated for the DF-UniPi student, the DF-UniPi commission must validate, if requested, the Internship during X3 as equivalent to a laboratory course. In the case that the Internship cannot be considered as such, the student must follow a laboratory course in Pisa before completing his/her “*Laurea Magistrale*”. In Pisa the X-student must pass all the courses listed in the study plan (“piano di studi”). There is no deadline to complete the study plan. A sufficient knowledge of Italian is required either by means of a B1 certificate (or equivalent) or by an oral test at DF-UniPi using electronic devices (e.g. skype, teleconf, etc.) by the DF-UniPi commission. The Master thesis will be discussed at DF-UniPi following the rules of DF-UniPi.