



UNIVERSITÀ DI PAVIA

Dipartimento di Fisica

ACADEMIC REGULATIONS
(Article 12 - Ministerial decree no. 270 of
22/10/2004)

MASTER'S PROGRAMME IN
PHYSICAL SCIENCES

Category LM-17

Enrolment cohort of
academic year 2024/2025

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PART ONE – GENERAL PROVISIONS

Article 1 – Programme name, category, teaching institution and duration

1. The Master's Degree Course in Physical Sciences, established by the Department of Physics of the University of Pavia, belongs to the LM-17 class of Master's Degrees in Physical Sciences and Technologies pursuant to the Ministerial Decree of 16 March 2007.
2. The Physical Sciences Master's degree course lasts two years.

Article 2 – Regulatory reference texts

1. In compliance with the freedom of teaching principle and the rights and duties of lecturers and students, the organisation of teaching and performance of educational activities planned for the Master's Degree in Physical Sciences are governed by this text, the Charter of the University of Pavia, the University's General Regulations, the University's Academic Regulations, the Regulations for part-time enrolment, the Student Career Regulations ([link](#)¹) and the Regulations of the Department of Physics ([link](#)²).
2. For all matters not expressly provided for in these Regulations, the provisions of the law in force apply.

Article 3 – Body responsible for academic and organisational coordination

1. Abiding by the powers and criteria established by the Regulations indicated above, as well as the Regulations for the composition and operation of Academic Boards, the competent body for the academic and organisational coordination of the Master's Degree in Physical Sciences is the Academic Board of Physical Sciences and Technologies, hereinafter referred to as the Academic Board, established by the Academic Senate at the proposal of the Department of Physics. The Academic Board also harmonises the Master's Degree Course in Physical Sciences with the activities of the Bachelor's Degree Course in Physics, which come under the same Board.
2. The Academic Board may appoint a course preparation committee tasked with making recommendations for drafting and modifying academic regulations, establishing or closing optional subjects of Study Courses coming under the Academic Board for Physical Sciences and Technologies.
3. The Academic Board appoints from its members a lecturer to act as coordinator for study plans, and possibly his/her deputy. The head of the Study Course is indicated by name in the SUA sheet.
4. Quality assurance activities for the Master's Degree Course in Physical Sciences are carried out by the Review Group appointed by the Department of Physics. Issues and criticalities are assessed and reported by the reference Joint Committee, appointed by the Department of Physics.

Article 4 – Administrative services

1. Administrative support is provided by the Secretariat of the Department of Physics and by the Student Affairs Service of the University of Pavia.
2. The Student Affairs Service, Enrolment and Student Information Office and Admissions Office are responsible for student career assistance (enrolment, transfers, etc.). Information available on the pages [Study at the University of Pavia](#)³ and [Educational Offer of the Scientific area](#)⁴.
3. The University Orientation Centre (Centro di Orientamento, COR) manages activities and projects to support students in the choice of university studies, the student's academic career,

¹ <https://portale.unipv.it/it/ateneo/organizzazione/statuto-e-regolamenti>

² <https://fisica.dip.unipv.it/it/dipartimento/atti-e-documenti>

³ <https://portale.unipv.it/it/didattica/corsi-di-laurea/studiare>

⁴ <https://web.unipv.it/formazione/futuri-studenti/scienze-mm-ff-nn/>

and the graduate's entry into the world of work. To this end, it organises collective and individual actions, counselling services and orientation meetings. The C.OR. site can be consulted using this [link](#)⁵.

4. The Administrative Secretariat of the Department of Physics have staff dedicated to providing information to students about the course offering and the various administrative tasks related to resolutions and CFUs awards.

PART TWO - ORGANISATION OF ACADEMIC ACTIVITIES

Article 5 – Annual Programme Plan

1. The Annual Programme Plan can be consulted at: <https://sonl.unipv.it/ava/index.php/2024SUA08408.pdf>

Article 6 - Requirements for admission

1. For admission to the Master's degree course, students must hold a bachelor's degree (which may be a bachelor's degree obtained according to the regulations in force prior to Ministerial Decree 509/99), or a three-year university diploma, or another qualification obtained abroad, recognised as suitable by the competent bodies of the University.
2. To enrol on the Master's Degree Course in Physical Sciences, the student must possess an adequate knowledge of English (level B2), certain curricular requirements and adequate personal preparation, to be verified by an ad hoc admission Panel for the aforementioned Master's Degree, appointed each year by the Academic Board, of which the coordinator for study plans is a member.
3. Curricular requirements are the class 25 degree as per the system of M.D. 509/1999, and class L-30 according to the system of M.D. 270/2004.

For degrees obtained in classes other than those indicated above, curricular requirements entail the acquisition of at least 15 CFUs in the MAT/* (MATHEMATICS) sectors and at least 60 CFUs in the FIS/* (PHYSICS) or related sectors. To be admitted, (certified) skills in Modern Physics are generally required, by way of example in the fields of quantum physics, nuclear and subnuclear physics and the structure of matter, and related theoretical, experimental and applicative aspects. For students who do not reach the minimum credits as indicated above and students who have a degree according to the law prior to Ministerial Decree 509/1999 or a three-year university degree, curricular requirements are evaluated by the Panel referred to in paragraph 2 above, which may reject the application or decide on the need for additional study (expressed in terms of credits in specific scientific disciplines) that must be obtained before assessing personal preparation as mentioned in paragraph 2, or admitting the student to a test on personal preparation for the purposes indicated in paragraph 6 below.

