Politecnico di Torino

ACADEMIC REGULATIONS

Master's degree programme

in

CHEMICAL AND SUSTAINABLE PROCESSES ENGINEERING

Department of Applied Science and Technology

Collegio di Ingegneria Chimica e dei Materiali

Academic Year **2025/2026**

The English translation of this document is provided as a support to the student community and has no legal effects. The Italian version shall constitute the sole authentic text and will be referred to for any legal matters.

SUMMARY

Art. 1 – Specific learning objectives and career prospects

1.1 Specific learning objectives

The Master's degree programme in *Chemical and Sustainable Processes Engineering* aims to train engineers who can drive technological innovation in the process industry—particularly in the chemical, pharmaceutical, environmental, energy, biochemical, biotechnological, food, and advanced materials sectors—by developing sustainable chemical-physical processes. These processes are designed to reduce or eliminate the use and generation of hazardous substances, thus preventing chemical risks and environmental pollution at their source.

The programme has the specific goal of enabling graduates to carry out the following activities:

- select and design individual process equipment, with particular focus on separation processes and chemical reactors;
- develop and optimise innovative industrial processes that are sustainable in terms of environmental impact, raw material management, waste production and safety, applying the principles of the circular economy;
- define control systems for complex chemical-physical processes (non-linear phenomena, fluid dynamics with chemical reactions);
- analyse existing chemical-physical processes to identify changes aimed at improving profitability and/or sustainability;
- assess risks and manage safety and environmental protection for equipment and plants in the process industry;
- operate and maintain multifunctional plants in the process industry;
- apply scientific theories and methods for the mathematical modelling and/or numerical simulation of complex chemical-physical systems involving transformations of matter or energy, adopting both macroscopic and molecular approaches;
- use methodological, technological and engineering knowledge to identify and solve complex problems in the process industry through an interdisciplinary approach;
- plan and conduct complex experiments to validate hypotheses and/or mathematical models of chemical-physical processes, equipment or industrial plants.

1.2 Career prospects

The Master's degree programme aims to train a variety of professional profiles. The career prospects and the main functions and competencies associated to each profile are illustrated below.

Professional profile	Main functions and competencies
Process Engineer	Functions: Graduates in Chemical and Sustainable Processes Engineering have the theoretical knowledge and methodological skills to assess the development of industrial processes and the design of process equipment and plants. They can work in companies, public or private organisations, where they: 1 contribute to the design of components, machines and production plants in the manufacturing industry; 2 support the development and management of control systems for industrial plants, optimising productivity, quality and safety; 3 use simulation methods, define protocols and supervise production operations; 4 contribute to quality control in both processes and final products and support product commercialisation. Process engineers also have the necessary skills to manage and optimise process plants and to monitor technical aspects related to safety and environmental protection. Thanks to this expertise, chemical engineers can: • manage industrial plants for the production of chemicals, pharmaceuticals, food and for the energy generation, distribution and use; • manage facilities for pollution control, flue gas treatment, waste disposal, water purification and soil remediation. In addition, the broad training of Master's graduates enables them to manage QHSE (Quality, Health, Safety and Environment) aspects in the workplace, safety in high-risk industries and environmental

