UNIVERSITA' DEGLI STUDI DI MILANO
PROGRAMME DESCRIPTION - ACADEMIC YEAR 2026/27
IN
SUSTAINABLE INDUSTRIAL CHEMISTRY (Classe LM-71 R)
Immatricolati nell'a.a. 2026/2027

HEADING

Degree classification - Denomination and code:	LM-71 R
Degree title:	Dottore Magistrale
Length of course:	2 years
Credits required for admission:	180
Total number of credits required to complete programme:	120
Course years currently available:	1st
Access procedures:	open, subject to entry requirements
Course code:	FBD

PERSONS/ROLES

Head of Study Programme

Luigi Falciola

Tutors - Faculty

Tutor for Teaching Support
Alberto Vertova (Tel. 0250314232 and Vittoria Guglielmi Tel. 0250314426; e-mail: tutoring.chimica@unimi.it)

Tutor for entrance orientation
Francesca Tessore (Tel. 0250314398; e-mail: francesca.tessore@unimi.it)

Tutor for exit orientation
Alessandro Minguzzi (Tel. 0250314224; e-mail: alessandro.minguzzi@unimi.it)

Tutor for Master's Degree admission
Carlo Pirola (Tel. 02503 14283; e-mail: carlo.pirola@unimi.it)

Study plan, transfer and credit recognition tutor
Pierluigi Mercandelli (Tel. 0250314447; e-mail: pierluigi.mercandelli@unimi.it)

Internship and Master Thesis tutor
Paola Fermo (Tel. 0250314246; e-mail: paola.fermo@unimi.it)

Erasmus and international mobility tutor
Emma Gallo (Tel. 0250314374; e-mail: emma.gallo@unimi.it)

Degree Course website

https://sic.cdl.unimi.it/en

International Students Office - Welcome desk

https://www.unimi.it/en/international/coming-abroad/international-students-office-welcome-desk

Referring Department: Department of Chemistry

Via Golgi, 19 - 20133 MILANO http://www.chimica.unimi.it

Representative for SLD and disability

Mariangela Longhi Tel. 0250314226 Email: mariangela.longhi@unimi.it

Student Office

Via Celoria, 18 - 20133 MILANO https://informastudenti.unimi.it/saw/ess?AUTH=SAML

Teaching Office of the Department of Chemistry

Email: didattica.dipchi@unimi.it

CHARACTERISTICS OF DEGREE PROGRAMME

General and specific learning objectives

The first specific training objective of the Master's Degree Course in Sustainable Industrial Chemistry is the training of a graduate specialised in industrial chemical sciences and technologies, who is able to competently apply procedures and protocols proper to industrial chemistry, develop and characterise new products and materials at an industrial level and in a sustainable manner, experiment new technologies and develop new processes characterised by a better environmental footprint, conduct chemical analyses and quality controls, also at the level of prevention, safety and environmental protection, which require full mastery of chemical and instrumental techniques. Furthermore, the master's degree graduate is able to conduct the subsequent processing of the acquired data, prepare reports on the results of the analyses, and carry out laboratory tests and trials for the development of new products, assess the environmental impact of the proposed processes and products.

Even more importantly, graduates with a master's degree in Sustainable Industrial Chemistry are able to develop innovative process schemes and plants for the exploitation of resources, raw materials and renewable energies, for the valorisation of waste and scrap materials, and for energy efficiency, with a view to promoting a circular economy and improving the environmental impact of production processes. All this is incorporated into the training programme with a view to the economic sustainability of the plants designed, so as to ensure their full and real feasibility, introducing the most modern methods of quantifying not only costs but also the main profitability indices of chemical plants. Similarly, sustainability is quantified, proposing logic and metrics for its precise quantification and implementation according to scientific standards. In this context, the master's degree course complies with European standards for the teaching of industrial chemistry, aiming to provide specific skills with particular regard to industrial chemistry disciplines and their applications. Graduates will be able to provide advice on industrial and applied chemistry and carry out any other activity defined by current legislation in relation to the profession of industrial chemist. Another specific objective of the degree course in Sustainable Industrial Chemistry is to enable students to immediately enter the professional world or, if desired, to continue with further higher education (PhD or Master's degree). Therefore, the course aims to provide students with a complete mastery of scientific methods and content in chemistry, with particular attention to issues of environmental, economic and safety sustainability, in order to facilitate smooth entry into the world of work or access to further training.

Finally, industry, including the chemical industry, is increasingly making use of the opportunities offered by artificial intelligence and process modelling in order to improve and optimise production processes, also with a view to greater environmental and economic sustainability. Graduates in Sustainable Industrial Chemistry will acquire basic knowledge of these aspects in the core courses and will be able to deepen their understanding through dedicated optional courses. In particular, the foundations will be laid for the profitable and responsible use of these new tools, with a focus on various machine learning models. In addition, various IT tools will be proposed for in silico process design and optimisation, as well as for the creation of "digital twins".

The Graduates in Sustainable Industrial Chemistry will have:

