# UNIVERSITA' DEGLI STUDI DI MILANO
# PROGRAMME DESCRIPTION - ACADEMIC YEAR 2023/24
# BACHELOR
## Natural Sciences (Classe L-32)
## enrolled from 2018/2019 academic year

| *HEADING* | |
|---|---|
| **Degree classification - Denomination and code:** | L-32 Environmental sciences |
| **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:** | Cap on student, student selection based on entrance test |
| **Course code:** | F66 |

## *PERSONS/ROLES*

**Head of Interdepartmental Study Programme**
Prof.ssa Morena Casartelli

**Degree Course Coordinator**
Prof.ssa Morena Casartelli

**Tutors - Faculty**
Tutor orientamento e piani di studio - Maria Rose Petrizzo, Diego Rubolini, Roberta Pennati, Claudio Olivari, Paolo Tremolada, Carlo Polidori, Cristina Bonza, Nicoletta Marinoni, Marco Caccianiga
Tutor per la mobilità internazionale e l'Erasmus - Silvia Caccia
Tutor per stage e tirocini - Alessandra Moscatelli
Tutor per trasferimenti - Cristina Bonza
Tutor per riconoscimento crediti - Cristina Bonza

**Degree Course website**
https://scienzenaturali.cdl.unimi.it/it
via Celoria 18 Email: morena.casartelli@unimi.it

**Course management**
via Botticelli, 23

**Libraries**
https://www.unimi.it/it/studiare/biblioteche

**Student registrar**
via Celoria 18 Phone 0250325032 https://www.unimi.it/it/node/360 https://www.unimi.it/it/node/359/

## *CHARACTERISTICS OF DEGREE PROGRAMME*

**General and specific learning objectives**
In line with the qualifying learning objectives of the corresponding degree class, the Bachelor?s degree programme in Natural Sciences aims to offer students a balanced synthesis between theoretical knowledge and methodological practice in the fields of biology and geology. Such expertise is essential for professional activities concerning the interpretation and protection of all elements of the past and present natural world, and highlighting the correlations between organisms, host substrate and the environment.
The programme is designed with the following objectives:
- Provide a systemic understanding of nature as well as robust practical experience in applying the scientific method to analyse biological components, their mutual interactions and their interactions with the chemical and physical environment;
- Prepare graduates that are able to study the biotic and abiotic components of the natural world, as well as their interactions. The degree programme notably covers a highly cross-disciplinary range of topics, from biology to geology and geography, including fundamentals of mathematics, chemistry and physics;
- Prepare graduates that are able to work in a team as well as autonomously, and to smoothly integrate in any work

environment;
- Prepare graduates that are able to use at least one language of the European Union other than Italian in their specific field of expertise and for general communication;
- Provide graduates with the necessary tools to access further educational and personal development opportunities, including teaching-oriented Master's degree programmes.
The degree programme requires students to gain oral and written proficiency in English.
Students will also become skilled in processing naturalistic data using mathematical and statistical techniques applicable to biotic and abiotic contexts. Moreover, they will acquire skills to identify living organisms, substrate types and landforms, to plan protocols and experimental procedures, and to properly write reports in different areas of natural sciences, such as surveys and analyses of the flora, fauna and morphology of the land or, more generally, methodological and experimental procedures for a cross-disciplinary study of organisms, the present environment and the geological past. Graduates will be able to autonomously assess and interpret experimental data, to choose the appropriate techniques for the analysis of environmental and natural components, as well as to apply the principles of professional ethics and a scientific approach to bioethical issues. Moreover, graduates will acquire verbal and written communication skills to be able to address both experts in the field and the general public, using the appropriate language register according to the different circumstances.