	protection. Competencies: This professional profile requires strong foundations in chemical engineering, integrated with the advanced knowledge provided during the Master's programme: analysis and development of sustainable chemical processes, process control, safety and reliability, procedures for operating process industry plants. Further skills include assessing the safety of chemical processes and plants, as well as ensuring product quality. QHSE engineers are expected to apply all the competencies acquired in the programme, including advanced engineering skills (e.g. numerical methods for problem-solving, structural mechanics and thermal machines) and specific chemical engineering skills. Potential employers: • Manufacturing companies in the process industry and in other sectors such as mechanical, automotive, aerospace, electronics, biomedical, etc. • Consulting firms and professionals serving companies, public authorities, courts, and other organisations • Consulting companies operating in the areas of quality, safety and the environment • Public and private organisations.
Design Engineer	Functions: Graduates in Chemical and Sustainable Processes Engineering are equipped with the theoretical and methodological tools required for designing unit operations and basic equipment for the chemical and process industry. In particular, they can: 1) support the definition of production and transformation processes, as well as the design of industrial and energy plants; 2) carry out modelling and design of fluid transport networks, heat exchangers, reactors, concentrators, separators, and general-purpose equipment for the process industry; 3) contribute to data collection and analysis aimed at ensuring process and plant safety; 4) participate in the design of components, machines, and production plants in the manufacturing sector. They also have the skills to manage, control and optimise plants and processes, as well as to monitor technical aspects of safety and environmental protection. Competencies: The foundational knowledge enables adaptability across different functions and application fields. This role requires both the advanced engineering knowledge acquired during the Master's degree programme —numerical methods, structural mechanics and thermal machines—and the specific knowledge of chemical engineering: sustainable process development, chemical process control, safety and reliability, and plant operation. Proficiency in design and simulation software is also expected. Potential employers: • Manufacturing and service companies in the process industry (chemical, petrochemical, food) and in other sectors such as energy production and agriculture. • Design firms • Public and private organisations • Consulting firms and professionals serving companies, public authorities, courts, and other organisations.

Research and Development Engineer (Industrial Researcher)	Functions: Master's-level chemical engineers working in research and development are involved in the conception, development and design of new plants, processes and control systems to be implemented in new or existing facilities, with the aim of maximising both economic and environmental sustainability, as well as health and safety in industrial and environmental contexts. Competencies: This role requires a broad set of skills that includes knowledge of innovative processes, technologies and materials. R&D engineers apply both the advanced engineering knowledge acquired in the Master's degree programme—especially numerical methods for engineering problems and the use (and potential innovation) of design and simulation software—and specialised chemical engineering skills such as sustainable process development, chemical process control, safety and reliability, and process plant operation. Potential employers: • Research centres and innovation-driven companies.
Laboratory Manager	Functions: Graduates in chemical engineering may work in R&D or industrial laboratories, where they supervise laboratory operations and organisation. Their responsibilities include coordinating technical staff, selecting and purchasing reagents and laboratory materials, managing project archives and ensuring proper maintenance of equipment. Competencies: Laboratory managers are responsible for all stages of product/process development, from design and prototyping to small-scale production. They are familiar with product design and manufacturing technologies, capable of selecting raw materials and processes based on cost-performance optimisation, and skilled in operating laboratory equipment and simulation software. They also possess strong process control skills for managing lab and pilot-scale facilities. Potential employers: Research and development laboratories, test and measurement centres, system and component characterisation facilities, in both public and private companies and research institutions.
Technical Sales Engineer	Functions: Chemical engineers in technical sales support clients throughout the entire process—from defining specifications to sales and after-sales services—related to chemical and transformation products, as well as equipment, plants and services. They organise and conduct presentations and system demonstrations at trade fairs or client premises. Competencies: Client relationships—whether with individuals, companies, or institutions—require both technical expertise and strong communication and sales skills. Engineers working in this role have a solid understanding of plant and equipment technologies, product properties, reliability, maintenance, performance and energy consumption. They also have excellent interpersonal skills. This profile builds on both the advanced engineering knowledge from the Master's programme—structural mechanics, sustainable process development, chemical process control, safety and reliability—and communication abilities. Potential employers: • Manufacturing companies in the process industry and other sectors • Design firms • Providers of quality, environmental, and safety services

Preparation for continuing Studies	Knowledge required for continuing studies
PhD Programmes	Aptitude for advanced studies: Students with a particular interest in research—whether theoretical or applied—can use the Master's degree programme as a training ground to assess their aptitude for a three-year PhD programme. The final thesis, as well as many optional courses, provide exposure to advanced topics that can serve as a bridge to PhD research. Competencies: In-depth theoretical knowledge in physical chemistry, biochemistry and industrial biotechnology, fluid dynamics, reactor engineering, catalysis, innovative chemical processes, and energy recovery. Strong analytical and synthesis skills in tackling complex problems, the ability to communicate knowledge effectively and a critical mindset.