- specific and in-depth cultural training in the various sectors of industrial chemistry, in its theoretical and experimental aspects, with particular attention to sustainable technologies and the reduction of environmental impact;
- perfect mastery of the scientific method of investigation, which includes the ability to apply innovative analytical methods and techniques, to use complex equipment and mastery in the use of mathematical and IT support tools;
- in-depth knowledge in the field of analysis, design, production and valorisation (also from a circular economy perspective) of molecules of great application interest, enabling them to use advanced and innovative synthesis methodologies and strategies, also taking into account the principles of sustainability (promoting economic and social development) and environmental protection;
- the ability to carry out projects of varying levels of complexity for the transition from laboratory scale to pilot scale to industrial scale for innovative products or processes characterised by lower environmental impact;
- the ability to quantify the economic impact through TEA (Techno Economic Assessment) and LCA (Life Cycle Assessment) analyses of the designed processes and to improve the environmental and economic sustainability of existing processes;
- a good knowledge of the issues involved in industrial-scale separation processes and improving the sustainability of solid, liquid and gaseous emissions from chemical plants;
- the ability to identify innovative biotechnological processes and develop more economical and less polluting methodologies in the field of fine chemistry;
- expertise in the field of electrochemical technologies in various areas of application: analytical, synthetic, energy and environmental, with an innovative and sustainable mindset, capable of addressing the environmental and social challenges of the 21st century;
- understanding of the problems involved in the preparation and use of metallic materials, with particular regard to corrosion and environmental degradation phenomena;
- understanding of the properties and problems associated with the development and transformation of polymeric materials;
- the knowledge necessary to carry out the design of catalysts and catalytic processes and to implement their industrial development in a sustainable and environmentally friendly manner;
- the ability to use English fluently, both written and spoken, in addition to Italian;
- the ability to adapt to the continuous evolution of chemical disciplines and to interact with culturally related professions.

The aim is to train master's degree graduates in Sustainable Industrial Chemistry who are able to:
- work independently, enabling them to hold positions of high responsibility in the implementation of projects and structures in the industrial and research fields;
- develop the skills and knowledge necessary to carry out professional activities in the field of industrial chemistry, personally managing activities such as sustainable design and characterisation of new products and materials, experimentation with new technologies, and development and pilot phase activities, with a view to industrial production;
- operate as sustainability managers in companies or organisations;
- interact in a decision-making capacity with other company departments (engineering, marketing, etc.) involved in the research, development, production and marketing of products, formulations and active ingredients, including those with high added value;
- carry out production or research activities in the field of inorganic, organic and polymeric materials and energy conversion, with particular reference to their preparation and characterisation;
- work in the creative, organisational and operational phases of research in the field of industrial chemistry in public and private laboratories, both European and non-European, research centres, and research and development companies;
- participate in the theoretical and practical development of new technologies in the field of chemistry;
- work in both industry and public institutions to manage facilities, personnel and equipment, and to respond to research, development, production and quality control requirements within the framework of legislative regulations and specific requirements of the various production processes;
- adequately transfer research results and acquired knowledge to end users.

To achieve these objectives, the first year of the master's degree programme includes theoretical and practical training activities specific to the industrial field, which are common to all students. These activities aim to expand on the knowledge acquired in the first-level degree programmes and provide the necessary knowledge to tackle more specific subjects. The second part of the first year will focus on specialised courses that can be selected by students, who can choose to follow a study path that provides them with skills in different chemical fields, distributing the credits to be acquired evenly, or to deepen their knowledge more specifically in certain disciplinary areas, distributing the credits unevenly. The courses provided also give graduates the knowledge they need to develop the ability to study independently and self-directed, through advanced texts and specialist scientific journals in foreign languages.
In the second year of the course, a significant part of the teaching is focused on training for the experimental or project thesis, with the aim of providing students with the necessary skills to work in the field of industrial chemical research through original research work that includes practical experience and technologically advanced knowledge. The work carried out and its quality are assessed through the preparation of a degree thesis written independently by the student, under the guidance of a tutor, and evaluated in a public discussion before a special committee.

Euromaster®.
The Master's Degree Course in Sustainable Industrial Chemistry of the Università degli Studi di Milano has been among the first ones in Italy to gain the EuroMaster Label. The EuroMaster Label is assigned by a special jury purposely appointed by the European Thematic Association (https://ectn.eu/), gathering European universities and chemical societies. The EuroMaster Label certifies the educational qualification provided by the Master Degree Course as a master degree recognized by the European Universities and gives the right to access the post-graduate courses of chemistry at the European level.

Expected learning outcomes

Knowledge and Undersanding
At the end of the master's degree in Sustainable Industrial Chemistry, thanks to front -chair teachings, laboratory teachings, an intense experimental training internship in a research laboratory and interdisciplinary activities, students will have acquired knowledge and understanding of problems in the areas of scientific disciplines and in particular in the context of industrial chemistry, demonstrating familiarity with the approach and the scientific method for the solution of typical problems of the research, development, production, quality control professions and regulatory activities.
In particular, graduates in this course, at the time of achieving the title:
- have in -depth general knowledge in the chemical field, especially in the experimental and application aspects, with particular specialization in the industrial and plant engineering field;
- have in -depth knowledge of industrial chemical processes (also biotechnological), and in particular those relating to the problems related to the research and development of processes for the preparation of active ingredients from the laboratory scale to the pilot system; the principles for the transition to the industrial scale and the problems related to separation processes on an industrial scale;
- have adequate skills in the areas of economics, patents, business management, innovation and legislation in force on safety in the workshops and more generally in the workplace;
- they have adequate knowledge of environmental sustainability and on the management of technological innovation seen as a process based on exviluppo research
These knowledge will also be achieved with the study of advanced textbooks and through the reasoned consultation of the scientific literature, under the guidance of teachers, to achieve those knowledge useful to understand theories and principles on topics concerning the problems relating to the applied chemical sciences and technologies, with particular focus on industrial chemical sphere, which also include the main avant -garde issues. The results achieved will be verified through the

performance of written and/or oral exams, the drafting of scientific relationships, the writing of the labor of thesis and the preparation of a presentation for the discussion of the degree thesis.

Applying Knowledge and Undersanding

The course of studies in Sustainable Industrial Chemistry combines theoretical training with an intense experimental activity in the educational workshops and especially during the experimental training internship of thesis, in order to strengthen the student's awareness in "knowing how to do", forming master's degrees capable of applying professional problems directly and indirectly connected to the industrial chemical sector their interdisciplinary skills and multidisciplinary as well as advanced skills, which demonstrate that mastery and innovation necessary to solve complex and unpredictable problems in its specialized work or study.

