UNIVERSITA' DEGLI STUDI DI MILANO
PROGRAMME DESCRIPTION - ACADEMIC YEAR 2025/26
MASTER DEGREE
BIOTECHNOLOGY FOR THE BIOECONOMY (Classe LM-7 R)
Enrolled in the 2025/26 academic year

HEADING

Degree classification - Denomination and code:	LM-7 R
Degree title:	Dottore Magistrale
Length of course:	2 years
Credits required for admission:	180
Total number of credits required to complete programme:	120
Years of course currently available:	1st
Access procedures:	Open, subject to entry requirements
Course code:	GBC

PERSONS/ROLES

Head of Study Programme

Prof. Alessio Scarafoni

Tutors - Faculty

Academic guidance tutor
Prof. Fabio Forlani (student surname A-L); Prof.ssa Eleonora Rolli (student surname M-Z)

Erasmus and international mobility tutor
Prof. Fabio Forlani

Study plan tutor
Prof. Fabio Forlani

Seminar and workshop tutor
Prof. Fabio Forlani

University and programme transfer tutor
Prof. Alessio Scarafoni

Master's degree admission tutor
Prof. Alessio Scarafoni

Credit recognition tutor
Prof. Alessio Scarafoni

Specific Learning Disabilities (SLD) tutor
Prof. Sara Borin

Degree Course website

https://biotechnologybioeconomy.cdl.unimi.it/

Phone 0250316820 Email: presidenza-BforB@unimi.it

via Celoria 2 - Milano Città Studi Phone 0250316511 Public opening hours: Monday from 10 am to 12 am and from 2 pm to 4 pm Contacts: https://informastudenti.unimi.it/saw/ess?AUTH=SAML

via Celoria 18 - Milano Città Studi Phone 0250325032 https://www.unimi.it/en/node/360 https://www.unimi.it/en/node/359

CHARACTERISTICS OF DEGREE PROGRAMME

General and specific learning objectives

Bioeconomy responds to the environmental challenges the world is facing, oriented to reduce the dependence on natural resources, transform manufacturing, promote sustainable production of renewable plant, microbial and animal resources and their conversion into food, feed, materials, bio-based products and bio-energy, while growing new jobs and industries.

Biotechnology is one of the key enabling technologies to sustain a new green and sustainable economy (i.e. bioeconomy), offering solutions for an efficient and sustainable production of plant and microbial biomasses; the production of bioenergy from (waste) biomasses; environmental protection and safety in terms of bioremediation; green chemistry processes and applications; sustainable agri-food production and processes, circular economy.

In this context, the Biotechnology for the Bioeconomy (BforB) Master degree aims at providing students with advanced molecular and cellular background of microbe and plant systems, which are the basis for the several sectors of the biotechnologies applied to the bio-economy. The BforB Master degree will equip students with a solid and broad expertise about the structure and function of biological macromolecules of interest for the bioeconomy sector, and complete knowledge about the analyses of informational molecules and the expression of characters with a special focus on multidisciplinary and integrated approaches. The BforB Master degree will provide theoretical and practical instruments for the set-up, analyses and improvement of biotechnological processes for i) the transformation of renewable raw materials in biotechnological processes exploiting microorganisms, plants and enzymes, ii) plant and microbial-based bioremediation strategies, iii) bio-based approaches in food and agriculture sustainable development.

The BforB Master degree will be taught entirely in English, providing the students with knowledge and competences that can be spent at European and extra European level, to which the bioeconomy sector is faced. Moreover, the English language will allow the participation of students from out of Italy, making the Master degree a stimulant international learning environment.

Expected learning outcomes

The students of the BforB Master degree will acquire:

