UNIVERSITA' DEGLI STUDI DI MILANO
PROGRAMME DESCRIPTION - ACADEMIC YEAR 2024/25
BACHELOR
Physics (Classe L-30)
Enrolled from 2012/2013 Academic Year

HEADING

Degree classification - Denomination and code:	L-30 Physics
Degree title:	Dottore
Length of course:	3 years
Total number of credits required to complete programme:	180
Years of course currently available:	1st , 2nd , 3rd
Access procedures:	Open, subject to completion of self-assessment test prior to enrolment
Course code:	F63

PERSONS/ROLES

Head of Study Programme

Prof.ssa Alessandra Guglielmetti

Tutors - Faculty

Tutor per l'orientamento (Academic guidance tutor)
F. Camera, S. Cialdi, G. Colò, S. D'Auria, L. Gariboldi, A. Guglielmetti, G. Lodato, N. Manini, L.G. Molinari, S. Olivares, M. Paris, P. Piseri, M. Sorbi, D. Tamascelli, A. Vicini

Tutor per i piani di studio (Study plan tutor)
A. Guglielmetti

Tutor per la mobilità internazionale e l'Erasmus (Erasmus and International mobility)
N. Piovella

Tutor per stage e tirocini (Internship tutor)
N. Piovella, A. Guglielmetti

Tutor per laboratori e altre attività (Laboratory Classes)
R. Vecchi

Tutors - Students

ANDOLFATO BIANCA
NSELMI GIOVANNIMARIA
ASINARI LUCA
CHEMOLI DARIO
CHIAPPERINO FRANCESCO
CHINI GIOVANNI
CRIPPA FRANCESCO
DANELLI MARIA
DE NARDI GIACOMO
FARINELLI FRANCESCO
GIUNTA CHIARA
PELLEGRINI GIOVANNI

Degree Course website

https://fisica.cdl.unimi.it/it

Dissertation and Final Exam

L. Bonizzoni (Presidente), C. Benedetti, F. Camera, S. Carrazza, V. Liberali, D. Maino

Laboratory Security

M. Potenza

Library

Via Celoria 18 - 20133 Milano http://www.sba.unimi.it/Biblioteche/bicf/13453.html

Matriculation

https://www.unimi.it/it/node/183

Outreach

https://unimibox.unimi.it/index.php/s/d3z27gH8KLosixk

PLS Program Chair

M. Giliberti

Program Transfer

G. Maero, C. Barbieri, M. Genoni, S. Riboldi Email: commissione.ammissione@fisica.unimi.it

Schedule of Classes

S. Bottoni, M. Gherardi

Scientific English

A. Guglielmetti, A. Stabile

Specific Learning Disabilities

L. Carminati

Student Registrar

Phone 0250325032 https://www.unimi.it/it/studiare/servizi-gli-studenti/segreterie-informastudenti

Study Program Office

Via Celoria, 16 - 20133 Milano Phone 02.503.17401 https://informastudenti.unimi.it/saw/ess?AUTH=SAML

TOLC test coordinator

L. Gariboldi

CHARACTERISTICS OF DEGREE PROGRAMME

General and specific learning objectives

The Bachelor's Degree program in Physics aims to enable the student to continue with higher studies or to start a professional activity. The program gives students the methodological, experimental, theoretical, mathematical basis on which Physics is based. Knowledge will be acquired of classical, relativistic and quantum Physics, as focused on phenomenological and theoretical aspects as well as on their mathematical formalization.