In particular, graduates in this course, at the time of achieving the title, are able, with great competence and in complete autonomy:

- to evaluate the imprint of ecological, economic and safety sustainability of a chemical and biotechnological process and to operate for its improvement;
- to design chemical processes and plants characterized by improved environmental and economically sustainable sustainability;
- to carry out synthesis and characterization of complex compounds, using innovative procedures and avant -garde instruments, as well as to evaluate the best methodology for the resolution of analytical problems;
- to design and perform experimental procedures with reference to the synthesis of organic or inorganic compounds and materials of industrial interest carried out through processes that propose those adopted in the chemical industry, underlining the aspects and parameters essential for the study of the passage of scale of the process;
- to identify innovative processes and achieve the development of cheaper and less polluting methodologies in the field of fine and basic chemistry;
- to analyze and process data obtained in the laboratory, with particular reference to the knowledge of plant equipment;
- to design and perform through practical exercises the procedures for compilating Business Plan, the calculation of GDP, economic accounts, situation of the balance sheet and cash flow;
- to develop numerical methods of system or laboratory data analysis in order to perform process optimization and sustainability, especially thanks to artificial intelligence methods, mainly based on machines learning;
- to fill in check list, perform and process economic-financial analyzes of a project, spread patents;
- to evaluate the chemical risk on practical examples and fill in the safety cards of chemicals;
- to apply the new digital tools of machine learning and artificial intelligence for the analysis of experimental data, for the planning of new experiments and for the optimization of industrial unitary processes and operations.

These knowledge will be achieved above all with the attendance to the educational workshops, which will be carried out under the supervision of the teacher of the individual teaching, assisted by co-investigating and assistants, for a widespread assistance in the various experimental procedures. The results achieved will be verified through the compilation of laboratory notebooks and the drafting of relations and laboratory relationships. Finally, the consolidation of these skills will take place during the training internship and the thesis laboratory, which will culminate in the writing of the thesis work for the final discussion.

Making of judgment

The autonomy of judgment and the ability to plan and conduct scientific experiments are developed in the field of experimental laboratory activities provided for in individual teachings, in the seminars organized during the academic year, and in particular in the experimental training training internship of thesis, which ends with the drafting of the degree thesis.

In particular, graduates in this course, at the time of achieving the title, will be able to:

- design and create an experiment in full autonomy, planning its times and methods, also on the basis of the instrumentation available, evaluating and quantifying the final result;
- carry out the passage of scale of chemical systems and the basic project of plant patterns, including the evaluation of the environmental, economic and safety sustainability of the process;
- formulate an analytical problem and propose ideas and solutions, even innovative;
- design the synthesis or formulation of new products, also based in particular on new raw materials and energy sources with reduced environmental impact;
- critically interpret the experimental data by framing specific chemical knowledge in their relationships with other scientific and technical disciplines, detecting any anomalies and inconsistencies in the results;
- find and examine sources of information, data, chemical literature;
- manage with great competence and professional ethics projects, structures and staff, also by identifying new prospects and innovative development strategies.

The verification of the achievement of the autonomy of judgment will be carried out through the assessments of the documents drawn up by the students after the periods of practical laboratory and in more detailed way with the continuous evaluation of the thesis speaker of the degree of autonomy and the ability to work, also in a group, during the course of the degree internship and the drafting of the thesis. The experimental degree thesis is then the subject of the final discussion in front of a special degree commission.

It is also important to evaluate the choice of the teachings proposed by the student on his individual study plan, also chosen under the evaluation of a special Committee .

Communication skills

Graduates of the Master's Degree programme in Sustainable Industrial Chemistry are able to:
- interact with other people, conduct and direct disciplinary and interdisciplinary research activities in collaboration with foreign partners, using the English language;
- coordinate work groups, thanks to the development of interpersonal skills;
- communicate ideas, problems, solutions and results of their research to specialist and non-specialist audiences in English;
- present data through reports and/or presentations, also using cutting-edge multimedia systems;
- acquire, disseminate and disseminate scientific information through the use of online databases and data banks.
These skills are acquired through participation in lectures and laboratory teaching, and in particular during the experimental training internship, a period in which students will interact with other colleagues, PhD students, research fellows, researchers and lecturers, within the activities of international research groups, also participating in 'Group Meetings' where they will present the results of their research and plan the next stages in an atmosphere of collegiality and discussion.
Participation in research seminars organised by the Department of Chemistry and also held by international speakers allows students to further enhance their communication skills, including in English. The acquisition and verification of written and oral communication skills, including in English, are also assessed through the writing of a thesis and its discussion in English before a special Committee in a public session.

Learning skills
The Master's Degree programme in Sustainable Industrial Chemistry is designed to encourage students to develop their potential for independent thinking and study. It aims to further develop their learning skills and help them acquire methodological and theoretical skills and competences that will enable them to easily enter the world of work or continue their studies in PhD or specialisation programmes.
In particular, graduates of the Master's Degree Course in Sustainable Industrial Chemistry:
- are equipped with an aptitude for development and know how to adapt to the evolution of the discipline through the conscious and critical updating of their knowledge, carried out through the use of bibliographic research, databases, archives and other online information, as well as through the acquisition of autonomy that allows them to consult advanced textbooks and specialised journals in the fields of chemistry and related and complementary scientific disciplines (including legal and/or economic disciplines) necessary for the management of complex projects;
- know how to organise and implement an independent study plan;
- have the ability to work towards objectives independently and in a group, reacting positively to problems encountered;
- know how to interact with culturally related professions.
These objectives are achieved through all the activities of the educational programme with forms of continuous assessment that require the presentation of data found independently. In addition, the achievement of learning skills objectives will be assessed in particular by measuring the degree of self-learning acquired during the experimental training internship for the preparation of the final thesis, which is itself the most important element for the assessment of results in this area.