4. Personal preparation is assessed in an oral interview with the Panel as referred to in paragraph 2. The Panel may reject the application for enrolment or indicate any gaps, which must be remedied before the student can reappear before the Panel. It may give a favourable opinion as to the student's personal preparation for the purposes indicated in the following paragraph.
5. The testing of personal preparation is not required for students who have graduated in class 25 according to the system under M.D. 509/1999 or in class L-30 as per the system of M.D. 270/2004 with a final grade of not less than 92/110.
6. To admit graduates shown to have a sufficient personal preparation before the Panel referred to in paragraph 2, coming from pathways that do not perfectly meet requirements, the Academic Board, after hearing the recommendations of the coordinator for study plans, may decide to

⁵ <https://orienta.unipv.it/>

enrol the student in the Master's degree course upon the condition of presenting a specific individual study plan.

7. Candidates may also enrol during the academic year, as long as the timing is sufficient to permit their attendance at educational activities consistent with the general structure of the Master's Programme, and in any case within the time limits annually decided by the Academic Senate.
8. Non-EU international students must have a knowledge of Italian to at least B2 level. More information at: <https://portale.unipv.it/it/didattica/corsi-di-laurea/ammissioni/iscriversi-ad-un-corso-di-studio-con-titolo-conseguito-allestero>.

Article 7 – Academic organisation

1. CFU (University credits) is the Italian unit of measurement of the average time commitment required of the student to complete his/her studies. 1 CFU is the equivalent of 25 hours of commitment, including hours of in-person lectures, exercises, laboratory activity, internships and individual studies.
2. For in-person lectures, 1 CFU corresponds to 8 hours, for laboratories 12 hours, for exercises 20 hours, in accordance with Article 16(5) of the University's Academic Regulations.
3. The student acquires the credits related to each course subject when passing the relative exam. An annual curriculum entails the acquisition of 60 CFUs; the Master's Degree in Physical Sciences is obtained by acquiring 120 CFUs.
4. Lectures are held in two periods of about 14 weeks each, conventionally called "semesters":
1st semester: end of September – mid-January
2nd semester: beginning of March-mid-June
Exam sessions in three periods, as indicated below:
mid-January - end of February
mid-June – end of July
end of August - end of September.
5. For some course subjects, such as those pertaining to transversal skills and sustainable development goals (SDG) as defined by the UN Agenda 2030, the passing of the exam results in recognition of CFUs as well as the issue of an *open badge*, or a digital certificate attesting to the knowledge, skills and competences acquired through the learning path. The open badge is issued automatically when the exam result is recorded, and is sent to the student's university e-mail address.
6. For each course subject, the minimum number of exam sessions for each academic year is six. The minimum number of calls for each exam is two.
7. The final exam sessions for the Master's degree may not be fewer than four for each academic year.
8. For each academic year the dates for the start of lectures, exam sessions and final exams calendar are communicated on the website of the Department of Physics ([link](#))⁶. The calendar of lessons, appeals and final exams is published in accordance with the ministerial deadlines, as reported in the SUA.
9. For student-athletes practising the disciplines recognised by the Italian National Olympic Committee (CONI) or by the Italian Paralympic Committee, extraordinary exam sessions may be arranged, at the request of the interested parties, in place of those scheduled, if the latter temporally coincide with sporting commitments of at least national relevance. Commitments that clash with participation in ordinary exam sessions must be documented and sent to the Director of the Department of Physics, who will arrange an alternative exam date in concert with the relevant lecturer.
10. Lectures are given in Italian or English.

⁶ <https://scienzefisiche.cdl.unipv.it/it/informazioni-pratiche/orario-delle-lezioni>

11. Beginning with academic year 2017-2018, students may enrol in the Master's Degree Plus (Laurea Magistrale Plus, LM+) programme, in the context of a collaboration project regulated by a specific agreement with a network of partner institutions and companies. Starting in the second year, students in the LM+ programme undertake two semesters of training at affiliated organisations/companies as an integral part of their education, with the aim of acquiring specific professional skills coherent with the Master's Programme. The institutions/companies included in the network agreement and the relative education programmes will be communicated over the course of the year, and meetings will be organised for communication with the interested students. On an annual basis, the Master's Programme Academic Council will make a selection from candidates who apply for the LM+ programme. The selection will be in keeping with a number of students defined by the Academic Council and in consideration of the education opportunities offered by the organisations/companies. The selection will be based on the candidate's curricular achievements, supplemented by the results of an individual interview. For assessment purposes, the Academic Council may request a non-binding opinion from the LM+ Steering Committee, composed of representatives of the University of Pavia and the partner organisations/companies. As part of the LM+ programme, the student will be able to extend the normal duration of the course to up to 3 academic years, including 2 semesters training in the selected company (which may also include experiences abroad). To make use of this possibility, the student must opt from the second year for enrolment in part-time mode, as per the relevant University Regulations. In carrying out their activities at the host organisation/company, students will be followed by an organisation/company tutor and a university tutor, who will interact constantly in monitoring the ongoing achievement of the objectives defined in the education project. Assessments will be conducted twice during the educational path: one at mid-point and one final. The student will be reimbursed for expenses incurred during the educational period with the organisation/company. The student enrolled in LM+ mode will obtain recognition of university credits acquired during experiences at the host institution/company for thesis activity connected with the final exam (up to 42 CFUs), or as part of other activities (up to 6 CFUs), and possibly extra credits, as specified in the articles below.