Expected learning outcomes

Based on the Dublin descriptors, graduates of the Bachelor's degree programme in Physics will develop the following competencies:

A) KNOWLEDGE AND UNDERSTANDING
Bachelor's graduates in Physics will gain:
- Knowledge and understanding of the scientific method;
- Knowledge and understanding of classical physics: mechanics, thermodynamics, electromagnetism, optics and wave propagation, fluid dynamics, analytical mechanics;
- Knowledge and understanding of modern physics: quantum mechanics, quantum theory of matter, nuclear and subnuclear physics, restricted relativity;
- Knowledge and understanding of chemistry (with regard to the basics);
- An understanding of the cross-disciplinary aspects of studying physical phenomena and the ability to frame problems in a wide-ranging historical and scientific context;
- Mathematical knowledge: mathematical analysis, linear algebra and geometry, complex analysis, elements of functional analysis;
- Computer science knowledge: procedural programming and object-oriented programming, solving problems using numerical methods, computer networks;
- Basic knowledge of electronics and electronic instruments: analogue electronics, elements of digital electronics, use of tools and simple systems for data acquisition;
- Intermediate knowledge in a specific branch of physics, such as: astrophysics; environmental physics; medical physics; statistical physics; Earth physics; general relativity.

B) APPLYING KNOWLEDGE AND UNDERSTANDING
Bachelor's graduates in Physics will be able to:
- Use the scientific method to study physical phenomena and analyse experimental data;
- Design and/or develop simple mathematical models of reality;
- Carry out simple laboratory measurements using modern tools and process data using statistical methods and computing platforms;
- Use physical signal sensors and/or detectors as well as measurement tools, including computer controlled tools;
- Use the specific instruments of one of the following fields:
astrophysics, nuclear physics, physics of matter, electronics, optics, laser, environmental physics;
- Work in team: this ability will be acquired during the experimental teaching laboratories and the computational physics laboratory, and/or in research groups, also outside of the University, while working on the final paper.

C) MAKING JUDGEMENTS
Bachelor's graduates in Physics will be able to:
- Assess and interpret experimental data collected in the laboratory;
- Assess the implications of experimental data collected in the laboratory or made available by research agencies in critical applications (e.g. biomedical imaging, dosimetry, avionics, automotive sector);
- Reflect on the social and ethical responsibilities related to the application of knowledge;
- Autonomously assess the various aspects of teaching;
- Assess themselves in a scientific context and/or with a view to their entry into the job market.

D) COMMUNICATION SKILLS
Bachelor's graduates in Physics will be able to:
- Communicate effectively both orally and in writing, with appropriate language and scientific rigour, adjusting the level of details and the communication focus accordingly
- Describe experimental and theoretical results using modern presentation techniques, including multimedia technologies;
- Properly communicate in English (B1 level);
- Have a good grasp of the English language, particularly with regard to the scientific vocabulary and the technical terms of physics.

E) LEARNING SKILLS
Bachelor's graduates in Physics will be able to:
- Effectively use textbooks and scientific publications written in English;
- Carry out bibliographic searches;
- Consult databases and electronic journals;
- Consult textbooks and specialised journals in a particular field of physical research.

Professional profile and employment opportunities
Professional Profile and Career Opportunities

The course prepares students for the profession of physics and nuclear technician.

Graduates typically continue their education in higher studies, but they can also pursue careers in industries and public and private institutions, working in facilities such as:

Research centers and laboratories
Hospitals and healthcare facilities that utilize techniques for diagnostics, therapy, and radiation protection
Astronomical observatories
Museums and other centers dedicated to scientific outreach
Banks and insurance companies
Facilities dedicated to the development of mathematical and statistical models of phenomena
Facilities dedicated to the use and development of complex systems and instruments or data acquisition and processing
Institutions involved in the restoration of artistic assets and the preservation of environmental goods
Power plants (including nuclear power plants)
International centers for nuclear energy control and the prohibition of nuclear weapons
The functions that graduates will perform in the work environment include, for example:

Analysis and scientific understanding of measurable phenomena of interest
Design and development of simple prototypes
Efficient utilization of measurement instruments and their development
Conducting measurements of natural phenomena (e.g., radioactivity, electromagnetic fields, etc.)
Data analysis, including statistical analysis ("data scientist")
Development of mathematical and statistical models in a wide range of contexts (mechanics, finance, medicine, etc.)
Control of industrial processes and quality assurance

Dissemination and promotion of scientific culture
Technical and scientific training of personnel and/or external users
Designing innovative educational proposals
Preparation of scientific reports (reports, books, essays, etc.)