- the ability to perform biotechnological interventions aimed at optimizing the production efficiency of biological systems (with particular reference to microorganisms, plants, enzymes) involved in bioprocesses of agricultural, food and environmental interest. These objectives will be achieved thanks to specific teaching of advanced biotechnological methodologies and more specific teachings in the field of microbial and protein biotechnologies included in the educational path; furthermore, specific teachings dedicated to fermentation biotechnologies and bioprocesses aimed at recycling and valorizing plant and waste biomasses are foreseen;
- knowledge of innovative biotechnological techniques regarding processes based on the use of microbial and plant systems, to modify their characteristics also concerning consumer needs, environmental sustainability concerning the agri-food sector and the analysis of risks associated with the use and release of biotechnological products. These objectives will be achieved with mandatory teachings dedicated to microbial, plant and environmental biotechnologies.
- knowledge of the effects of biotechnological products on an environmental level. Specific courses dedicated to microbial and plant biotechnologies applied to the environment are planned;
- an advanced knowledge of IT tools, with particular reference to bioinformatics, developing aspects of computational biology both at the level of genomic annotation and structural bioinformatics in general methodologies courses and in specific courses of plant, microbial and protein biotechnologies. The ability to organize, build and access databases for the analysis of genomes, proteomes and metabolomes will be deepened;
- in-depth knowledge of the structure, function and organisation of plant and microbial systems, in particular on the molecular, informational, integrated and interactive logics that direct their activities. These aspects will be covered in various compulsory courses, in particular, those dedicated to the development of plant and microbial cell factories;
- the preparation necessary to develop and fine-tune analytical methods of biotechnological and chemical investigation, in particular for the characterization and quality control of agri-food and industrial products deriving from microbial and plant bioprocesses. Courses dedicated to the study of the function and structure of biomolecules and the molecular analysis of food and plant products are offered to students;
- the preparation to design and develop biotechnological approaches aimed at optimizing the efficiency and defence from biotic and abiotic stress of organisms of agricultural interest, for the protection and remediation of the agro-industrial environment and for the valorization of by-products of the agri-food sector, implementing the circular economy model;
- the achievement of a high mastery of the scientific method of investigation and design in order to be able to conceive, design and manage technical-scientific projects related to biotechnological processes that transform renewable resources into products of applicative interest;
- the ability to operate with great autonomy, assuming responsibility for structure and design will be acquired in particular during the experimental thesis and in courses in which the student will be encouraged to develop project ideas independently;
- being able to use fluently, in written and oral form, at least one language of the European Union; the course will be held entirely in English, to promote the widest and most complete communication in the biotechnology field at a global level;
- the acquisition of knowledge and techniques to carry out basic and applied research, as well as the promotion and development of scientific and technological innovation in the bioeconomy sector. This knowledge will be acquired in particular during the experimental thesis (36 CFU) and in most of the courses made available by the course of study;
- basic knowledge related to legislation, intellectual property management and business planning, and aimed at acquiring skills related to the bioeconomy in terms of assessing the environmental footprint of bioprocesses, project management, and technology transfer;
- the development of transversal skills (soft skills) of a relational and behavioral nature, which characterize the ethical and moral correctness with which the individual communicates and relates to others in the professional context and with which he can evaluate the implications of his activities in terms of environmental sustainability, will be guaranteed within the teaching activities of the courses.

Professional profile and employment opportunities

The professional profile of the graduate in Biotechnology for the Bioeconomy is that of a biotechnologist for the bioeconomy and concerns the coordination, management and development of research and development laboratories in public and private bodies and in the chemical, agri-food and biotechnology industries, in particular, those operating in the broad sector of the bioeconomy.
His function in a work context is to carry out and coordinate laboratory activities in the context of basic and applied research projects, developing and fine-tuning bioprocesses, and quality control.
The skills associated with the functions are mainly:
- Skills to carry out basic and applied research, promotion and development of sustainability and scientific and technological innovation in the field of biotechnology disciplines in the agricultural sector;
- Skills needed to design, develop and monitor fermentation processes, both on a laboratory scale and on an industrial scale, for producing primary and secondary metabolites and obtaining renewable energy sources.
- Ability to develop new biological and biotechnological products in the agricultural, food and other sectors of the bioeconomy (e.g. biomaterials, bioenergy), also through the valorization of waste biomass.
- Skills in selecting, obtaining and developing plant and microbial cells as biofactories for producing molecules of interest in the sectors of fine chemicals, polymers, agri-food and pharmaceutical industries.
- Ability to develop and control biological processes for producing raw materials (plant and microbial biomass) suitable for transformation into molecules of applicative interest.
- Skills in the development and application of bioremediation processes, in particular through the use of microorganisms and plants.
- Ability to design, develop and control bioprocesses for the production of intermediates and products for green chemistry production activities and for the agri-food industry (use of cells or their parts, in particular enzymes)
- Molecular and cellular skills in designing and developing innovative diagnostic techniques, particularly for the traceability of agri-food supply chains.
Career opportunities exist within public and private research and development institutions, including Ph.D. programs after passing the relevant competitive exams, and in the chemical, pharmaceutical, agri-food, and biotechnology industries.
BforB graduates can access the Italian State exams for professional qualification and registration in the Professional Register of the Order of Agronomists and Forestry Doctors (section A), and in the Professional Register of the National Order of Biologists (section A). Furthermore, graduates can participate in the qualifying exams for the profession of Agrotechnician and Graduate Agrotechnician.