1.3 Professional profiles (ISTAT codes)

With reference to the list of professional profiles classified by ISTAT (Italian National Institute of Statistics, https://www.istat.it/en/), graduates from this Master's degree programme can work as:

ISTAT code	Description
2.2.1.5.1	**Ingegneri chimici e petroliferi**

Art. 2 – Admission requirements

Italian regulations on enrolment in Master's degree programmes require Italian universities to check that applicants meet the following requirements:

- have a three-year Bachelor's degree or university diploma, or other educational qualification obtained outside Italy and recognized as suitable for admission;
- meet specific curricular requirements;
- have an academic performance considered suitable for admission;

CURRICULAR REQUIREMENTS

As far as curricular requirements are concerned, applicants must have a Bachelor's degree or a three-year university diploma, or an educational qualification obtained outside Italy and recognized as suitable for admission. In addition, they must have gained specific knowledge and competencies during their previous academic path (credits in specific Scientific Disciplinary Fields).

In particular, applicants must have earned:

- minimum 40 credits earned in the following Scientific Disciplinary Fields (settori scientifico-disciplinari): CHIM/07, FIS/01, FIS/03, ING-INF/05, MAT/02, MAT/03, MAT/05
- minimum 60 credits earned in the following specific Scientific Disciplinary Fields (settori scientifico-disciplinari): BIO/11, ICAR/01, ICAR/03, ICAR/08, ING-IND/08, ING-IND/10, ING-IND/11, ING-IND/14, ING-IND/15, ING-IND/21, ING-IND/22, ING-IND/23, ING-IND/24, ING- IND/25, ING-IND/26, ING-IND/27, ING-IND/31, ING-IND/32, MAT/07, MAT/08

The credits of the Scientific Disciplinary Fields found both in the first group and in the second group are primarily counted for the first group. The remaining credits are counted for the second group. Therefore, the credits of a course can be counted partly to reach the minimum number of credits of both groups.

Applicants who lack less than 10 credits can be admitted to the programme by the Academic Advisor of the degree programme. For applicants who lack more than 10 credits, the evaluation will be subject to the final approval of the Coordinator or the Vice coordinator of the degree programme.

Applicants who do not meet the curricular requirements must make up for their unfulfilled curricular requirements (missing credits) before enrolment, by means of:

- **enrolment in single courses in order to make up for unfulfilled curricular requirements**: this is possible for students who need to earn up to a maximum of 60 credits. Students who enrol in single courses for this reason are allowed to include in their Personal Study Plan exclusively the courses assigned by the evaluator.
  or else,
- **credit transfer at Bachelor's level**: this is possible for students who need to earn more than 60 credits. In this case, students need to enrol in the Bachelor's degree programme that offers the credits in the specific Scientific Disciplinary Fields (core subjects and commentary subjects) required for admission to this Master's degree programme.

SUITABLE ACADEMIC PERFORMANCE

Applicants must have a suitable academic performance and an English language certificate (B2 level or above, as defined by the Common European Framework of Reference for Languages: Learning, Teaching, Assessment - CEFR).

The academic performance will be assessed as follows.

1) Applicants from Politecnico di Torino

a) Applicants can be admitted to the programme if they earned their Bachelor's degree in:

- 4 years or less - no exam average grade required (1);
- between 4 and 5 years–exam weighted average grade required: ≥21/30
- more than 5 years– exam weighted average grade required (2): ≥ 24/30

b) admissions by merit-based evaluation of the Evaluation Committee

Applicants who do not have the above-mentioned average grade can take an admission test if they earned their Bachelor's degree in:

- between 4 and 5 years (1) –exam weighted average grade required (2): < 21/30
- more than 5 years– exam weighted average grade required (2): > 21/30 and < 24/30

provided that during their Bachelor's path the weighted average grade of the exams belonging to the Scientific Disciplinary Fields (settori scientifico-disciplinari) FIS/01-02-03 and ING-INF/01 is ≥ 24/30.