Article 8 – Study plans

1. The syllabus of the Master's Degree course in Physical Sciences is indicated in Annex 1, which is published on the website of the Department of Physics and in the student's guide for the reference academic year.
2. All students are required to submit their study plan within the deadlines indicated annually by the University.
3. The study plans conforming to the templates illustrated in Annex 1 for curricula established by the academic regulations of the Master's Degree Course in Physical Sciences will be approved.
4. A student intending to follow a different study path from the one set out in these Regulations may submit an individual study plan, within the deadline established annually by the University, in compliance with the constraints set out in the Class declaration and the academic regulations of the Master's Degree Course in Physical Sciences (Academic Regulations for the year of matriculation). The study plan must be approved by the Academic Board which, after hearing the recommendations of the coordinator for study plans, will take into account the general knowledge and vocational preparation needs of the student, and be able to suggest appropriate changes in order to bring the educational path more into line with the specific objectives of the Master's Degree in Physical Sciences. Related educational activities on offer must also be in line with the educational objectives of the Course of Study, and relate mainly to technical-scientific areas in the fields of mathematics, chemistry, computer science and engineering.
5. With regard to the provisions of article 50 of the University's Academic Regulations, students may request, at the time of matriculation, part-time enrolment mode to extend the length of the

course to four years. Pursuant to article 3 of the regulations for part-time enrolment, the study plan requires the acquisition of approximately 30 CFUs per year. The student may submit a study plan conforming to the templates illustrated in Annex 1 for one of the system's curricula or alternatively submit an individual study plan as referred to in paragraph 4.

6. Students participating in the LM+ programme may opt for part-time enrolment beginning in the second year of the programme, in accordance with the relevant University regulations.
7. In addition to educational activities required to obtain the degree, extra educational activities may be added to the study plan exceeding 24 university credits, with the exception of activities in the medicine/healthcare and psychological areas subject to national programming, taking care to abide by any preparatory activities required for the course of study.

Article 9 – Joint degree programmes

1. The Master's Degree course in Physical Sciences is subject to a "double degree" agreement with the University Paris Cité (Paris, France).
2. The identification of admitted students, enrolment criteria and methods, contents of the study plan and any other aspect related to the programme are regulated by particular bilateral agreements. Further information will be available on the website of the Department of Physics.

Article 10 – Prerequisites and attendance obligations

1. Attendance of lectures is strongly recommended for the student's full acquisition of knowledge; individual lecturers will adopt all useful tools to encourage attendance. Attendance is mandatory for courses or parts of courses for which the lecturer deems it necessary in relation to exercises or laboratory activities. In such cases, the lecturer defines attendance monitoring methods.
2. There are no preparatory requirements for exams in subjects included in the study plan.

Article 11 – Student electives

1. Students enrolled in the Master's Programme are allowed to include 12 elective university credits in their study plan (so-called "Type D" educational activity, TAFD, in keeping with Article 10, paragraph 5.a of Ministerial Decree 270/2004). The study plans of students who will choose from the list of all the course subjects present in Annex 1 and not already previously chosen in the reference course type (TAF) will be considered as approved. Students may also choose between course subjects offered by the University, and the Academic Board, in agreement with the study plan coordinator, reserves the right to evaluate the appropriateness of these subjects in relation to the educational objectives of the Master's Degree Course in Physical Sciences, also taking into account the reasons given by the student.
2. EU, equivalent and non-EU students with a degree obtained abroad and who choose the curriculum taught entirely in English (Biomedical physics) will be asked to include an activity to acquire knowledge of Italian (3 CFUs). The following students are considered exempt:
 - a. those who have a high school diploma or level 1 degree in Italian in Italy;
 - b. those who have obtained an Italian school diploma abroad;
 - c. those in possession of an Italian language certification of at least level B1.
3. Free-choice activities may include course subjects from the educational offer of three-year and master's courses, with the exception of those in the medicine/healthcare and psychological areas, subject to national programming. Students will not be able to choose subjects already studied and tested during previous university studies, unless they have been expressly validated.

Article 12 – Internships and traineeships

1. Study plans do not include the possibility of curricular training placements or the possibility of internships among the student's free-choice activities.