Professional profile and employment opportunities
Typically, the graduates in Sustainable Industrial Chemistry are characterized by the following professional profiles:

INDUSTRIAL CHEMIST
function in a work context:
Industrial chemists design and develop new products and materials with a lower environmental footprint, recycle and repurpose used or waste materials, mainly in the industrial sector, and define production and control criteria that also take into account the reduction of environmental impact and promote sustainable economic and social development. They define strategies and procedures for the synthesis, transformation, recovery (also with a view to the circular economy) and purification of chemical compounds, techniques for chemical and physical analysis, and scientific methods of investigation and data management. They may carry out activities to promote and develop scientific and technological innovation, as well as manage and design technologies, also taking into account the principles of sustainability and environmental protection, and exercise functions of high responsibility in the fields of industry, the environment, health, cultural heritage and public administration, as well as in all areas of ?green? chemistry for environmental protection and to promote energy transition.

skills associated with the function:
Industrial chemists have specialist knowledge of chemistry, industrial chemistry and chemical plant engineering, as well as the synthesis of new products and materials and their scale-up. They understand the principles of sustainability and the impact of human activity on the environment.
They also have considerable expertise in chemical analysis methods using current information technology and are proficient in English.

career opportunities:
Industrial chemists can work in public and private research institutions, public administrations, professional firms and national or international consulting firms, companies, industries and research laboratories. They can find employment in the basic chemical industry, fine chemicals, research and development laboratories and, in general, in work environments that require in-depth knowledge of industrial chemistry and chemical plant engineering and high qualifications. In the public sector, industrial chemists can work in the technical and environmental offices of local authorities, in provincial hygiene and prophylaxis laboratories and/or in occupational accident prevention services. Freelance work is generally carried out as a consultant for design, plant management, environmental authorisation procedures and risk analysis, as well as in courts to

carry out technical and legal assessments relating to damage to plants or the environment. In addition, graduates with a master's degree in Sustainable Industrial Chemistry can continue their studies in doctoral programmes or specialisation schools in the scientific field.

HEAD/DIRECTOR OF THE REASEARCH AND DEVELOPMENT LABORATORY
function in a work context:
the Research and Development Laboratory Manager/Director directs research activities for the creation and development of new industrial products and the improvement of related processes, in line with company strategies for environmental, energy and economic efficiency and operational safety. manages the research and production sectors and provides guidance for the constant updating of the company's technological assets; assigns the necessary technical resources to the various projects, proposing investments in research and formulating the relevant budgets. He/she also tests and inspects the chemical production plants, ensuring their safety and verifying that products, processes and formulations comply with current regulations and safety standards.

skills associated with the function:
in addition to in-depth knowledge of industrial chemistry, plant engineering and management tasks, this professional figure must have specialist knowledge of issues related to chemical synthesis and scale-up, as well as safety regulations and relevant legislation. They are able to set up research plans and carry out the necessary tests and experiments, choosing the methods, means and timing; they are competent in issues relating to the implementation of research projects in terms of time and cost and know how to process, interpret and evaluate the experimental results obtained. Positions as head and director of a research and development laboratory also require management skills, autonomy and responsibility, together with a good command of current information technology and English.

career opportunities:
this professional can find employment in work environments that require high qualifications, such as research and development laboratories in private chemical, chemical-pharmaceutical, petrochemical, cosmetics, food, plastics, formulations, dyes, detergents, adhesives companies or those operating in the environmental field.

CHEMICAL PLANT DIRECTOR/OPERATOR
function in a work context:
the Chemical Plant Operator is the professional figure who, within a chemical industry, ensures, directly and through the service structures, the management of the production plants, the level of efficiency and the availability of the plants necessary to allow the achievement of the objectives in terms of production volume, production cost, quality level, work safety and environmental protection. In particular: he/she manages the progress of the processing phases, from preparation to dosing; he/she controls the different phases of the product being processed; he/she takes care of the loading and unloading of raw materials and finished products; he/she diagnoses faults and anomalies in the operation of the plants and also takes care of the waste treatment and elimination processes according to current legislation.

skills associated with the function:
this professional figure must have specialized knowledge of industrial chemistry, plant engineering and problems related to products, raw materials and processes. He/she knows the problems and methods related to quality control, has a good knowledge of the safety standards and procedures for the management of plants, including automated ones. The position of plant manager also requires management, relational, autonomy and responsibility skills together with good competence in the use of current information technologies and English Language.

career opportunities:
the Director/operator of chemical plants finds employment in work environments that require high qualifications in production plants of private chemical, chemical-pharmaceutical, petrochemical, cosmetic, food, plastic materials, formulations, colorants, detergents, and building additives companies.

PRODUCTION MANAGER
function in a work context:
the Production Manager follows the operation of the plants in compliance with safety and the environment, according to the production plan and in function of the market needs and takes care of everything that is necessary for their safety. He/she collaborates in the study of solutions for the continuous improvement of the reliability and energy efficiency of the plants. Furthermore, he guarantees the supplies to the customers in terms of quality, compliance with the specifications and safety.

skills associated with the function:
this professional figure must have knowledge of industrial chemistry and problems related to the procedures and techniques of producing goods and services (chemical products, raw materials, processes). He/she must also be an expert in quality control and have good knowledge of safety and environmental sustainability standards and procedures, to be applied within the production departments. Plant management skills are also required, as well as skills that allow to interact effectively with others. Finally, the professional figure requires good competence in the use of current information technologies and the English language.

career opportunities:
the Production Manager can find employment in work environments that require high qualifications in private chemical, chemical-pharmaceutical, petrochemical, cosmetic, food, plastic, formulation, dye, detergent and building materials companies.