**Expected learning outcomes**

Graduates are expected to acquire:

A: knowledge and understanding:
- knowledge of the fundamentals of mathematics, statistics, computer science, physics and chemistry aimed at the acquisition of the basic features of the disciplines to be used in different working areas and/or during the continuation of the studies (Master);
- knowledge of biological disciplines to understand the diversity of living organisms, their organization and the mechanisms underlying their functioning, also in an evolutionary framework;
- knowledge of ecological disciplines to understand the relationships between plants and animals and the environment in which they live;
- knowledge of the disciplines of Earth Sciences to understance the processes acting on our planet both in the present and in the geological past;
- knowledge of agricultural, management and communication disciplines for the acquisition of fundamental skills for land management in natural and man-made contexts and for understanding and interpreting the natural world in its biotic and abiotic component.

B: application skills:
- ability to process naturalistic data using mathematical and statistical techniques and to apply basic analytical techniques to the different contexts of the natural sciences.
- ability to identify living organisms, the nature of the substrate and the shapes of the landscape, to interpret and use topographic maps for the analysis of the territory, and to process these elements through geographic information systems, to plan protocols and experimental procedures, to apply them , and write reports in the different areas of Natural Sciences, such as surveys and analysis of the vegetation, fauna and geomorphology, or methodological and experimental procedures for the analyses of living organisms and the environment in the present and in the geological past;
- ability to use different IT tools with their main applications
- ability to use the English language efficiently.

C: autonomy of judgment:
- ability to evaluate and interpret experimental data;
- ability to use appropriate laboratory and field safety tools;
- ability to choose the appropriate techniques for analyzing the components of the environment;
- ability to apply the principles of professional ethics and the scientific approach to bioethical issues.

D: communication skills:
- ability to use different IT tools to communicate effectively to experts and non-experts;
- ability to communicate orally and in writing with a public of experts and with a general public, using language-appropriate registers to each circumstance;
- ability to use different IT tools with their main applications;
- ability to work in a team and to operate independently.

E: ability to learn:
- knowledge of scientific updating tools for the Natural Sciences disciplines;
- ability to consult databases;
- ability to access scientific literature produced in at least one European language in addition to one's own.

**Professional profile and employment opportunities**

The aim of the degree programme is to train graduates who can: perform professional and technical-operational tasks for the identification and classification of processes and phenomena that had, or are having, an impact on the territory; collect, store and process data; define sampling criteria; identify living organisms, substrate types and landforms; organise environmental

planning and control activities. This is done with a view to preparing students to enter the world of work right after graduating. The above-mentioned skills can be applied in national and local public administrations dealing with the territory, at research entities and private companies involved in the monitoring of the territory and its resources, as well as by freelancers.
Graduates will also be able to perform professional and technical-operational tasks for the management of natural systems and agri-ecosystems, and take on management and technical assistance roles in parks and natural reserves, farms and cooperatives, as well as in public administrations, research entities and private companies involved in the management and recovery of the territory and its resources.
Graduates will be able to identify protocols and analytical methods to plan laboratory tests and will be familiar with the most common analysis techniques for the characterisation of natural materials. These activities may be undertaken at research centres and public and private analysis laboratories of the agri-food, environmental and pharmaceutical sectors.
Graduates will be able to provide support for the protection of cultural, botanical, zoological, palaeontological and geo-archaeological heritage, and to enhance collections and natural and cultural resources. To this end, they may work at science museums, botanical gardens, teaching and dissemination centres, research entities and private companies involved in the management of cultural and natural heritage.
Finally, graduates will be able to: disseminate knowledge regarding current ecosystems and ecosystems of the geological past; promote environmental education in schools; set up exhibitions on nature; raise awareness on sustainable development. Employment opportunities for this kind of activities are to be found in museums, parks, schools, publishers, public administrations, research entities and private companies active in knowledge dissemination and ecosystems management and protection.

Professional profiles

Expert in the collection and monitoring of naturalistic data
Job function: to collect data on the field; to produce thematic cartography; to classify, analyse and monitor biotic and abiotic components of the aquatic and terrestrial ecosystems.
Professional skills: ability to fulfil professional and technical-operational tasks so as to cooperate in the identification and classification of processes and phenomena that had, or are having, an impact on the territory; data collection skills, data storage skills and basic data processing skills; ability to define sampling criteria. Ability to identify animals and plants.
Career opportunities: public administrations (at the national and local level) that deal with the territory; research entities and private companies involved in the monitoring of the territory and its resources. Freelance professional activity.