Initial knowledge required

Students with an Italian University degree: The BforB Master degree can be accessed by graduates of Laurea Triennale belonging to the L-2 class (Biotecnologia) and previous class 1 (Biotecnologia). It can also be accessed by any student with a Laurea Triennale providing a strong background in biotechnology-related subjects, specifically at least 35 university credits (CFU) in basic disciplines (mathematics, physics, chemistry, biology) among the following SSD: MAT/01-02-03-04-05-06-07-08-09, FIS/01-02-03-04-05-06-07-08, SECS-S/01-02, AGR/07-16, BIO/04-10-11-12-13-18-19, CHIM/01-02-03-06 and at least 25 CFU in "core disciplines" for the L-2 class of Laurea Triennale, among the following SSD: AGR/01-02-03-04-11-12-13-15-17-18, BIO/01-02-03-07-09-15, CHIM/04-05-08-10-11-12, MED/03-07-42, VET/03-04.
Students with a degree from a non-Italian institution: They must possess a Bachelor?s degree from an accredited college or University that includes exams in basic disciplines of mathematics, physics, general chemistry, biology, and also an adequate number of exams in all the following disciplines: organic chemistry, biochemistry, molecular biology, microbiology, genetics and plant biology, and disciplines included in the biotechnology area.

Proficiency in English at a B2 level or higher per the Common European Framework of Reference for Languages (CEFR) is required for admission.
The B2-level requirement will be ascertained by the University Language Centre (SLAM) upon admission as follows:
- Language certificate of B2 or higher level issued no more than three years before the date of admission application. 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 when submitting the online application;
- English level achieved during a University of Milan degree programme and certified by the University Language Centre (SLAM) no more than four years before the date of admission application, including levels based on language certificates submitted by the applicant during their Bachelor's degree at the University of Milan. In this case the process is automatic, the applicant does not have to attach any certificates to the application;
- Entry test administrated by the University Language Centre (SLAM) according to the calendar published on the website: (https://www.unimi.it/en/node/39267/)
All those who fail to submit a valid certificate or do not meet the required proficiency level will be instructed during the admission procedure to take the Entry test.
Applicants who do not take or pass the Entry test will be required to obtain a language proficiency certificate recognized by the University (see https://www.unimi.it/en/node/39322) and deliver it to the SLAM via the InformaStudenti service by the deadline fixed for the master's programme (https://www.unimi.it/en/node/39267/).
Applicants who do not meet the requirement by said deadline will not be admitted to the master's degree programme and may not sit any further tests.

Eligibility assessment: the personal curriculum of the applicants and the certifications will be evaluated to verify that the requirements for admission are satisfied by an Admission Committee composed of the coordinator and at least one lecturer

of the Master degree. For students with an Italian Bachelor degree the analysis of the curriculum aims to verify the level of knowledge in the "core disciplines" for the L-2 class of Laurea Triennale. Students who have qualified abroad equivalent to a Bachelor's degree must have passed, together with the basic disciplines of mathematics, physics, general chemistry and biology, also a suitable number of exams in all the following disciplines: organic chemistry, biochemistry, molecular biology, microbiology, genetics and plant physiology, and disciplines included in the biotechnology area.
For all applicants, admission to the LM is subject, in addition to possessing the above curricular requirements, to assessing the adequacy of the applicant's personal preparation. This should verify the level of knowledge (CFU acquired, and grade obtained) in mathematics and statistics, organic chemistry, biochemistry, molecular biology, genetics, plant biology, and microbiology. It should be noted that preparation in the disciplines mentioned above may also have been achieved through attendance at individual courses.
If deemed necessary, the Committee may integrate this documentary assessment with an interview with the applicants. The interview may be held remotely through an online conference platform. Should the candidates be called by the commission, the interview is mandatory for possible admission to the Master. The interview is aimed at examining more thoroughly the applicant's background knowledge.
The applicants will receive communication of their eligibility and be allowed to enroll in the Master's degree program. An optional, anonymous, online self-assessment test is available for admitted students who wish to identify knowledge areas for focused, autonomous study. Faculty members are available for personalized guidance and to suggest relevant bibliographic materials.