Article 13 – Final examinations and assessments

1. The Master's Degree course entails up to 12 subject exams or appraisals, as per the reckoning criteria indicated below.
2. The final examinations or assessments taken must cover: the core educational activities, the related or supplementary activities, and the elective activities chosen by the student. Course exams related to the student's free-choice activities are considered in the reckoning as corresponding to one unit (even if they entail more than one exam). The set of educational activities referred to in art. 10(5)(c, d, e) of M.D. no. 270/2004) do not count for the number of course exams; the tests and exams in place for these activities should not in any case exceed 5 in number, including the final exam for obtaining the academic qualification.
3. Each course subject ends with the sitting of an exam, consisting of an oral test and/or a written or practical test, according to methods established by the lecturer or lecturers in the case of subjects divided into modules. Course subject exams may take into account the results of any interim or partial tests. Interim or partial tests are not mandatory, and the student can still sit a course exam in a subject without having passed such tests.
4. Students are given an exam grade expressed in thirtieths, as reported in an ad hoc exam record-book. Credits are considered acquired if the evaluation is equal to or greater than 18/30. In the event of a maximum mark of 30/30, the Examination Committee may award laude honours. No marks are awarded for failing grades. Knowledge of foreign languages at introductory and/or advanced level and/or other
5. The student may withdraw from an oral test or a written or practical test, without this giving rise to any written record. If the student fails the exam or withdraws from it, he/she may be advised to spend a suitable period of study time before re-taking the exam.
6. An exam that has already been passed may not be re-taken to improve the relative grade.
7. A Fail assessment does not usually receive a grade, and any note on the exam record-book, usable for statistical purposes, is not recorded in the student's official career records. Pursuant to the Student Career Regulations (art. 30(1)), appraisals must be recorded, even negative ones.

Article 14 –Final degree examination and award of the qualification

1. The final exam, for which 42 CFUs are assigned, is public, and consists of a discussion of the student's thesis before a panel appointed by the Department's Head. The discussion may be in Italian or in English. The thesis is personally drafted by the graduating student under the guidance of a supervisor lecturer in possession of the qualifications set out in paragraph 3. The supervisor is not a member of the exam panel, but is invited to participate as an external member only for the presentation and discussion concerning his/her candidate. The thesis must develop themes closely related to the educational objectives of the course of study within the curriculum chosen by the student. It may be an experimental or theoretical research, a review manuscript or the findings of research carried out at a public or private entity or company.
2. The panel assigns a degree grade in accordance with the criteria published in the Student's Guide related to the year of matriculation of the graduate. The student's guide can be consulted here: <https://scienze fisiche.cdl.unipv.it/it/informazioni-pratiche/guida-dello-studente>
3. If the panel deems the final test to have been passed, it assigns a degree grade, ranging from 66 to 110 out of 110. The degree grade (and honours if applicable) takes into account the student's educational path and the outcome of the final exam in accordance with the criteria set out in paragraph 2.

4. The following may act as supervisors:
 - a. Tenured lecturers and researchers of the University of Pavia;
 - b. Non-tenured lecturers teaching subjects in the course of study;
 - c. Researchers of public or private research institutions with which the University has entered into agreements pursuant to article 27 of Presidential Decree. 382/1980 teaching subjects in the course of study;

If the supervisor chosen by the student does not come from the Department of Physics, or from the Academic Board of Physical Sciences and Technologies or an affiliated research institution carrying out activities at the Department of Physics, an assistant supervisor must be appointed from one of the above-mentioned structures. The final exam panel, appointed by the Department Board, is made up of at least five members, of whom at least four tenured lecturers or researchers, in charge of teaching given by the Department of Physics. All the subjects indicated in letters a), b), c) of paragraph 4 as well as experts in the FIS/* scientific disciplines appointed by the Department of Physics may also be designated as members of the final exam panel.

5. Students enrolled in the LM+ programme may request approval for a thesis topic linked to the specific training experience carried out at the host organisation/company.
6. Students enrolled in the LM+ program may be awarded up to 42 CFUs at the time of their final examination. The Academic Council may also recognise the training activity carried out in an organisation/company as supernumerary credits. Such recognition will be calculated on the basis of hours of attendance in addition to the curricular hours, as documented by the tutors, in accordance with Article 16, paragraph 5, letter c of the University Academic Regulations.
7. The final exam may be given in English. To this end, the following conditions must be met:
 - a) the due authorisation of the Supervisor;
 - b) an "abstract" in Italian attached to the thesis, summarising the content thereof;
 - c) title written in both English and Italian.

PART THREE – PROVISIONS CONCERNING STUDENT ACADEMIC CAREERS

Article 15 – Criteria for the recognition of duly certified extra-university knowledge and skills

1. Taking into due account the need for cultural and vocational formation, the Academic Board may reward duly certified knowledge and skills with a number of credits not exceeding 12 CFUs, of which:
 - a. for professional knowledge and skills, individually certified in accordance with the relevant regulations in force, up to 12 CFUs;
 - b. for knowledge and skills acquired in post-secondary educational activities planned with the participation of a university, up to 12 CFUs.
 - c. for certification relating to the training course "Safety and health in the workplace pursuant to Legislative Decree no. 81/08", organised by the University's Environment and Security Area, 1 CFU;
 - d. for sports activities recognised by the competent authorities, up to a maximum of 12 CFUs according to the following schedule: i) sport practised at Olympic, world and European level, up to 6 CFUs; ii) sport practised at Italian level and intermediate categories up to 3 CFUs; iii) qualification in the "medal zone" at the University Championships, or the performance of competitive activities for the sections of Pavia University Sports Centre (CUS), including in the context of competitions at regional and national level, up to 6 CFUs.
2. The educational credits referred to in paragraph 1 are recognised if in keeping with the training objectives of the Master's degree course. The Academic Board shall decide on this after hearing the recommendations of the person in charge of curricula. For the recognition of credits referred

to in paragraph 1 above, the Academic Board may approve the student's enrolment on the second year of the course.