Expert in the management of natural areas and agricultural ecosystems
Job function: to analyse and monitor systems and biological processes both in natural and anthropic settings, in order to preserve the natural environment and improve its quality; to preserve and restore the biotic components of aquatic and terrestrial ecosystems; to provide technical support in environmental planning and control; to provide specialised support to protect and recover areas at risk.
Professional skills: ability to fulfil professional and technical-operational tasks so as to cooperate in the management of natural systems and agroecosystems
Career opportunities: management and technical assistance roles in parks and natural reserves, farms and cooperatives; public administrations (at the local and national level) for land management and recovery; research entities and private companies involved in the management of the territory and its resources. Freelance professional activity.

Expert in the laboratory analysis of biological and geological materials
Job function: to analyse biotic and abiotic components of natural ecosystems; to define physical-chemical and biological properties of materials (characterisation); to serve as quality controller; to employ natural materials in industry.
Professional skills: ability to identify the right protocols and analytical methods to plan laboratory analyses; knowledge of the main analytical techniques for characterisation of natural materials.
Career opportunities: public and private research centres and analysis laboratories of the agri-food and environmental sectors, as well as of the pharmaceutical industry. Public administrations (at the local and national level) dealing with material characterisation and providing operational support to research entities. Freelance professional activity.

Expert in the management and conservation of museum collections
Job function: to provide support for the protection of the cultural, botanical, zoological, palaeontological and geo-archaeological heritage; to enhance collections and the natural and cultural heritage.
Professional skills: ability to classify biotic and abiotic natural elements; data storage, processing and enhancement; knowledge of exposition techniques.
Career opportunities: science museums, botanical gardens and teaching and dissemination centres; operational support roles for research entities and private companies involved in the management of cultural and natural heritage. Freelance professional activity.

Expert in the dissemination of natural sciences
Job function: to disseminate knowledge regarding current ecosystems and ecosystems of the geological past; to promote environmental education in schools; to set up naturalist exhibitions; to raise awareness on sustainable development.
Professional skills: knowledge of biotic and abiotic components of fossil and current ecosystems and their evolution in the history of Earth; knowledge of the impact of human beings on ecosystems.
Career opportunities: museums; parks; schools; public administrations (at the local and national level) dealing with knowledge dissemination; research entities and private companies involved in the management and protection of the ecosystems. Freelance professional activity.

Provided that they pass the corresponding state exam and enrol in the relevant professional register, graduates may access the following state-regulated professions:
Graduated agricultural technician
Junior biologist
Graduated agricultural expert
Junior planner

**Initial knowledge required**

Admission to the three-year degree course in Natural Sciences is open to candidates with a high school diploma or equivalent foreign qualification in accordance with Ministerial Decree no. 270 of 22 October 2004. The degree course in Natural Sciences has a limited number of places in order to guarantee the quality of the teaching offer in relation to the available resources and provides for a TOLC (Test On Line CISIA) as an admission test. There are 300 places available for enrolment in the first year.
The TOLC can be taken at the University of Milan or at any other university adherent to CISIA (Consorzio Interuniversitario Sistemi Integrati per l'Accesso). Registration for the TOLC can be made on the CISIA website (ww.cisiaonline.it). The TOLC valid for enrolment in the Natural Sciences degree course is the TOLC-S, consisting of the following sections: Basic Mathematics (20 questions - 50 minutes), Reasoning and Problems (10 questions - 20 minutes), Text Comprehension (10 questions - 10 minutes), Basic Sciences (10 questions - 20 minutes). Each question has 5 possible answers, of which only one is correct. Scoring: +1 for each correct answer, -0.25 for each wrong answer, 0 for each answer not given in the other sections.
The structure and topics of the test are published at https://www.cisiaonline.it/en/area-tematica-tolc-scienze/struttura-della-prova-e-syllabus/.
The entry requirements and the call for applications are available at https://scienzenaturali.cdl.unimi.it/it/iscriversi.