The details of the admission test are available in the section below "Merit-based evaluation for applicants from Politecnico di Torino and from other Italian universities".

The weighted average grade is calculated on all accrued course credits (graded on a scale of 30) counting towards the achievement of the Bachelor's degree, after having subtracted the worst 28 credits.

The duration of the Bachelor's path is calculated on the basis of the number of academic years in which the applicant has been enrolled at the university, starting from the first enrolment in the Italian university system:

- for full-time students: the duration of the Bachelor's path is equivalent to the number of academic years of enrolment.
- for part-time students: each year of enrolment is counted as half-year.
- for full-time students taking part in the "Dual Career" programme: each year of enrolment is counted as half-year, as for part-time students.

In the event of credit transfer, the duration of the Bachelor's path must be increased proportionally to the number of credits that have been recognized by Politecnico (10-60 CFU =1 year, etc.). The worst 28 credits must be subtracted proportionally to the number of validated credits.

(1) Applicants must have graduated by the end of the December Graduation Period
*(2) The weighted average is calculated as follows: ∑(grade*credits) / ∑credits*

2) Applicants from other Italian universities

Applicants who have a Bachelor's degree awarded by another Italian university must have a weighted average grade of all the exams ≥ **24/30**, regardless of the number of years it took them to graduate. The weighted average grade (∑(grade*credits) / ∑credits) is calculated on all accrued course credits (graded on a scale of 30) counting towards the achievement of the Bachelor's degree, after having subtracted the worst 28 credits.

Admissions by merit-based evaluation of the Evaluation Committee

Applicants with a weighted average grade > 21/30 and <24/30 can take an admission test (merit-based evaluation). The details of the admission test are available in the section below "Merit-based evaluation for applicants from Politecnico di Torino and from other Italian universities".
Merit-based evaluation for applicants from Politecnico di Torino and from other Italian universities.

The merit-based evaluation (admission test) aims to ascertain specific requirements in order to verify that prospective students have the knowledge, competencies and aptitude to the contents and learning objectives of the Master's degree programme.
The admission tests consist in an oral interview (it can also be a remote interview) about the subjects of the following disciplines:

- Separation Processes
- Transport Phenomena
- Reactors and Chemical Kinetics
- Safety in Industrial Processes
- Control and Instrumentation for Chemical Processes
- Plants for the Chemical Industry
- Processes of Inorganic Industrial Chemistry

A positive evaluation (offer of admission) allows applicants to enrol in the programme only in the academic year in which the evaluation has been given. Admitted applicants who do not complete the enrolment process within the deadlines are required to apply again and retake the admission test in the next academic years.
Students from Politecnico who have been admitted to the programme and have advanced some Master's courses (taken during their Bachelor's path) are allowed to enrol without retaking the admission test also in the next academic year, provided that they meet the other admission requirements.

3) Applicants with a non-Italian educational qualification

To be admitted to Politecnico Master's degree programmes, applicants must have an academic qualification awarded by an accredited/recognized foreign university, earned after completing at least 15 years of total education (including primary school, secondary school and university).

Applicants who have attended a university programme lasting five or six academic years (different from the 3+2 system) without completing it must still meet the minimum requirement of 15 years of total education (of which at least 3 years at university level) and they must have earned at least 180 ECTS credits or equivalent. Pre-university courses or foundation years cannot be counted towards the minimum number of credits or the minimum numbers of years of total education mentioned above.

In addition to having an adequate academic background and certified knowledge of the English language (minimum B2 level), students applying to degree programmes delivered in Italian or partially taught in Italian must also have an Italian language certificate (minimum B2 level), as defined by the Common European Framework of Reference for Languages (CEFR), as an admission requirement.