SCIENCE INFORMER AND COMMUNICATOR
function in a work context:
this graduate increases scientific knowledge in the chemistry field, uses and transfers this knowledge in industry, medicine, pharmacology and other production sectors. He/she spreads to operators in the industrial field the characteristics and properties of his company's products. The function of the scientific informer and communicator is to propose the adoption of specific products, develop the scientific information activity at the interested companies to ensure their correct use.

skills associated with the function:
the skills skills required of a scientific representative in the performance of their work consist not only of scientific knowledge, but also commercial skills. In particular, they must have: a good basic knowledge of chemistry, knowledge of pharmaceutical, cosmetic and food products and their correct use. Knowledge of technical English, information technology and communication abilities complete this professional profile.

career opportunities:
scientific informants work for cosmetics, pharmaceutical, food, plastics, dye, detergent and glue companies, or companies operating in the environmental sector, or in general for all companies in the chemical sector and/or for specialist magazines.

SUSTAINABILITY MANAGER
function in a work context:
this graduate uses the skills acquired to analyse the sustainability footprint of production processes, to identify areas for improvement in compliance with process constraints and legislative standards. The professional's role also includes drafting the sustainability plan and implementing it in the company's production logic, with a view to continuous improvement.

skills associated with the function:
the skills required of a scientific representative in the performance of their work consist not only of scientific knowledge, but also commercial skills. In particular, they must have: a good basic knowledge of chemistry, knowledge of pharmaceutical, cosmetic and food products and their correct use. Knowledge of technical English, information technology and communication skills complete this professional profile.

career opportunities:
sustainability managers work for cosmetics, pharmaceutical, food, plastics, dyes, detergents and adhesives companies, or companies operating in the environmental field, or in general for all companies in the chemical and/or manufacturing sector and/or for public or private research bodies and institutes.

The Master's Degree in Sustainable Industrial Chemistry constitutes a preferential title to access the PhD programmes in the area of industrial chemistry. For the graduate of this class, enrolment in the National Federation of the Order of Chemists and Physicists is possible, after passing the State Exam.

Pre-requisites for admission

Requirements and knowledge required for access
The curricular prerequisites to access the Master?s Degree Course in Industrial Chemistry are those peculiar of the L-27 class of degree courses, and in particular:
- at least 20 credits in disciplines of mathematics (from MAT/01 to MAT/09), physics (from FIS/01 to FIS/08) and information technology (INF/01; ING-INF/05);
- at least 70 CFU in discipline groups belonging to the distinguishing areas included in the L-27 Class Table (Analytical and Environmental chemistry - CHIM/01 and CHIM/12; Inorganic and Physical chemistry - CHIM/03 and CHIM/02; Industrial chemistry and engineering - CHIM/04, CHIM/05, ING-IND/21-22, ING-IND/25; Organic chemistry and Biochemistry CHIM/06- BIO/10-12).
Moreover, also a minimum English language proficiency at minimum level B2 within the Common European Framework of Reference for Languages (CEFR) is required.

The above disciplinary credits are fully recognized to graduates of the undergraduate programs of Class L-27 of the Università degli Studi di Milano. All other students must demonstrate to have the curricular requirements of the graduates of the class L-27. Different curricular profiles will be evaluated by the Admission Commission.

Methods for verifying knowledge and personal preparation
Before the enrolment knowledge assessment, students must submit an application for admission, through an online procedure, during the period and according to the methods indicated on the website https://industrialchemistry.cdl.unimi.it/en/enrolment where it is also possible to find all the updated information on the admission and subsequent enrolment procedures. Graduates who intend to graduate by December 31, 2026 may also submit

an application for admission.

The verification of knowledge and personal preparation will be verified through an interview with the Admission Commission, composed by teachers appointed by the Teaching Council, who will ascertain student personal skills on topics related to fundamental aspects of core chemistry disciplines of the degree in Industrial Chemistry. The failure of the interview prevents the access to the MSc in Sustainable Industrial Chemistry for the current year.
The interview is scheduled in June, July, September and December and can be carried out before graduation, subject to the possession of the curricular requirements indicated above.
For non-EU students, who may have visa and/or residence permit problems, an interview will also be scheduled in May. Furthermore, it will be possible for them to schedule the interview remotely using a videoconferencing platform. It is recommended to all foreign students to take advantage of this early-bird possibility to avoid problems in obtaining all the documentation useful for the enrolment.

FOR A BETTER TEACHING PLANNING ALL CANDIDATES, INCLUDING THOSE EXPECTING to graduate before December 31st, 2026, ARE STRONGLY SUGGESTED TO APPLY FOR the INTERVIEW in July or September.

MOREOVER, proficiency in English at level B2 or higher according to 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:
- Valid language certificate at B2 level or higher, issued no more than three years before the application date. The list of language certificates recognized by the University is available 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 application date, including levels based on language certificates submitted by the applicant during their Bachelor?s degree at the University of Milan. Verification will be carried out automatically, no documents need to be uploaded.
- Entry test administrated by the University Language Centre (SLAM) according to the calendar published on the website: (https://www.unimi.it/en/node/39267/)
Applicants 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 submit it to SLAM via the InformaStudenti service by the deadline set by the master?s degree programme (https://www.unimi.it/en/node/39267/).
Applicants who fail to meet the requirement by said deadline will not be admitted to the master's degree programme and may not sit any further tests.

Finally, graduates who have successfully passed the verification interview will be able to ENROL after 5 working days from the date of the verification, within the terms indicated on the website https://www.unimi.it/en/study/bachelor-and-master-study/degree-programme-enrolment/enrolment-masters-programme

Programme structure

Programme structure

Methods of teaching and its articulation
The Master's degree course in Sustainable Industrial Chemistry is structured over two years (duration of the CdS). The teaching is organized for each year of the course in two coordinated cycles, conventionally called semesters, with a minimum duration of 13 weeks each.
All teaching activities (lessons, exercises, laboratory activities, seminars, research activities) are computed in CFU (Crediti Formativi Unitari - Credits). To graduate, students must acquire 120 CFU.
1 CFU corresponds to 25 hours of study of the student, and precisely:
- for lessons: 1 CFU corresponds to 8 hours of teaching and 17 hours of individual study;
- for exercises and laboratory activities: 1 CFU corresponds to 16 hours of practical activities and 8 hours of individual study;
- for lab stages and thesis laboratory: 1 CFU corresponds to 25 hours of lab work.