Students who have taken the TOLC-S will be enrolled in the selection for admission to the degree course in Natural Sciences, and will be placed in the merit list, drawn up on the basis of the scores obtained in the test. The winners will be able to enrol within the deadlines indicated in the announcement. Freshmen who do not achieve a score greater than or equal to 10 in the Mathematics module will be assigned Additional Educational Obligations (OFA). In the TOLC-S there is an additional section of English, consisting of 30 questions to be completed in 15 minutes, the result of which does not count towards the test score.

Access by transfer or for students who have already graduated.
Students already enrolled in a degree course at the University of Milan, at another university or already graduated, may be exempted from the test only if they are admitted to years other than the first, but only if they meet the minimum requirements, i.e. at least 30 CFU recognisable as exams of the degree course, of which 12 can be validated for the Institutions of Mathematics and Statistics exam.
To this end, a request for prior career evaluation must be submitted by accessing the online service indicated in the call for admission.
Applicants must declare all the exams they have taken with the corresponding sectors, credits and grades and attach the course programmes. For further details on the procedure, dates and deadlines, please refer to the call for applications.
Students admitted to the first year must take the test and register for the call.

Additional educational obligations and modalities for OFA recovery.
Support activities will be organised for students with OFA, followed by a recovery test in which the student must demonstrate that he/she has improved his/her preparation. In the absence of this evidence, the student will not be able to take any exam of the second year before having passed the Institutions of Mathematics and Statistics exam (link: https://scienzenaturali.cdl.unimi.it/en/studiare/le-matricole).
Information on how to enrol in the degree course is available at https://www.unimi.it/en/study/bachelor-and-master-study/degree-programme-enrolment/enrolment-first-degree-programme.

**Compulsory attendance**

Attendance to didactic activitites including laboratories, field activities, internships which provide credits, is compulsory.

**Degree programme final exams**

The Final Exam consists of a presentation and discussion of a written report related to experimental activities or the relationship related to a practical traineeship. This report plays a foundamental teaching role necessary that completes the 3-years individual study programme. No particular originality of development is required and its preparation must commensurate with the number of 4 CFU assigned to it by the regulations.
The Final Exam can be taken in english, as well as the drafting of the corresponding paper.

In order to be admitted to the final exam students must have acquired 176 credits, including those required for the foreign language.

Admission link: https://www.unimi.it/en/study/bachelor-and-master-study/graduation

**Campus**

Course locations: Department of Biosciences (via Celoria 26), Settore Didattico (via Celoria 20, via Golgi 19, via Venezian 14), Department of Earth Sciences "Ardito Desio" (via Mangiagalli 34 e via Botticelli 23) and other classrooms situated in different buildings in Milan-Città Studi.

**Laboratories**

Laboratory locations: Department of Biosciences (via Celoria 26), Settore Didattico (via Celoria 20, via Golgi 19, via Venezian 14), Department of Earth Sciences "Ardito Desio" (via Mangiagalli 34 e via Botticelli 23)

**Notes**

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/297/). 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, B2, 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.

## *EXPERIENCE OF STUDY ABROAD AS PART OF THE TRAINING PROGRAM*

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**

As part of the ERASMUS + program, agreements have been made with Danish, Spanish, French and Romanian universities for students enrolled in the Bachelor's Degree in Natural Sciences. During the study period abroad the students can attend courses and take the related exams, and carry out research for the degree thesis. Students admitted to the mobility program must submit a study plan proposal that includes the training activities they plan to carry out abroad. The number of CFU of the proposed plan must, as far as possible, correspond to what the student would acquire in an equivalent period of time at his university. The proposed activities, chosen as part of the host university's educational activities, must be consistent with the educational project of the degree course. The study plan must be submitted for approval to the Erasmus Commission of the Collegio Didattico Interdipartimentale. The Commission may ask the student to integrate the program of an exam taken in the host university with an interview to be carried out in the University of Milano on an agreed supplementary program. At the end of the mobility program, in compliance with the University guidelines, the exams passed in the approved study plan will be recorded in the student's career with the original name of the course in the host foreign university, and their ECTS converted into CFU and the vote expressed in thirtieths.