Article 16 – Criteria for recognition of previous credits

1. After hearing the recommendations of the curriculum coordinator, the Academic Board shall decide on the recognition of educational credits in cases of transfers from another course of study of this or another university, or performance of educational activities at another Italian or foreign university. Credits are recognised when they are in keeping with the educational objectives of the Master's Degree in Physical Sciences, providing they have not been used to obtain the qualification required for admission to a Master's Degree course, and are compatible with course subjects currently offered by the University of Pavia. These credits will be included in the student's career record, with the code and nomenclature of a corresponding subject of the University of Pavia.
2. For the recognition of credits referred to in the paragraph above, the Academic Board may approve enrolment on the second year of the course.
3. Those who no longer have student status (art. 30 of the Student careers regulations) or have ceased their studies (art. 29 of the Student career regulations) may, after enrolling anew, obtain recognition of credits acquired after the Academic Board has checked their continuing validity. Recognition may be total or partial; in the latter case, the Academic Board will order supplementary tests to bridge any educational gaps.

Article 17 – Criteria for recognition of educational activities during study at foreign universities

1. According to the provisions of articles 47 and 48 of the University's academic Regulations, students may carry out training and study periods at foreign universities in order to enhance their knowledge base.
2. The plan of activities to be carried out at the foreign university is agreed upon by the student with the Delegate for international mobility, appointed by the Board of the Department of Physics, and is approved by the Academic Board based on the educational objectives of the Master's degree course.
3. The study periods carried out by students of the Master's Degree in Physical Sciences at foreign universities within the framework of bilateral agreements (such as the European Erasmus Programme or other agreements to which the University adheres) are recognised as an educational instrument similar to that offered by the University, requiring the same student commitment and contents in line with the student's educational path. They are also encouraged as a means of cultural exchange and an addition to one's personal and vocational formation for the purpose of obtaining the academic qualification.
4. The Learning Agreement is the document that defines the educational project referred to in paragraph 1, which will be followed abroad and replace some of the activities of the Physical Sciences Master's degree course. The student must draft the Learning Agreement without an over-emphasis on pursuit of the same content as the Degree Programme, but rather aim to be fully consistent with its educational objectives.
5. The possibility of recognising credits acquired abroad is established in advance through the Learning Agreement that is signed, by way of approval, by the Delegate for international mobility and the student for educational and internship activities carried out abroad. The Delegate is responsible for ensuring the consistency of the Learning Agreement with the educational objectives of the Master's Degree Course in Physical Sciences.
6. At the end of the study period, the Academic Board, at the request of the student and based on the results obtained and suitably documented by the foreign University (in the case of the Erasmus Programme, through the Transcript of Records), recognises the educational activity

carried out abroad and assigns a possible grade. If there are different criteria for assigning a grade, the reference system is the ECTS (European Credit Transfer System).

Article 18 – Admission to subsequent years

1. There are no second-year enrolment restrictions for a student already enrolled in the first year.

Article 19 - Certifications

- 1 The Physical Sciences Master's degree does not recognise international linguistic or IT certification.

Annex 1

Official study plans of the Master's Degree in Physical Sciences-LM-17 (for A.Y. 2024-2025)

The curricula planned the Master's Degree in Physical Sciences are as follows:

- 1) **Physics of matter;**
- 2) **Nuclear and subnuclear physics;**
- 3) **Theoretical physics;**
- 4) **Biomedical physics;**
- 5) **Teaching and history of physics, scientific communication**
- 6) **Physics of quantum technologies**

The study plans of the curricula presented below are not organised by course year. The student is free to choose the year in which to include the subjects.

The choices made by the student for the bachelor's degree course in Physics cannot be repeated in the Master's degree course in Physical Sciences. These choices may however be made to meet some constraints inherent in the study plans of the various curricula of the master's degree.

Of the 120 credits needed to achieve the Master's Degree:

- 72 CFUs are to be acquired with the subjects specified for the various curricula according to the following TAF breakdown: 48 CFUs from main TAF, 12 CFUs from related TAF and 12 CFUs free choice;
- 42 CFUs are to be acquired through the preparation of the thesis and the final exam;
- 6 CFUs related to other activities (TAF other) (CFUs certified by the thesis supervisor and recorded by the chair of the Academic Board, including the acquisition of IT skills and relational skills, or activities to facilitate vocational choices).

The 42 CFUs set aside for the final exam are made up of 36 CFUs for thesis preparation work and 6 CFUs for the actual final exam.

Thesis preparation work can be divided, at the student's choice, between the two years of the course, the only constraint being that the work performed in the first year does not exceed that of the second.

The following choices are possible for thesis preparation work in terms of CFUs:

0 (1st year) and 36 (2nd year);

6 (1st year) and 30 (2nd year);

12 (1st year) and 24 (2nd year);

18 (1st year) and 18 (2nd year);

CFUs relating to individual subjects to be included in the plan will be:

60 (1st year) and 12 (2nd year);

54 (1st year) and 18 (2nd year);

48 (1st year) and 24 (2nd year);

42 (1st year) and 30 (2nd year);

Detailed information on individual course subjects can be found on the website:

<https://scienzefisiche.cdl.unipv.it/it/informazioni-pratiche/piano-degli-studi>

PHYSICS OF MATTER CURRICULUM

6 possible CFUs with 1 subject chosen from the following list (main TAF - “experimental applicative”)

Subject name	Sector	CFUs	Semester	University Degree
Laboratorio di Fisica Quantistica	FIS/01	6	I	M
Laboratorio di Strumentazioni Fisiche	FIS/01	6	II	M