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The applicant's academic performance and the consistency between the degree programmes offered by Politecnico and the applicant's previous academic background are assessed by the professors designated by Coordinator of the Collegio. The evaluation is carried out on the Apply@polito platform under the section called "Applicants with a non-Italian qualification."

A positive evaluation (offer of admission) allows applicants to enrol in the programme only in the academic year in which the application has been submitted. Admitted applicants who do not complete the enrolment process within the deadlines are required to apply again to the programme in the next academic years.

More information is available at https://www.polito.it/en/education/applying-studying-graduating/admissions-and-enrolment/master-s-degree-programmes

Art. 3 – Programme curriculum

3.1 Programme overview

The educational path of the Master's degree programme in Chemical and Sustainable Processes Engineering aims to equip students with the necessary skills to develop and manage complex matter transformation processes. These processes may be characterised by strong operational non-linearities, the interaction of physical and chemical phenomena of different nature and occurring at widely varying spatial scales, the use of multifunctional equipment, and the inherent complexity of chemical plants, which often consist of dozens of interacting main units.

For this reason, it is necessary to strengthen students' theoretical background in two main areas: 1) core principles of process engineering, and 2) design skills for individual process equipment. The first aspect (1) is addressed by training students in:
i) fluid dynamics and transport phenomena (mass and energy transfer);
ii) real and multiphase chemical reactors;
iii) industrial chemical processes, with a focus on organic and petrochemical production;
iv) microscale molecular phenomena and mesoscale colloidal phenomena;
v) control of complex, nonlinear and multivariable systems;
vi) safety management in process plants.
Design skills related to individual equipment (2) are developed through both mechanical and functional design training. Most of these topics are covered during Year 1, as this foundational knowledge is often a prerequisite for the more advanced courses that follow.

A second set of skills that Master's graduates must acquire is the ability to model and simulate matter transformation processes. This includes both the informed use of commercial software for complex problems and the autonomous development of simple calculation codes for less complex cases. In this context, students are taught the mathematical foundations of numerical computation, methods for detailed simulation of velocity, temperature, and composition fields within equipment, and methods and tools for modelling transformation processes at the scale of entire chemical plants.

These core competencies are common to all students and are complemented by more specialised knowledge offered through the specialized tracks and optional courses. The programme offers four tracks:
i) Biotechnologies and Food, focusing on biology, biochemistry, and food industry processes;
ii) Process Design and Development, aimed at developing the skills required for the detailed design of chemical processes;
iii) Sustainability of Processes and Products in the Chemical Industry, focusing on innovation in the development and design of sustainable processes and products.
These three tracks offer most compulsory courses in Italian, along with some courses in English.
Finally,
iv) Chemical Engineering for Green Transition offers all compulsory courses in English and provides multidisciplinary content aimed at addressing the challenges of the green transition. This track also offers the opportunity to pursue a double degree with the Master's degree programmes in Energy and Nuclear Engineering and Environmental and Land Engineering.

3.2 Organization of educational activities

The list of courses (compulsory and optional), curricula, possible organization of courses into modules, any pre-requisites and exclusions and the list of the faculty members responsible for the courses are available at https://didattica.polito.it/pls/portal30/sviluppo.offerta_formativa_2019.vis?p_a_acc=2026&p_sdu=32&p_cds=482

The list of the Scientific Disciplinary Fields (Settori Scientifico Disciplinari) for each activity (specific subjects and complementary subjects) is available at https://didattica.polito.it/pls/portal30/sviluppo.vis_aig_2023.visualizza?sducds=32482&tab=0&p_a_acc=2026

Art. 4 - Student career

The Student Guide is published on the Teaching Portal every year before the beginning of the academic year. There is a specific Student Guide for each Master's degree programme. The Student Guide is available on the web site of the degree programme.

It contains information and deadlines on:

- academic calendar;
- Personal Study Plan and Annual Personal Study Plan;
- free choice credits;
- internships;
- tuition fees;
- dual career;
- classes and exams;
- class delivery;
- foreign language learning;
- studying abroad/mobility programmes;
- exam rules;
- transfers in/out and internal transfers;
- interruption, suspension, withdrawal, forfeiture;
- credit transfer.