Initial knowledge required

Admission requirements
Qualifications and knowledge required for admission
Applicants to the Bachelor's degree programme in Physics must hold an upper secondary-school diploma or an equivalent qualification obtained abroad.
Admission to the programme is open, subject to a mandatory, non-selective assessment test before enrolment. The test is aimed at ascertaining the candidate's educational background, in terms of knowledge and understanding of the basic scientific disciplines, especially mathematics and elementary logic. The test syllabus is available at:
https://www.cisiaonline.it/en/area-tematica-tolc-scienze/struttura-della-prova-e-syllabus/

Admission assessment
Candidates are usually assessed through the TOLC CISIA Online Test, to be taken at the University of Milan or any other universities belonging to the Consortium of Inter-University Integrated Access Systems (CISIA). Students have to register for the TOLC test on the CISIA website (www.cisiaonline.it).

Admission of transfer or graduate students
Transfer students from a degree programme of the University of Milan, or another university, and graduate students will be waived from the test requirement only if they are admitted to years subsequent to the first.
For further details, please see the call for applications

The TOLC tests providing access to the degree programme in Physics are TOLC-S and TOLC-I.
Students will be able to enrol only after taking one of these tests, WHATEVER THE RESULT:
- TOLC-S, divided into 4 sections: Basic mathematics (20 questions - 50 minutes), Logic and problems (10 questions - 20 minutes), Reading comprehension (10 questions - 20 minutes), Basic science (chemistry, physics and geology - 10 questions - 20 minutes)
- TOLC-I, divided into 4 sections: Mathematics (20 questions - 50 minutes), Logic (10 questions - 20 minutes), Sciences (10 questions - 20 minutes), Verbal comprehension (10 questions - 20 minutes).
Each question has 5 answer options, of which only one is correct.
Score: +1 for a correct answer, -0.25 for a wrong answer, 0 for not given answers.

Each TOLC test includes an additional English section, consisting of 30 questions to be answered in 15 minutes. This section does not replace the for-credit English proficiency assessment required by the degree programme, but serves as a self-assessment tool for the student.

Other equivalent tests may be accepted on a case-by-case basis, with the prior approval of the Academic Board.

Additional learning requirements (OFA) and remedial activities
First-year students who have not achieved at least 10 points in the Mathematics module will have to fulfil additional learning requirements (OFA) for this subject within the first year of the programme.
Remedial activities and tests: students with additional learning requirements will have to carry out remedial activities in the period October-December, and then pass a test to prove they have filled their gaps. Otherwise, they will not be allowed to take any second-year exams before passing the Mechanics exam (https://fisica.cdl.unimi.it/it/studiare/le-matricole).

Test topics, registration procedures, dates, deadlines and other information are specified in the call for applications: https://fisica.cdl.unimi.it/it/iscriversi

Compulsory attendance

Attendance is compulsory and will be monitored in each class for laboratory courses

Degree programme final exams

To obtain their degree, the student must have earned 180 credits, possibly also before the end of the three-year period.
The paper consists of an individual work carried out by the student under the guidance of a supervisor.
It is also possible to work on the final paper in external public or private entities, under the guidance of both an external and an internal supervisor.

Before starting thesis work, the student is required to submit an application (with a tentative thesis title) to the Degree Board for approval. The board will grant any applications that are consistent with the study programme, and assign each student their supervisor(s) and co-supervisor(s).
Following a resolution of the Academic Board, students enrolled in the second year in 2021/2022 or in subsequent years are required to pass the electromagnetism exam before they are assigned a thesis.