Practical instructions
Applicants considered eligible by the Admission Committee can enroll in the BforB Master degree under the terms and conditions indicated at https://www.unimi.it/en/education/biotechnology-bioeconomy.
Students who have applied for admission to BforB prior to the conclusion of their bachelor degree (Laurea Triennale), if possessing the other admission requirements and a valid English proficiency certificate, will be granted the possibility to attend the first term classes (pre-enrollment). In this case students must present to Segreteria Studenti the bachelor degree up to December 31st 2025 to receive formal admission to the course. Only after admission are students allowed to enrol and only after enrolment can they take exams.

Internship criteria

The students will carry out an experimental project leading to writing a dissertation in English, whose public discussion will constitute the final exam. The experimental project involves the attendance of a research laboratory either at University of Milan or in other research laboratories, in Italy or abroad, upon previous authorization of the Coordinator of the Master degree. The experimental project accounts for 36 CFU, and thus it represents a main activity within the Master degree program. The dissertation will describe an original research carried out by the student under the supervision of a lecturer within the BforB Master degree, and its subject must be consistent with the goals and the disciplines taught in the Master degree.

Degree programme final exams

The final exam consists of an oral presentation and discussion of the thesis's main results in front of a Graduation Committee (GC), which can award the presentation a maximum of ten points. One extra point may be assigned if the student has completed a curricular training period abroad. In no case will the points assigned by the GC exceed the total number of 10. The final grade will be thus assigned as the weighted average of the grades in the lecture courses, calculated on a scale of 110, to which the points assigned by the GC will be added.

Notes

Additional Language Skills: Italian (foreign students).

Among the electives, those who do not hold an Italian high school diploma or degree can obtain 3 credits in Additional language skills: Italian by demonstrating A2 level in Italian per the Common European Framework of Reference for Languages (CEFR). This level can be assessed in one of the following ways:
- by submitting a certificate of A2 or higher level issued no more than three years prior to the date of submission. You will find the list of language certificates recognized by the University at: https://www.unimi.it/en/node/349/). The language certificate must be uploaded https://cas.unimi.it/login?service=https%3A%2F%2Fstudente.unimi.it%2FuploadCertificazioniLingue%2F;
- by an entry-level test administrated by SLAM that can be taken only once and is compulsory for all students who do not have a valid language certificate. Those who fail to reach A2 level will have to attend one or more than one 60-hour Italian course(s) geared to their level. Those who do not take the entry-level test or fail to pass the end-of-course test after six attempts will have to obtain language certification privately in order to earn the 3 credits of Additional language skills: Italian. As an alternative, they can modify their course programme by choosing a different elective.

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 organisations.
Similar international mobility opportunities are provided outside Europe, through agreements with a number of prestigious institutions.
The University of Milan is a member of the 4EU+ European University Alliance that brings together eight public multidisciplinary universities: University of Milan, Charles University of Prague, Heidelberg University, Paris-Panthéon-Assas University, Sorbonne University of Paris, University of Copenhagen, University of Geneva, and University of Warsaw. The 4EU+ Alliance offers integrated educational pathways and programmes to promote the international mobility of students (physical, blended and virtual).