Art. 5 - Final Examination

The final examination is a key educational component of the Master's degree programme and consists of a thesis that must be developed independently and originally by the student under the supervision of a Supervisor.
Students are expected to independently carry out an in-depth study of a scientific, technical, or design-related problem, critically review the relevant literature or documentation, and analyse the problem by proposing appropriate engineering solutions.
Students can work on their thesis project at the University's departments and laboratories, at other Italian or international universities, at external research centres, or in collaboration with companies and professional firms with which formal partnerships have been established.

The workload required to complete the thesis is approximately 400 hours, corresponding to 16 ECTS credits.

Students may choose from the thesis proposals made available by the teaching staff and published on the teaching portal. Alternatively, students may work on their thesis project at a company or at other universities or research institutions in Italy or abroad, subject to confirmation that a Polito faculty member of the degree programme is available to act as internal Supervisor.

Students must submit their thesis application and request the thesis topic online through a dedicated procedure available in their personal page on the Teaching Portal, under the section entitled "Thesis," in compliance with the Graduation Periods deadlines published in the Student Guide – Thematic Calendar Section.
Students are required to publicly present their thesis in front of a Graduation Examining Committee. During the defence, the candidate must demonstrate the ability to work independently, a sound understanding of the topic addressed, and the ability to summarise and effectively communicate the main contents while engaging in critical discussion.

The Master's thesis may be written and presented in English. In this case, it is recommended that the thesis include a summary written in Italian.

The final grade is given by the Graduation Examining Committee. Its members evaluate the overall average grade of all the exams on a scale of 110. The committee may add up to a maximum of 8 points, considering the following:
- quality of the thesis work (commitment, autonomy, methodological rigor, relevance of results achieved, etc.);
- thesis oral defence (clarity in presentation, etc.);
- outstanding results achieved during the academic path (number of honours, experience at foreign universities or research centres, extracurricular activities, participation in Student Team, etc.).

A degree with honours (lode) is awarded if the total score is 113.
A degree with honours (lode) may be awarded at the Committee's discretion if the total score is 111.5 by unanimous decision of the Committee members.

More information about the determination of the final grade is available in the News Board of the degree programme (https://www.polito.it/didattica/corsi-di-laurea-magistrale/ingegneria-chimica-e-dei-processi-sostenibili/bacheca-ingegneria-chimica-e-dei-processi-sostenibili).

More Information and Deadlines:
- Student Regulations
- Student Guide

Diploma Supplement:
In compliance with article 11, paragraph 8, of Ministerial Decrees No. 509/1999 and 270/2004. Politecnico di Torino issues the Diploma Supplement, a document that can attached to a higher education qualification. It is designed to improve the transparency of international qualifications, as it provides the description of the curriculum successfully completed by the student. This certificate follows the European model developed by the European Commission, the Council of Europe and UNESCO – CEPES: it is issued in two languages (Italian-English) and it is composed of approximately 10 pages.

More information at https://www.polito.it/en/education/applying-studying-graduating/academic-experience/certificates-and-other-documents

Art. 6 – References

6.1 Student Regulations

The Student Regulations define the rights and responsibilities of students and set out the administrative and disciplinary rules that all students enrolled in a degree programme or in a single learning activity at Politecnico must abide by.

6.2 Other Regulations

Particular aspects of students' academic progress are governed by specific Regulations or Calls for Applications published on its website.
In particular:

- The Tuition Fee Regulations specify the annual tuition fees that students must pay. The procedure for requesting a tuition fee reduction is explained in a dedicated guide.
- The University Regulations on Funds for Student Mobility Abroad outline the principles and rules for awarding and disbursing mobility grants. Standard procedures apply to all types of mobility programmes with unified Calls for Applications published twice a year at https://www.polito.it/en/education/applying-studying-graduating/studying-abroad
- The Code of Ethical Conduct also applies to students.