The training activities consist of teaching courses, numerical and laboratory exercises, seminars, teaching activities in small groups, free courses, participation in seminars, conferences, conventions, research activities relating to the research thesis, bibliographic research activities. The teaching courses can be organized in modules. The course includes the passing of curricular exams, according to the study plan presented by the student, for a total of 81 CFU, as well as the carrying out of a period of experimental stage (15 CFU) and the final thesis laboratory with final dissertation (24 CFU) to be carried out in the research laboratories of the Chemistry Department at the Università degli Studi di Milano or at other research facilities, at the Università degli Studi di Milano or other universities, or at public research centres with adequate facilities. A university tutor, the thesis supervisor, will guarantee the quality level of the aforementioned activities. The work performed is ascertained through the preparation and discussion of the final degree thesis.

Teaching Courses articulation
The Courses, totally held in English Language, have a semester duration. For each of them, lectures, practical exercises and/or laboratory hands-on activities, also taught with the help of the most modern teaching technologies, are provided. Specific information on the individual courses is provided on the CdS website and annually on the respective MyAriel websites, which can be accessed with the University e-mail credentials.

Procedures for enrolment in lab activities
Students must enrol to Laboratory Activities according to the times and modalities indicated by the teachers of the individual courses, reported on the MyAriel sites of each course.

Presentation of the study plan (methods and deadline for submission)
To favour the planning of the educational activities, and to offer to the students a disciplinary orientation service, preliminary to the Admission Interview students are asked to fill a preliminary study plan, according to the dates that will be communicated on the CdS website, that will be discussed during the Interview.

Subsequently, it will be necessary to present the OFFICIAL study plan, which is mandatory. This study plan - which may also differ from the preliminary one - must be submitted in the first year of the course: the deadlines and methods of submission are made known by the Student Secretariat Management with notices published on the page https://www.unimi.it/en/study/bachelor-and-master-study/following-your-programme-study/plan-study
After approval of the study plan, the student can independently take further additional exams with respect to his/her educational path.

The official study plan may be modified, if needed, in the subsequent years, but ONLY in specified periods, as indicated by Segreteria Studenti. The submission/modification of study plan is NOT ALLOWED outside the fixed dates and by students not enrolled for the academic year.

For suggestions and problems with the selection of the Courses for the Study Plan, students may contact the Tutoring Commission (tutoring.chimica@unimi.it) or the Studi Plan Commission (pierluigi.mercandelli@unimi.it).

For the admission to the final exam, the list of passed exams must correspond to the last approved official study plan. When applying for the admission to the final exam, in the case of discrepancy between the student's educational career and the relevant study plan, the student cannot be admitted to the final exam. For support and enquiries about the effective correspondence between passed exams and courses selected in the study plan students may refer to Teaching Office at the Department of Chemistry.

Teaching Agenda
Lessons take place as follows:
- 1st Semester: September 28th, 2026 – January 22nd 2027
- 2nd Semester: March 1st, 2027 – June 18th 2027

Any changes to the start and end dates of the semesters, which may be necessary when compiling the timetables, will be promptly communicated on the CdS website.

Lessons timetable
The lessons' timetable can be consulted at the link:
https://www.unimi.it/en/study/bachelor-and-master-study/following-your-programme-study/course-timetables
or using the ANDROID app LezioniUNIMI, available and downloadable at the link indicated above.
Exams (exam sessions and methods of profit assessing)
For each course at least one exam session is scheduled for each of the following months: February, June, July, September, and January. Extra sessions might be scheduled in November and at the end of the Easter holidays.
The schedule of the examination sessions for the assessment of the learning outcomes is available through the online UNIMIA services or at the website: https://www.unimi.it/en/study/bachelor-and-master-study/following-your-programme-study/sitting-exams/exams-calendar

Exams registration
To register for an examination, the student must enrol for the relevant session, through the online UNIMIA services (http://unimia.unimi.it/portal/server.pt)
Detailed information on the exam organization can be found at:
https://www.unimi.it/en/study/bachelor-and-master-study/following-your-programme-study/sitting-exams

Before (or contextually with) the exam enrolment the student must fill the online questionnaire for the evaluation of the relevant course. It is strongly recommended that you complete the questionnaire by the end of each course, even if you do

not intend to take the exam immediately. The application guarantees anonymity.

Contextually with the exam enrolment, the student career is checked via the information system. It is strongly suggested to check the effective enrolment for the selected exam via the UNIMIA services (https://www.unimi.it/en/study/student-services/technology-and-online-services/unimia). Students are reminded that enrolments, as well as cancellations, for exam sessions generally close five days before the exam date.

Exams recording
Exams and tests are recorded electronically. Only the students correctly enrolled via the UNIMIA online services are allowed to take exams.
It is mandatory that, before any exam or test, the board of examiners verifies the personal identity of the candidate, who must exhibit a valid identification document. No student can be allowed to take any exam or test in the absence of an identification document and the University Badge.