The official thesis assignment is a MANDATORY step to be taken before starting thesis work. Thesis supervisors and co-supervisors thereby take responsibility for and are required to check all formal aspects, including for insurance purposes. The thesis application must be submitted online at https://registrazione.fisica.unimi.it/richiesta-tesi/login

To be admitted to the final exam, the student must have earned 172 CFU. Moreover, there must be consistency between academic records and the last approved study plan.
Thesis defense marks the completion of the study programme, and the graduate can enter the world of work or enrol on a Master's degree programme

Notes

For-credit assessment B1
In order to obtain their degree, students must be proficient in English at a B1 level under the Common European Framework of Reference for Languages (CEFR). This proficiency level may be certified as follows:
- By submitting a language certificate attesting B1 or higher level in English and issued no more than three years before the date of submission. You will find the list of language certificates recognized by the University at: https://www.unimi.it/en/node/39322). The certificate must be uploaded during the enrolment procedure, or subsequently to the portal http://studente.unimi.it/uploadCertificazioniLingue;
- By taking a placement test offered by the University Language Centre (SLAM) between October and December of the first year. Students who fail the test will be required to take a SLAM course.
The placement test is mandatory for all those who do not hold a valid certificate attesting to B1 or higher level.
Those who have not taken the placement test by the end of December or fail the end-of-course exam six times must obtain the necessary certification privately before graduating.

As a further requirement for graduation, the student's proficiency in scientific English language (English Language 2) will be assessed in one of the following ways:
1. the delivery of a written Laboratory Report in English
2. carrying out and passing one of the curricular examinations in English
3. attending a course delivered in the English language
4. training activities related to the final thesis executed in the English Language

EXPERIENCE OF STUDY ABROAD AS PART OF THE TRAINING PROGRAM

Experience of study abroad as part of the training programme

The University of Milan supports international mobility by providing its students with the opportunity to spend study and internship periods abroad. It is a unique chance to enrich your educational path in a new exciting environment.
The agreements entered into by the University with over 300 universities from the 27 EU member countries under the European Erasmus+ programme allow regularly enrolled students to carry out part of their studies at one of the partner universities or to undertake internships at companies, training and research centres and other organizations.
Similar international mobility opportunities are provided outside Europe, through agreements with a number of prestigious institutions.

Study and internships abroad

The thesis work may be occasionally carried out in prestigious research centers like CERN or GSI, or important Universities worldwide, in the frame of international collaborations and research programs.

How to participate in Erasmus mobility programs

How to participate in Erasmus+ mobility programmes

The students of the University of Milan can participate in mobility programmes, through a public selection procedure.
Ad hoc commissions will evaluate:
• Academic career
• the candidate's proposed study programme abroad
• his/her foreign language proficiency
• the reasons behind his/her application
Call for applications and informative meetings
The public selection for Erasmus+ mobility for study generally begins around February each year with the publication of a call for applications specifying destinations and requirements. Regarding the Erasmus+ Mobility for Traineeship, the University of Milan usually publishes two calls a year enabling students to choose a destination defined by an inter-institutional agreement or to find a traineeship position on their own.
The University organizes informative meetings to illustrate mobility opportunities and rules for participation.
Erasmus+ scholarship
The European Union grants the winners of the Erasmus+ programme selection a scholarship to contribute to their mobility costs, which may be supplemented by the University funding for disadvantaged students.
Language courses
Students who pass the selections for mobility programmes can benefit from intensive foreign language courses offered each

year by the University Language Centre (SLAM).
https://www.unimi.it/en/node/8/
Learn more at https://www.unimi.it/en/node/274/
For assistance, please contact:
International Mobility Office
Via Santa Sofia 9 (second floor)
Tel. 02 503 13501-12589-13495-13502
Contacts: InformaStudenti; mobility.out@unimi.it
Student Desk booking through InformaStudenti

1st COURSE YEAR Core/compulsory courses/activities common

Learning activity	Ects	Sector
COMPUTER SCIENCE	6	INF/01
English assessment B1 (2 ECTS)	2	ND
GEOMETRY 1	7	MAT/03
MATHEMATICAL ANALYSIS 1	8	MAT/05
MATHEMATICAL ANALYSIS 2	8	MAT/05
MECHANICS	8	FIS/01
PHYSICS LABORATORY WITH INTRODUCTION TO STATISTICS	10	FIS/01
WAVES AND OSCILLATIONS	7	FIS/01
Total compulsory credits	56	

