DF-UniPi –X double degree learning agreement

Department of Physics of Pisa (DF-UNIPI) - *École Polytechnique* (X)

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 after completing the first and second year in Pisa must pass the admission exam at X during the beginning of the third year of "Laurea Triennale" and must be selected by the DF-UniPi Commission based on her/his curriculum vitae here following.

First year (1° anno)		
Calculus	[Analisi Matematica]	15 ECTS
Linear Algebra and geometry	[Geometria e algebra lineare]	12 ECTS
Physics 1	[Fisica 1]	15 ECTS
Laboratory 1 and computation	[Laboratorio 1 e computazione]	15 ECTS
English B2 language test	[Prova di lingua inglese B2]	3 ECTS

Second year (2° anno)		
Advanced Calculus	[Complementi di Analisi Matematica]	6 ECTS
Physics 2	[Fisica 2]	15 ECTS
Chemistry	[Chimica Generale]	6 ECTS
Laboratory 2	[Laboratorio 2]	12 ECTS
Classical Mechanics	[Meccanica Classica]	12 ECTS
Mathematical Methods 1	[Metodi Matematici 1]	6 ECTS

Third year, first semester (3° anno, I semestre)		
admission window at l' X	[Esame di ammissione a X]	6 ECTS
Quantum Mechanics	[Meccanica quantistica]	9 ECTS
Physics 3	[Fisica 3]	9 ECTS
Laboratory 3	[Laboratorio 3]	9 ECTS
Suggested: **Math. Methods 2 or computer science**	[Metodi Mat. 2 o informatica]	6 ECTS
Optional courses	*to be done in Pisa or at X at choice*	
Final degree exams	in Pisa	3 ECTS
Tot	At UNIPI	36 (/ 42)

In summary, before her/his departure the DF-UNIPI student must pass the first, second and first semester third year exams in Pisa of which at least Quantum mechanics, Physics 3 and Laboratory 3 are mandatory. It is suggested but not mandatory to pass Math. Methods 2 or computer science before departure.

Summary of the road map at X for the DF-UNIPI student*

The complete study plan to obtain the "Laurea Triennale in Fisica" (Bachelor in Physics) at UniPi must be submitted through the appropriate web interface and approved by the DF-UniPi Commission before the end of the X1 period. The ECTS needed to complete the study plan will be obtained at X during X1 and X2 of the "Ingénieur polytechnicien" curriculum. During X2 at least 6 ECTS of MODAL courses must be taken by choosing at least one of the equivalent physics laboratory courses listed in period 2 or 3. The DF-UniPi student study plan must contain a number of ECTS and corresponding courses that match the rules of "*Laurea Triennale in Fisica*" at UniPi. As soon as the ECTS are completed at X, the UniPi will deliver the diploma of "Laurea Triennale" after passing the final degree in Pisa (a remote exam is allowed). Then, after completing the courses required by Ecole Polytechnique during X1 and X2 and having obtained the diploma of "Laurea Triennale" at UNIPI, the DF-UNIPI student will be enrolled at X3 and at Laurea Magistrale in Physics at UNIPI by choosing one of the curricula of the study plan at X for Physics. Finally, after completing X3 at X, the DF-UniPi student will complete the double diploma by coming back to Pisa and concluding her/his road map including the Master Thesis. The Master Thesis will be defended at DF-UniPi following the rules of DF-UniPi.

* *The DF-UNIPI student having successfully passed the admission exam at X must download and read, before departure, this Learning Agreement from the webpages of the Physics Department of Pisa. The Study plan, including the educational activities to be carried out during the mobility period, must be submitted by the DF-UNIPI student at max before May 10 during the X1 period. The study plan must be approved by the Pisa-CdL before the start of X2.*

DF-UNIPI student at POLYTECHNIQUE

The DF-UNIPI student must reach X at latest end of January. In case of the need of a delay to finalize a last exam in Pisa, the request must be approved by the DF-UniPi commission in agreement with X. She/He will follow at X the preparatory semester for international students, which includes language and scientific courses.

1.2. First year at X – X1 ("Laurea Triennale")

(see https://programmes.polytechnique.edu/cycle-ingenieur-polytechnicien/details-du-programme/premiere-annee-du-cycle-ingenieur)

	X1 – April to June. All courses compulsory	ECTS
Computer Science (one at choice)	• INF361 Introduction to Computer Science • INF371 Object-oriented programming mechanisms	4
Pure Mathematics (one at choice)	• MAT371 Real and complex Analysis • MAT361 Real analysis and intro to variational methods	4
Applied Mathematics	MAP361 Introduction to the Probability Theory including MAP361P Python	4
Physics	PHY361 Quantum Mechanics	4
Economics	ECO361 Introduction to Economics sciences	4
English, French, Communication, *Sport* (French for non-French speaker)		1
ECTS YEAR 1		**21**

1.3. Second year at X – X2 ("Laurea Triennale")

(see https://synapses.polytechnique.fr/catalogue/2023-2024/parcours/2954/X-2A-P1-SC-x-2a-p1-modules-scientifiques?from=P2633 for courses details)

The DF-UniPi student must follow 3 scientific courses per period in at least 4 different scientific fields (modal not included) and a final stage. Courses in Social Sciences, languages, sport and Management and Innovation are mandatory following X-rules.