Special instructions
- To take any exam or test, the student must have fulfilled the payment of taxes and contributions, must have passed possible propaedeutic exams, must have all the attendance certificates, where requested.
- It is forbidden to retake an already passed exam, even in the case of educational activities recorded in a previous career. The violation of the above rules implies the annulment of the exams by Rectoral act.
- All the exams must be taken in English language

Tutoring
The task of advising and guiding students in their university studies is entrusted to a special tutoring commission, which can be contacted by e-mail at: tutoring.chimica@unimi.it.
This Commission will be introduced to students during a meeting that will be held during the first semester.
Students are recommended to often visit the Degree Course website (https://sic.cdl.unimi.it/en) and to regularly consult the assigned institutional e-mail address, to stay up to date on all communications and initiatives that concern them.

Language test / computer literacy test
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 through http://studente.unimi.it/uploadCertificazioniLingue ;

- 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.

Compulsory attendance
Attendance to laboratory activities is mandatory, in all other cases it is strongly recommended.

Internship criteria
Laboratory stage and Research Thesis Laboratory characteristics
In the second year of the course, an experimental internship (15 CFU) is expected, followed by a thesis laboratory (24 CFU), preparatory to the preparation of the degree thesis, which consists of a written dissertation on original industrial chemistry research carried out by the student, under the guidance of a Supervisor and, if necessary, a Co-Supervisor and carried out in the research laboratory specified in the application for admission. The duration of the experimental internship and the thesis laboratory is at least one calendar year, including attendance of the courses scheduled in the same year.

The Master Thesis could be:
- Internal Experimental Thesis
- External Experimental Thesis

The Internal Experimental Thesis are carried out at the Department of Chemistry of the Università degli Studi di Milano or in other Departments belonging to the Faculty of Sciences and Technology. As part of these internal thesis, in agreement with the thesis supervisor, it will be possible to carry out internships at public or private entities or companies, under the guidance of an external supervisor. The duration of the internship may correspond to a maximum of 20 CFU, even in non-continuous periods. These internship periods must in any case be approved by the Teaching Council of the Chemistry Department.

The External Experimental Thesis are carried out at other university structures, at other public Institutions or at highly

qualified public and private (non-profit) research centres, with adequate facilities and personnel capable of adequately supporting the research. The possibility of an external Thesis is evaluated, case by case, by the Teaching Council of the Department of Chemistry.
To apply for an External Thesis the following documents must be provided:
- justification of the application to an external experimental thesis (one printed page) signed by the student and undersigned by the Supervisor (an Official Supervisor, according to the rules further below);
- detailed research plan (one printed page);
- a declaration of the referent person of the hosting structure about the availability to host at no-cost the student and to guarantee the use, free-of-charge, of any facility and instrumentation.
The applications must be submitted well in advance, to obtain the approval of the Teaching Council. Please consult in advance the Thesis Commission and the Rules you can find on the Course website.

Students on internships at external organizations or companies and students in external experimental thesis are required to report on a fortnightly basis, to the supervisor and to another competent teacher, appointed by the Thesis and Internship Commission after consulting the supervisor, on the experience and activities conducted outside the Department.

The Master Thesis Supervisor (Relatore) is responsible to the Teaching Council for the scientific research activity assigned to the student and for its correct execution. The Professors and Researchers in chemistry, afferent to the Teaching Council or to the Department of Chemistry or other Departments of the Faculty of Science and Technology, are eligible as Supervisors. The Supervisor can be assisted by a maximum of two co-tutors.
In addition to all the Professors and Researchers, the following people are eligible as co-tutors of Master Thesis:
- Professors and Researchers of other Universities and Polytechnic Schools, in Italy and abroad;
- persons with the Master Degree, with a recognized activity as experts;
- the employees of Università degli Studi di Milano, enrolled as non-teaching personnel at D level or higher and having a recognized activity as experts;
- the National Research Council (CNR) Researchers working within the Department of Chemistry;
- the experts selected by the hosting institutions as referents for External Thesis.
For any other case, the Teaching Board will consider the scie

Degree programme final exam

To be admitted to the final exam, the student must have passed all the exams required by the study plan.
The final exam consists in the discussion of the degree thesis in front of a specific Commission of the Teaching Council. The thesis must be of a theoretical and/or experimental nature making an original contribution to scientific knowledge in the industrial chemistry field. The Degree Thesis has to be written in English. The preparation of a summary in English (maximum 5 typed pages) is also required, to be delivered according to the timing indicated on the website:
https://sic.cdl.unimi.it/en/study/graduating

SESSIONS FOR FINAL DEGREE EXAMS
- July 2027
- October 2027
- December 2027
- February 2028
- April 2028

EXPERIENCE OF STUDY ABROAD AS PART OF THE DEGREE 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

Students enrolled in the Sustainable Industrial Chemistry course are encouraged to apply to the Erasmus + actions, where various positions are available in 20 European universities. They can earn their credits by following courses and/or by

performing part of their experimental thesis abroad. Before leaving, students must submit a Learning Agreement to be approved by the Teaching Board: this approval is mandatory for the acquisitions of the credits.

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

ADMISSION CRITERIA: 1ST YEAR OPEN, SUBJECT TO ENTRY REQUIREMENTS

Application and enrolment information and procedures

Application and enrolment information and procedures
For information, methods and access requirements, see the "Pre-requisite for admission" paragraph at the beginning of the document.
The procedures and deadlines for registration will be indicated in the competition notice published on the University website at the page https://www.unimi.it/en/study/enrolment

Links to enrolment information and procedures

https://www.unimi.it/en/study/bachelor-and-master-study/degree-programme-enrolment/enrolment-masters-programme

N° of places reserved to non-EU students resident abroad

40

1st COURSE YEAR Core/compulsory courses/activities

Scheduling	Learning activity	Module/teaching unit	Ects	Sector
1 semester	Advanced industrial chemistry with lab		9	CHEM-04/A
1 semester	Chemical processes and industrial plants		6	CHEM-04/A
1 semester	Economics and management		6	ECON-07/A
		Total number of compulsory credits/ects	21	

Elective courses

TABLE 1 - ELECTIVE 9 CFU COURSES
Student must earn 9 credits by selecting 1 of the following courses

2 semester	Advanced functional materials for industrial applications with lab		9	CHEM-03/A
2 semester	Applied organic chemistry with lab		9	CHEM-05/A

2 semester	Chemical technologies for the energy transition with lab		9	CHEM-02/A

2nd COURSE YEAR (available as of academic year 2027/28) Elective courses

STUDENTS MUST ACQUIRE 3 CREDITS according to the following rules:
1) students holding an Italian high school diploma or university degree must obtain 3 credits in Chemical regulation and legislation;
2) students not holding an Italian high school diploma or university degree must obtain 3 credits ALTERNATIVELY in Chemical regulation and legislation or in Additional language skills: Italian. More information is provided in the "Language test" paragraph above.