**How to participate in Erasmus mobility programs**

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 |
|---|---|---|---|
| Botany | | 12 | (6) BIO/02, (6) BIO/01 |
| Chemistry | | 10 | CHIM/03, CHIM/06 |
| English assessment B1 (2 ECTS) | | 2 | ND |
| Fundamental of mathematics and statistics | | 12 | MAT/09, MAT/01, MAT/02, MAT/03, MAT/04, MAT/05, MAT/06, MAT/07, MAT/08 |
| General and environmental biology with elements of Histology | | 8 | BIO/06 |
| Physical geography and cartography | | 8 | GEO/04 |
| Physics | | 6 | FIS/08, FIS/07, FIS/06, FIS/05, FIS/04, FIS/03, FIS/02, FIS/01 |
| Zoology | | 12 | BIO/05 |
| | Total compulsory credits | 70 | |

### *2nd COURSE YEAR Core/compulsory courses/activities common*

| Learning activity | | Ects | Sector |
|---|---|---|---|
| Comparative anatomy | | 7 | BIO/06, BIO/16 |
| Ecology and behavioural ecology | | 15 | BIO/07 |
| General and environmental physiology | | 8 | BIO/09 |
| Genetics | | 8 | BIO/18 |
| Geology | | 6 | GEO/02 |
| Mineralogy | | 6 | GEO/06 |
| Paleontology | | 6 | GEO/01 |
| Petrography | | 6 | GEO/07 |
| | Total compulsory credits | 62 | |

### *3rd COURSE YEAR Core/compulsory courses/activities common*

| Learning activity | | Ects | Sector |
|---|---|---|---|
| Evolutionary biology | | 6 | BIO/19, BIO/18, BIO/05, BIO/02 |
| Final exam | | 4 | ND |
| Geographic Information Systems | | 6 | INF/01 |
| | Total compulsory credits | 16 | |

### *Elective courses*

**The student must acquire 12 CFUs by choosing from the courses listed below. The only rule to be observed is that no more than one course may be chosen in the area of Biological Disciplines (sectors BIO/02-04-05-06-08) and no more than one course in the area of Ecological Disciplines (sectors BIO/03-07 and GEO/04)**

| | | |
|---|---|---|
| Anthropology and archaeological excavation | 6 | BIO/08 |
| Biodiversity conservation | 6 | BIO/07 |
| Climatology | 6 | GEO/04 |
| Developmental biology | 6 | BIO/06, BIO/01 |
| Environmental microbiology | 6 | BIO/19 |
| Freshwater biology | 6 | BIO/05 |
| General entomology | 6 | AGR/11 |
| Geobotany | 6 | BIO/02 |

| | | |
|---|---|---|
| Geomorphology | 6 | GEO/04 |
| Geopedology | 6 | GEO/04 |
| Mineral resources and environmental interactions | 6 | GEO/09 |
| Molecular biology and evolution of genomes | 6 | BIO/11, BIO/19 |
| Paleontology heritage and excavations | 6 | GEO/01 |
| Plant physiology | 6 | BIO/04 |
| Quaternary climate changes | 6 | GEO/02 |
| Vertebrate zoology | 6 | BIO/05 |

**The student must autonomously acquire 12 cfu from all the courses offered by the University (preferably chosen within the scientific area), as long as they are in line with the training project, subject to assessment by his or her tutor. This choice therefore also includes the courses listed above.**

## *COURSE YEAR UNDEFINED Core/compulsory courses/activities common*

| Learning activity | | Ects | Sector |
|---|---|---|---|
| Field activity, training activity and laboratories | | 8 | ND |
| | Total compulsory credits | 8 | |

## *COURSE PROGRESSION REQUIREMENTS*

Petrography exam must be preceded by the Mineralogy one.

| Learning activity | Prescribed foundation courses | O/S |
|---|---|---|
| Petrography | Mineralogy | Core/compulsory |