2nd COURSE YEAR Core/compulsory courses/activities common

Learning activity	Ects	Sector
CLASSICAL MECHANICS	7	MAT/07
ELECTROMAGNETISM	15	(5) FIS/07, (10) FIS/01
EXPERIMENTAL DATA PROCESSING LABORATORY	6	FIS/01
MATHEMATICAL ANALYSIS 3	6	MAT/05
MATHEMATICAL METHODS IN PHYSICS	7	FIS/02
OPTICS,ELECTRONICS AND MODERN PHYSICS LABORATORY	10	FIS/01
QUANTUM PHISYCS 1 *The exam for this course will be taken in the third year, upon completion of the Quantum Physics module (Module 2), and will result in the verbalization of a single 15 CFU Quantum Physics exam*	7	FIS/02
THERMODYNAMICS	6	(3) FIS/07, (3) FIS/01
Total compulsory credits	64	

3rd COURSE YEAR Core/compulsory courses/activities common

Learning activity	Ects	Sector
CHEMISTRY 1	6	CHIM/03
INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS	9	FIS/04
QUANTUM PHISYCS 2	8	FIS/02
STRUCTURE OF MATTER 1 *In the academic year 2024/25, the Structure of Matter 1 course will be offered in two editions, one in the FIRST SEMESTER and one in the SECOND SEMESTER.*	9	FIS/03
Total compulsory credits	32	

Elective courses

One course chosen from among

ASTRONOMY LAB	6	(3) FIS/05, (3) FIS/01
COMPUTATIONAL PHYSICS LABORATORY	6	FIS/08, FIS/07, FIS/06, FIS/05, FIS/04, FIS/03, FIS/02, FIS/01
CONDENSED MATTER PHYSICS LABORATORY	6	(3) FIS/03, (3) FIS/01
EARTH PHYSICS LABORATORY	6	(2) FIS/07, (2) FIS/06, (2) FIS/01
ELECTRONICS 1	6	(3) ING-INF/01, (3) FIS/01
ELECTRONICS LABORATORY *Course offered every other year: not available in the academic year 2024/25. Its activation is scheduled for the academic year 2025/26*	6	(3) ING-INF/01, (3) FIS/01
ENVIRONMENTAL PHYSICS LABORATORY	6	FIS/07
GAMMA SPECTROSCOPY LABORATORY	6	(3) FIS/04, (3) FIS/01
INTRODUCTION TO ASTROPHYSICS	6	FIS/05
INTRODUCTION TO GENERAL RELATIVITY	6	FIS/02
INTRODUCTION TO HEALTH AND MEDICAL PHYSICS	6	FIS/07
INTRODUCTION TO STATISTICAL PHYSICS	6	(3) FIS/03, (3) FIS/02
NUCLEAR PHYSICS LABORATORY	6	(3) FIS/04, (3) FIS/01
NUMERICAL SIMULATION LABORATORY	6	FIS/08, FIS/07, FIS/06, FIS/05, FIS/04, FIS/03, FIS/02, FIS/01
OPTICS LABORATORY	6	(3) FIS/03, (3) FIS/01

It is recommended to choose a Laboratory course from the ones mentioned above.

The student must also acquire 12 CFU by freely choosing from all the courses offered by the University, provided that they are culturally consistent with their educational path and do not overlap in content with the already used fundamental and optional courses in the study plan. This choice also includes all the courses listed in the above table of Elective Activities.

COURSE YEAR UNDEFINED Core/compulsory courses/activities common

Learning activity		Ects	Sector
ENGLISH 2		2	L-LIN/12
	Total compulsory credits	2	

End of course requirements

FINAL EXAM		8	NA
	Total compulsory credits	8	

COURSE PROGRESSION REQUIREMENTS

The course contains the following obligatory or advised prerequisites

Learning activity	Prescribed foundation courses	O/S
MATHEMATICAL ANALYSIS 3	MATHEMATICAL ANALYSIS 1	Core/compulsory
	MATHEMATICAL ANALYSIS 2	Core/compulsory
MATHEMATICAL ANALYSIS 2	MATHEMATICAL ANALYSIS 1	Core/compulsory
ELECTROMAGNETISM	MECHANICS	Recommended
THERMODYNAMICS	MECHANICS	Recommended