	Additional Language Skills: Italian (3 ECTS)		3	NN
year	Chemical regulation and legislation		3	NN

Further elective courses

TABLE 2 – ELECTIVE 6 CFU COURSES A
Student must earn 6 credits by selecting 1 of the following courses

1 semester	Advanced methods in organic synthesis *(borrowed from LM in Chemical Sciences - Class LM-54 R)*		6	CHEM-05/A
1 semester	Catalytic methodologies in organic synthesis *(borrowed from LM in Chemical Sciences - Class LM-54 R)*		6	CHEM-05/A
1 semester	Concepts and methods in organic synthesis		6	CHEM-05/A
1 semester	Environmental electrochemistry		6	CHEM-02/A
1 semester	Formulation science and technology		6	CHEM-02/A
1 semester	Nanotechnology for advanced materials		6	CHEM-03/A
1 semester	Technology-driven organic synthesis *(borrowed from LM in Chemical Sciences - Class LM-54 R)*		6	CHEM-05/A
2 semester	Analytics for chemical industry		6	CHEM-01/A
2 semester	Environmental control and sustainability management		6	CHEM-01/A
2 semester	Heterogeneous catalysis		6	CHEM-02/A
2 semester	Machine learning for chemical sciences and industry		6	CHEM-02/A
2 semester	Metal science and corrosion		6	CHEM-02/A
2 semester	Polymorphism and crystal forms in industry *(alternated activation; activated in 2026/2027)*		6	CHEM-03/A
2 semester	Recovery and recycling of critical materials and chemicals for waste management		6	CHEM-03/A
2 semester	Sustainable synthetic methodologies in homogeneous catalysis		6	CHEM-03/A
2 semester	Synthetic methods in biotechnology		6	CHEM-05/A

TABLE 3 – ELECTIVE 6 CFU COURSES B
Student must earn 12 credits by selecting 2 courses from TABLE 2 or TABLE 3

1 semester	Plastics Degradation and its environmental impact		6	CHEM-04/A
1 semester	Polymer testing and analysis		6	CHEM-04/A
1 semester	Recycle and Life Cycle Assessment (LCA) of products and processes		6	CHEM-04/A
2 semester	Process Development		6	CHEM-04/A

TABLE 4 – ELECTIVE 6 CFU COURSES C
Student must earn 6 credits by selecting 1 course from TABLE 4

1 semester	Design and Optimization of Chemical Plants		6	ICHI-02/A
1 semester	Fermentation biotechnology *(borrowed from MD in Biotechnology for the bioeconomy - Classe LM-7 R)*		6	CHEM-07/C
1 semester	Industrial Processes and Scale-up		6	ICHI-02/A
1 semester	Patents and management of innovation *(borrowed from LM in Chemical Sciences - Class LM-54 R)*		6	ECON-06/A
2 semester	Chemistry digitalization for industry 4.0		6	ICHI-02/A
2 semester	Medicinal Chemistry *(borrowed from LM in Chemical Sciences - Class LM-54 R)*		6	CHEM-07/A

TABLE 5
Student must earn 12 credits by selecting 2 related and integrative courses from TABLE 5

1 semester	Energy economics *(borrowed from MD in Environmental and food economics - Classe LM-76 R)*		6	ECON-01/A
1 semester	Programming for Chemistry *(borrowed from LM in Chemical Sciences - Class LM-54 R)*		6	INFO-01/A
2 semester	(Bio)nanotechnology *(borrowed from LM in Chemical Sciences - Class LM-54 R)*		6	PHYS-03/A
2 semester	C language programming *(borrowed from LM in Chemical Sciences - Class LM-54 R)*		6	INFO-01/A
2 semester	Chemical safety		6	GIUR-04/A
2 semester	Chemometrics *(borrowed from LM in Chemical Sciences - Class LM-54 R)*		6	STAT-01/A
2 semester	Information Technology *(borrowed from BD in Communication and Society - Classe L-20 R)*		6	INFO-01/A
2 semester	Protein biochemistry *(Borrowed from MD in Molecular biology of the cell - Classe LM-6 R)*		6	BIOS-07/A
2 semester	Protein engineering and molecular enzymology *(Borrowed from LM in Molecular biotechnology and bioinformatics - Classe LM-8 R)*		6	BIOS-07/A
2 semester	Technological properties of minerals, cements and ceramics *(Borrowed from LM in Scienze della terra - Classe LM-74 R)*		6	(3) GEOS-01/D, (3) GEOS-01/A

********* FREE CHOISE ACTIVITIES *********

The student must earn 12 credits by choosing freely between all the activated activities offered by the University (even if they are held in Italian), provided their consistency with the educational project, which will be validated by the Educational Plans' Commission. In the case of activities held in Italian language, the exam could be taken in English or Italian, according to student choice.

However, the Teaching Council suggests using the courses of the Master Degrees in Sustainable Industrial Chemistry or Scienze Chimiche, consistent with the educational project.

End of course requirements

year	Experimental research stage		15	NN
year	Thesis work and final dissertation		24	NN
		Total number of compulsory credits/ects	39	