6 possible CFUs with 1 subject chosen from the following list (main TAF - “theory and foundations of physics”)

Subject name	Sector	CFUs	Semester	University Degree
Meccanica Statistica	FIS/02	6	II	T
Problem solving in fisica	FIS/02	6	II	T
Termodinamica Quantistica	FIS/02	6	I	M
Complementi di fisica teorica	FIS/02	6	I	M
Computational methods in Physics	FIS/02	6	II	M
Quantum electrodynamics	FIS/02	6	I	M

36 possible CFUs with 6 subjects chosen from the following list (main TAF - “microphysics and the structure of matter”)

Subject name	Sector	CFUs	Semester	University Degree
Magnetismo e superconduttività	FIS/03	6	I	M
Fisica dei Dispositivi Elettronici a Stato Solido	FIS/03	6	I	M
Fisica dello Stato Solido I	FIS/03	6	I	M
Fisica dello Stato Solido II	FIS/03	6	II	M
Fisica e tecniche ultraveloci per lo stato solido	FIS/03	6	I	M
Fisica Quantistica della Computazione	FIS/03	6	II	M
Fotonica	FIS/03	6	I	M
Nanostrutture Quantistiche	FIS/03	6	II	M
Ottica Quantistica	FIS/03	6	I	M
Spettroscopia dei materiali	FIS/03	6	I	M

12 possible CFUs with 2 subjects chosen from the following list (related TAF)

Subject name	Sector	CFUs	Semester	University Degree
Nanochimica e nanomateriali	CHIM/02	6	I	M
General biology, anatomy and human physiology	BIO/06	6	I	M
Introduzione alla scienza dei materiali con laboratorio	CHIM/02	6	I	M
Nuovi materiali e processi per il fotovoltaico matematica	CHIM/02	6	II	M
Tecniche di caratterizzazione dei materiali	CHIM/02	6	II	M
Chimica dei beni culturali	CHIM/12	6	I	M
Machine learning	ING-INF/05	6	II	M
Artificial intelligence	ING-INF/05	6	I	M
Industrial laser design	ING-INF/01	6	I	M
Optoelectronic devices	ING-INF/01	9	I	M
Optical communication	ING-	9	I	M

	INF/01			
Programmazione 1	INF/01	6	I	M
Teoria dei sistemi dinamici	MAT/07	6	II	M

12 possible CFUs with 2 free-choice subjects (TAF D).

42 CFUs for Final Exam (TAF E) - for breakdown of this AF see the introductory page

6 CFUs Other activities (TAF F)

NUCLEAR AND SUBNUCLEAR PHYSICS CURRICULUM

48 possible CFUs with 8 subjects from the following list, of which:

12 CFUs in FIS/01 or FIS/07 (main TAF - “experimental applicative”);

12 CFUs in FIS/02 (main TAF - “theory and foundations of physics”);

24 CFUs in FIS/04 (main TAF - “microphysics and structure of matter”)

Subject name	Sector	CFUs	Semester	University Degree
Laboratory of nuclear and subnuclear physics I	FIS/04	6	II	M
Particle detectors	FIS/01	6	II	M
Elettrodinamica e relatività	FIS/02	6	I	T
Complementi di fisica teorica	FIS/02	6	I	M
Quantum Electrodynamics	FIS/02	6	I	M
Computational methods in physics	FIS/02	6	II	M
Teoria delle interazioni fondamentali	FIS/02	6	I	M
Teoria quantistica dei campi	FIS/02	6	II	M
Gruppi e simmetrie fisiche	FIS/02	6	II	M
Particle physics	FIS/04	6	I	M
Fisica nucleare	FIS/04	6	II	M
Laboratory of nuclear and subnuclear physics II	FIS/04	6	I	M
Radioattività	FIS/04	6	I	M
Acceleratori e reattori nucleari	FIS/04	6	I	M
Neutrino Physics	FIS/04	6	I	M
Laboratory of ionizing radiations	FIS/04	6	II	M
Tecnologie fisiche e beni culturali	FIS/07	6	II	T
Artificial Intelligence for Experimental and Applied Physics	FIS/01	6	II	M
Statistical methods in physics	FIS/01	6	I	M
Tecniche digitali di acquisizione dei dati	FIS/01	6	I	T
Relatività generale	FIS/02	6	II	M
Simulations in experimental and applied physics	FIS/07	6	I	M

12 possible CFUs with 2 subjects chosen from the following list (related TAF)

Subject name	Sector	CFUs	Semester	University Degree
Artificial Intelligence	ING-INF/05	6	I	M
Algorithms and systems for robotics	ING-INF/05	6	I	M
Information security	ING-INF/05	6	I	M
Machine learning	ING-INF/05	6	II	M
Deep learning	ING-INF/05	6	II	M
Astrofisica	FIS/05	6	II	M
Astronomia	FIS/05	6	I	M
Introduzione all'astronomia	FIS/05	6	I	T
Astroparticles	FIS/05	6	II	M

12 possible CFUs with 2 free-choice subjects (TAF D).