Study and internships abroad

The complete and updated bouquet of opportunities for participation in international programs can be found at https://www.unimi.it/en/international/study-abroad. It is possible to participate to each of them following selections on a competitive basis. The offer includes:
1) Thesis abroad (Tesi all'estero) program: the University of Milan calls twice every year for applications for a study-abroad scholarship to be used to prepare all or a portion of the student's Master's Degree thesis while in residence at an international academic or research institution. Students can choose any destination and institution in the world, without any geographical restrictions. Specific information and deadlines: https://www.unimi.it/en/international/study-abroad/thesis-abroad.
2) ERASMUS+ Traineeship program: students can undertake a traineeship with a company, research or training center, university or other organization, in the member states of the European Union, and Iceland, Liechtenstein, Norway, Republic of Macedonia, Serbia. Specific information and deadlines: https://www.unimi.it/en/node/2109/.
3) ERASMUS+ Study program: the time spent abroad can be used to attend courses and pass the relative exams, thus collecting credits towards the Master degree and carrying out the experimental project for the dissertation. The BforB Master course has in place agreements with Universities in Finland, Germany, Spain, France, Austria, Belgium, all offering courses in English. Calls for participation will be open usually in February and details can be found at the following link: https://www.unimi.it/en/international/study-abroad/studying-abroad-erasmus.
The student admitted to any of the mobility programs must submit a study plan detailing the training activities that he/she plans to carry out, with the corresponding credits. The number of credits should correspond as much as possible to the number of credits that the student should acquire in a similar span of time at the home University. The proposed activities must be consistent with the goals and the contents of the Master degree. The study plan must be approved by the BforB Student Mobility Committee, which can request changes or integrations. At the end of the mobility program, according to the guidelines provided by the University of Milan, the courses (with a passed exam) and laboratory trainings attended by the student are registered in his/her career, with its original name and with an indication of the ECTS (European Credit Transfer and Accumulation System) and their conversion in CFU (usually 1 ECTS= 1 CFU). The students willing to carry out their dissertation work as part of a mobility program abroad must have an internal supervisor (chosen among the BforB lecturers) and the study plan must be approved by the BforB board.
For carrying out any experimental activity abroad, a letter of acceptance from the hosting supervisor is required. If the experimental activities are intended to be part or all the dissertation work (thesis), a similar letter should be drawn up by the internal supervisor. These letters must be sent to the ERASMUS Coordinator before the departure to the foreign destination. As a general rule, if the period of stay at the foreign laboratory is less than six months long, the student should complete the thesis work at the laboratory of the internal supervisor, or other laboratory indicated by the supervisor, in ordto complete the training program.

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 organises 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;
Student Desk booking through InformaStudenti

1st COURSE YEAR Core/compulsory courses/activities common

Learning activity	Ects	Sector
Biomass and waste recycling promoting the circular economy	7	AGR/13
Environmental microbial biotechnology	6	AGR/16
Environmental plant biotechnology	6	AGR/13
Fermentation biotechnology	7	CHIM/11
Methods in biotechnology	9	(5) AGR/07, (4) AGR/12
Plants as biofactories	6	AGR/07
Protein engineering and proteomics	6	BIO/10
Structure and functions of biomolecules	8	CHIM/10
Total compulsory credits	55	

2nd COURSE YEAR (available as of academic year 2026/27) Core/compulsory courses/activities common

Learning activity	Ects	Sector
Bioeconomy: management, assessment and intellectual property	6	AGR/01
Total compulsory credits	6	

Further elective courses

Table 1 - Elective courses: the student will choose 2 courses among the following:

Applied biocatalysis	6	CHIM/11
Bio-based innovation in food industry	6	AGR/15
Biostatistics and design of experiments in biotechnology	6	AGR/17
Developing soft skills in science: case-studies from microbial biotechnology	6	AGR/16
Functional foods and nutraceuticals	6	MED/49
Molecular analysis and traceability of biotechnological products	6	BIO/10

Table 2 - Optional courses

To complete the study program the student must acquire 8 CFU by freely choosing among:
i) Courses activated by the University of Milan for Master Degrees, as long as consistent with the aims of the BforB degree and not a repetition of any course already inserted in the study plan;
ii) Optional courses specifically activated by the BforB Master Degree:
iii) Additional elective courses (see Table 1).

Biomolecular experiment planning	2	BIO/10
Molecular biobased approaches for plant protection	6	AGR/12
Plant microbiome-based strategies for agri-environmental biotechnologies	4	AGR/16
Ree Crispres - a Workshop On Genome Editing Technologies	3	(1) AGR/07, (2) BIO/01

Table 3 - Further activities:

STUDENTS HAVE TO ACQUIRE 3 CREDITS according to the following rules:
• students holding an Italian high school diploma or university degree must obtain 3 credits in “Other activities (laboratories, seminars)" or in “Ree Crispres - A workshop on genome editing technologies”
• foreign students, who do not hold an Italian high school diploma, an Italian bachelor's degree or a certificate of knowledge at the A2 or higher level per the Common European Framework of Reference for Languages (CEFR), can also acquire 3 CFU through “Additional Language Skills: Italian”.

The acquisition of Italian language skills is strongly recommended for international students, as they may be necessary for employment and professional opportunities in the Italian national context, in accordance with the educational objectives of this Master's programme.

Additional Language Skills: Italian (3 ECTS)	3	ND
Other activities (laboratories, seminars)	3	NA
Ree Crispres - a Workshop On Genome Editing Technologies	3	(1) AGR/07, (2) BIO/01

End of course requirements			
Internship and final exam		36	NA
	Total compulsory credits	36	