X2		ECTS
Period 1		
Physics	PHY430 Advanced Quantum Physics	5
Mathematics	MAT431 Differential calculus and holomorphic functions	5
Applied Mathematics	MAP412 Introduction to Numerical Analysis MAP433 Statistics	5
Mechanics	MEC430 Mechanics of deformable media	5
Biology	BIO452 Molecular Biology and Genetic Information	5
Chemistry	CHI431 Orbitals, molecules and materials	5
Computer Science	• INF411 Programing and Algorithm Basics • INF412 Foundations of Computer Science	5
Economy	ECO431 Microeconomics	5
MODAL	*At least one at choice*	6

Period 2		
Physics	PHY431 Relativity and Variational Principles PHY432 Electromagnetic waves	5
Mathematics	MAT432 Distributions, Fourier Analysis and PDEs	5
Applied Mathematics	MAP431 Variational analysis of PDEs MAP432 Modeling of random phenomena	5
Mechanics	MEC432 Fluid Mechanics	5
Biology	BIO451 Cell biology and development	5
Chemistry	CHI421 Reactivity and Molecular Synthesis	5
Computer Science	INF421 Design and Analysis of Algorithms	5
Economy **(one at choice)**	• ECO432 Macroeconomics • ECO435 Business management	4 4
MODAL (at least one at choice here or in period 3)	• PHY472A Plasma physics and elementary particles • PHY472B Laser Physics & Applications • PHY472C Condensed matter physics	6

Period 3		
Physics	PHY433 Statistical Physics	5
Mathematics	• MAT451 Algebra and Galois Theory • MAT452 Functional analysis	5
Applied Mathematics	MAP435 optimization and control	5
Mechanics	• MEC431 Solid Mechanics • MEC433 Atmosphere and ocean dynamics	5
Biology	• BIO432 Pathologies and therapeutic strategies • BIO431 Ecology and Biodiversity	5
Chemistry	CHI451 Chemistry of materials	5
Computer Science	INF431 Algorithms for data analysis in C++	5
Economy	ECO434 International economics	5 5
MODAL	Choice of MODAL (for example PHY472A Plasma physics and elementary particles). The MODAL can also be chosen in a non-physics subject, if the laboratory ECTS are already sufficient for the Laurea Triennale rules in Pisa.	6

1.4 Third year at X - X3 (first year of "Laurea Magistrale")

The 3rd year is divided into 3 terms following one of the X-curricula in Physics listed below. During the first two terms, the DF-UNIPI student is required to choose 3 scientific courses plus an advanced training or an equivalent "long project" to be approved by the DF-commission per term according to the scientific curriculum she/he has chosen and should complement it with a course in Humanities and Social Sciences and Management and innovation, two foreign languages and sport. In parallel to the scientific classes, the DF-UNIPI student must conduct a scientific project, equivalent to 10 ECTS. The 3rd year is completed during the 3rd 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 physics laboratory course (suggested). Anyway, the DF-UNIPI student must obtain, if needed, the lacking laboratory ECTS by following the laboratory course next year in Pisa during the last year of the Double Diplome. In order to obtain the UNIPI Master Degree, the DF-UNIPI student must submit, before the start of X3, the Study Plan via the CAPS UNIPI website https://caps.df.unipi.it/, which must be approved by the DF-Unipi Commission.

X3 - 1st & 2nd Term Early September – Mid-March	ECTS
Physics or Space Science (mandatory)	30
Scientific Project	10
Research Internship – 3rd Term – March to August	20
Foreign Language	6
Humanities & Social Science and Management of Innovation and Entrepreneurship	6
Sport	4
Total for year 3	7

Options for the curriculum in Physics at X:

- From particles to stars: Fundamental interactions and elementary constituents
- Photons and atoms: Lasers, Optics, Plasmas
- From the atom to the material: Condensed Matter, Soft Matter, Functional materials
- Quantum sciences and technologies
- Computational Physics
- Science and challenges in Space Physics

1.4. Fourth year at DF-UniPi – second year of "Laurea Magistrale" (X4)

The DF-UniPi student will complete the double diploma by coming back to Pisa after X3 and concluding her/his 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. As a general rule, the Master's thesis can be done abroad including at Ecole Polytechnique.

2. Student from X: study plan (X4)

The X-student's roadmap to obtaining the double diploma starts with the admission to the "Laurea Magistrale" at UniPi during the third year of the "Ingénieur Polytechnicien" program (X3), after having completed the first two years of the program (X1, X2) and being enrolled in one of the X-curriculum in Physics. The student from X will be admitted to the "Laurea Magistrale" by the DF-UniPi Commission based on her/his curriculum vitae. The first year of the "Laurea Magistrale" take place at X (X3). If necessary, the DF-UniPi Commission may ask to the candidate from X for a remote interview. After the successful completion of X3, the student from X will come to Pisa where she/he will follow the study plan presented and approved by the DF-UniPi Commission before arrival. The study plan must be composed, for the last year in Pisa, by a total of 15 ECTS of courses available at the "Laurea Magistrale" and by 45 ECTS Master's thesis (Master's stage). As stated for the DF-UniPi student, the DF-UniPi Commission must validate 15 ECTS during X3 as equivalent to a laboratory course in Pisa. If the 15 ECTS have not been achieved, the X-student must obtain the lasting laboratory ECTS in Pisa. As a general rule in Pisa, the study plan can be rearranged anytime but the new version must be approved the DF-UniPi Commission. There is no deadline at UNIPI for the completion of the study plan in Pisa according to what specified in the article 9 of the convention. The Master's thesis will be discussed at DF-UniPi according to the rules of DF-UniPi.