42 CFUs for Final Exam (TAF E) - for breakdown of this AF see the introductory page

6 CFUs Other activities (TAF F)

THEORETICAL PHYSICS CURRICULUM

36 possible CFUs with 6 subjects chosen from the following list (main TAF - “theory and fundamentals of physics”)

Subject name	Sector	CFUs	Semester	University Degree
Elettrodinamica e relatività	FIS/02	6	I	T
Meccanica statistica	FIS/02	6	II	T
Problem solving in fisica	FIS/02	6	II	T
Complementi di fisica teorica	FIS/02	6	I	M
Quantum electrodynamics	FIS/02	6	I	M
Termodinamica Quantistica	FIS/02	6	I	M
Teoria delle interazioni fondamentali	FIS/02	6	I	M
Econofisica	FIS/02	6	I	M
Fondamenti della meccanica quantistica	FIS/02	6	II	M
Gruppi e simmetrie fisiche	FIS/02	6	II	M
Metodi matematici della fisica teorica	FIS/02	6	II	M
Computational methods in Physics	FIS/02	6	II	M
Relatività generale	FIS/02	6	II	M
Teoria quantistica dei campi	FIS/02	6	II	M
Teoria fisica dell'informazione	FIS/02	6	I	M

Students who have taken the exams Electrodynamics and Relativity and/or Statistical Mechanics and/or Problem solving in physics in the Physics degree must choose other subjects on the list.

6 possible CFUs with 1 subject chosen from the following list (main TAF - “experimental applicative”)

Subject name	Sector	CFUs	Semester	University Degree
Laboratorio di fisica quantistica	FIS/01	6	I	M
Statistical methods in physics	FIS/01	6	I	M
Artificial Intelligence for Experimental and Applied Physics	FIS/01	6	I	M
Particle detectors	FIS/01	6	II	M

6 possible CFUs with 1 subject chosen from the following list (main TAF - “microphysics and the structure of matter”)

Subject name	Sector	CFUs	Semester	University Degree
Magnetismo e Superconduttività	FIS/03	6	I	M
Particle physics	FIS/04	6	I	M
Fisica dello stato solido I	FIS/03	6	I	M
Fisica nucleare	FIS/04	6	II	M
Fotonica	FIS/03	6	I	M
Ottica quantistica	FIS/03	6	I	M
Fisica dello stato solido II	FIS/03	6	II	M
Fisica quantistica della computazione	FIS/03	6	II	M
Nanostrutture Quantistiche	FIS/03	6	II	M

12 possible CFUs with 2 subjects chosen from the following list (related TAF)

Subject name	Sector	CFUs	Semester	University Degree
Equazioni differenziali e sistemi dinamici	MAT/05	6	I	T
Introduzione all'astronomia	FIS/05	6	I	T
Analisi funzionale	MAT/05	9	I	M
Equazioni della fisica matematica	MAT/07	6	II	M
Astrofisica	FIS/05	6	II	M
Astronomia	FIS/05	6	I	M
Fenomeni di diffusione e trasporto	MAT/07	9	II	M
Astroparticles	FIS/05	6	II	M
Algebra superiore (solo II anno)	MAT/02	6	I	M
Complementi di algebra (solo I anno)	MAT/02	6	I	M
Teoria dei sistemi dinamici	MAT/07	6	II	M
Modelli cinetici e applicazioni	MAT/07	6	II	M
Machine learning	ING- INF/05	6	II	M

12 possible CFUs with 2 free-choice subjects (TAF D).

42 CFUs for Final Exam (TAF E) - for breakdown of this AF see the introductory page

6 CFUs Other activities (TAF F)

BIOMEDICAL PHYSICS CURRICULUM

48 possible CFUs with 8 subjects from the following list, of which:

6 CFUs in FIS/02 (main TAF -“theory and foundations of physics”);

12 CFUs (2 subjects) in FIS/04 (main TAF - “microphysics and structure of matter”)

30 CFUs (5 subjects) in FIS/01 and FIS/07 (main TAF -experimental and applicative);

Subject name	Sector	CFUs	Semester	University Degree
Quantum electrodynamics	FIS/02	6	I	M
Computational methods in Physics	FIS/02	6	II	M
Particle physics	FIS/04	6	I	M
Physics of ionizing radiations	FIS/04	6	I	M
Laboratory of ionizing radiations	FIS/04	6	II	M
Statistical methods in physics	FIS/01	6	I	M
Artificial Intelligence for Experimental and Applied Physics	FIS/01	6	II	M
Particle detectors	FIS/01	6	II	M
Rheology and Diagnostic Techniques: Theory and Practice	FIS/07	6	I	M
Physics of innovative oncological therapy techniques	FIS/07	6	I	M
Simulations in experimental and applied physics	FIS/07	6	I	M
Physics of medical imaging	FIS/07	6	I	M
Medical diagnostic techniques with ionizing radiations	FIS/07	6	II	M
Introduction to ionizing radiation protection	FIS/07	6	II	M

Related TAF - 12 CFUs - 2 subjects

Subject name	Sector	CFUs	Semester	University Degree
General biology, anatomy and human physiology	BIO/06	6	I	M
Radiation biophysics and radiobiology	MED/36	6	II	M
Machine learning	ING-INF/05	6	II	M
MRI Physics for Neuroscience	M-PSI/02	6	II	M
Bioinformatics	ING-INF/06	6	II	M

12 possible CFUs with 2 free-choice subjects (TAF D).

42 CFUs for Final Exam (TAF E) - for breakdown of this AF see the introductory page

6 CFUs Other activities (TAF F)

TEACHING AND HISTORY OF PHYSICS, SCIENTIFIC COMMUNICATION CURRICULUM

36 possible CFUs with 6 subjects chosen from the following list, including one belonging to the FIS/02 sector – main TAF - “theoretical and foundations of physics”)

Subject name	Sector	CFUs	Semester	University Degree
Elettrodinamica e relatività	FIS/02	6	I	T
Storia della fisica	FIS/08	6	I	T
Problem solving in fisica	FIS/02	6	II	T
Preparazione di esperienze didattiche	FIS/08	6	I	T
Meccanica statistica	FIS/02	6	II	T
Complementi di fisica teorica	FIS/02	6	I	M
Didattica della fisica	FIS/08	6	II	M
Fondamenti della fisica	FIS/08	6	I	M
Relatività generale	FIS/02	6	II	M
Teoria fisica dell'informazione	FIS/02	6	I	M
Comunicazione della scienza	FIS/08	6	II	M

6 possible CFUs with 1 subject chosen from the following list (main TAF - “experimental applicative”)

Subject name	Sector	CFUs	Semester	University Degree
Laboratorio di fisica quantistica	FIS/01	6	I	M
Laboratorio di strumentazioni fisiche	FIS/01	6	II	M

6 possible CFUs with 1 subject chosen from the following list (main TAF - “microphysics and the structure of matter”)

Subject name	Sector	CFUs	Semester	University Degree
Introduzione alla fisica dei solidi	FIS/03	6	II	T
Magnetismo e Superconduttività	FIS/03	6	I	M
Fisica dello stato solido I	FIS/03	6	I	M
Fisica nucleare	FIS/04	6	II	M
Radioattività	FIS/04	6	I	M

12 possible CFUs with subjects chosen from the following list (related TAF)

Subject name	Sector	CFUs	Semester	University Degree
Equazioni differenziali e sistemi dinamici	MAT/05	6	I	T
Introduzione all'astronomia	FIS/05	6	I	T
Matematiche complementari (solo I anno)	MAT/04	6	I	M
Matematiche elementari da un punto di vista superiore (solo II anno)	MAT/04	6	I	M
Storia della matematica	MAT/04	6	II	M
Storia delle scienze	M-STO/05	6	I	M
Astrofisica	FIS/05	6	II	M
Astronomia	FIS/05	6	I	M
Astroparticles	FIS/05	6	II	M
Didattiche specifiche della matematica	MAT/04	9	II	M
Didattica della matematica	MAT/04	9	I	M

12 possible CFUs with 2 free-choice subjects (TAF D)

42 CFUs for Final Exam (TAF E) - for the breakdown of this AF see the introductory page

6 CFUs Other activities (TAF F)

PHYSICS OF QUANTUM TECHNOLOGIES CURRICULUM

48 possible CFUs with 8 subjects from the following list, of which 6 CFUs in FIS/01, 18 CFUs in FIS/02 and 24 CFUs in FIS/03 (main TAF)

Subject name	Sector	CFUs	Semester	University Degree
Laboratorio di Fisica Quantistica	FIS/01	6	I	M
Fondamenti della Meccanica Quantistica	FIS/02	6	II	M
Fisica Quantistica della Computazione	FIS/03	6	II	M
Fotonica	FIS/03	6	I	M
Teoria Fisica dell'Informazione	FIS/02	6	I	M
Nanostrutture Quantistiche	FIS/03	6	II	M
Ottica Quantistica	FIS/03	6	I	M
Termodinamica Quantistica	FIS/02	6	I	M
Meccanica Statistica	FIS/02	6	II	T
Gruppi e Simmetrie Fisiche	FIS/02	6	II	M
Magnetismo e Superconduttività	FIS/03	6	I	M
Fisica dello Stato Solido I	FIS/03	6	I	M

12 possible CFUs with 1 subject chosen from the following list (related TAF)

Subject name	Sector	CFUs	Semester	University Degree
Artificial Intelligence	ING-INF/05	6	I	M
Machine Learning	ING-INF/05	6	II	M
Processi Stocastici	MAT/06	6	II	M
Teoria dei Sistemi Dinamici	MAT/07	6	II	M
Elementi di Statistica Matematica	MAT/06	6	I	M
Algorithms and systems for robotics	ING-INF/05	6	I	M
Digital communications	ING-INF/03	6	II	M
Information security	ING-INF/05	6	I	M
Bioinformatica	ING-INF/06	6	I	M
Deep learning	ING-INF/05	6	II	M

12 possible CFUs with 2 free-choice subjects (TAF D)

42 CFUs for Final Exam (TAF E) - for the breakdown of this AF see the introductory page

6 CFUs Other activities (TAF F)

Free-choice subjects

The following course subjects established by the Department of Physics can be chosen for free-choice subjects:

Subject name	Sector	CFUs	Semester	University Degree
Tecniche di presentazione	FIS/08	3	II	M
Agile project management	SECS-P/08	3	II	M
Entrepreneurship	SECS-P/08	3	I	M
Quantum Mechanics: Facts, puzzles, progress, and possibilities. An introduction for physicists and non-physicists	FIS-02	3	II	M
Sciences, diplomacy, and policymaking for a sustainable future	FIS-08	3	II	M

Study activity carried out within the Department of Physics is supplemented by courses held at historical Pavia colleges, which can be included in study plans as free-choice subjects.