



**UNIVERSITA' DEGLI STUDI DI MILANO**  
**PROGRAMME DESCRIPTION - ACADEMIC YEAR 2024/25**  
**SINGLE-CYCLE DEGREE**  
**Pharmaceutical Chemistry and Tecnology (Classe LM-13)**  
**Enrolled from academic year 2023/24**

### **HEADING**

|  |  |
|--|--|
| <b>Degree classification - Denomination and code:</b>          | LM-13. Pharmacy and industrial pharmacy                  |
| <b>Degree title:</b>   | Dottore Magistrale                                       |
| <b>Length of course:</b>                                       | 5 years  |
| <b>Total number of credits required to complete programme:</b> | 300  |
| <b>Years of course currently available:</b>                    | 1st , 2nd  |
| <b>Access procedures:</b>                                      | Cap on student, student selection based on entrance test |
| <b>Course code:</b>  | E27  |

### **PERSONS/ROLES**

#### **Head of Interdepartmental Study Programme**

Prof. Marco Pallavicini, Tel. 02 503 19336 marco.pallavicini@unimi.it ricevimento studenti mart, merc e giov ore 8.00

#### **Tutors - Faculty**

Tutors per l'orientamento e piani di studio:

Primo anno

Prof.ssa Isabella Rimoldi, isabella.rimoldi@unimi.it

Secondo anno

Prof. Cristiano Bolchi, cristiano.bolchi@unimi.it

Terzo anno

Prof.ssa Clelia Mariangiola Luisa Dallanoce, clelia.dallanoce@unimi.it

Quarto anno

Prof. Marco De Amici, marco.deamici@unimi.it

Quinto anno

Prof. R.C. Melcangi, roberto.melcangi@unimi.it

Tutors per stage e tirocini:

Prof.ssa Anastasia AnnaFoppoli, anastasia.foppoli@unimi.it

Prof. Matteo Cerea, matteo.cerea@unimi.it

Prof. Nico Mitro, nico.mitro@unimi.it

Prof. Marco Pallavicini, marco.pallavicini@unimi.it

Prof.ssa Francesca Selmin, francesca.selmin@unimi.it

#### **Degree Course website**

<https://ctf-cu.cdl.unimi.it/it>

#### **Deputy Chair of the Interdepartmental Academic Board: Prof. Alberto Corsini**

Via Balzaretti 9 - Milano Phone 02 503 18322 Ricevimento studenti: previo appuntamento telefonico o email

Email: alberto.corsini@unimi.it

#### **Erasmus and international mobility tutor: Prof.sse Lucia Tamborini e Alessandra Romanelli**

Via Mangiagalli n. 25, Milano/Via Venezian 21, edificio 5, Corpo A, Milano Phone 02 503 19367/14475 Ricevimento studenti:

previo appuntamento telefonico Email: lucia.tamborini@unimi.it; alessandra.romanelli@unimi.it

#### **Pharmacy course management**

Via Golgi 19 - Edificio 1, ingresso D - Milano lun, merc, ven 9:30-11:30; mar e gio 13:30-15:30 [https://informastudenti.unimi.it/saw/ess?](https://informastudenti.unimi.it/saw/ess?AUTH=SAML)

AUTH=SAML

#### **Programme transfer and transfer credits tutor: Prof.sse Paola Rusmini e Valentina Pirovano**

Via Balzaretti 9 - Milano/Via Golgi 19 - Milano Phone 02 503 18214/14473 Ricevimento studenti: previo appuntamento

telefonico o email Email: paola.rusmini@unimi.it; valentina.pirovano@unimi.it

#### **Representative for disability services and specific learning disabilities: prof. Cristiano Bolchi**

Via Mangiagalli 25 - Milano Phone 02 503 19347 Ricevimento studenti: previo appuntamento telefonico o email  
Email: cristiano.bolchi@unimi.it

**Secretary of the Interdepartmental Academic Board: Prof.ssa Isabella Silvia Rimoldi**

Via Golgi 19 - Milano Phone 02 503 15504 Ricevimento studenti: previo appuntamento telefonico o email  
Email: isabella.rimoldi@unimi.it

**Student registrar**

Sedi e orari: <https://www.unimi.it/it/node/360>

**Student registrar**

Contatti: <https://www.unimi.it/it/node/359> tel. 02 503 25032

## **CHARACTERISTICS OF DEGREE PROGRAMME**

### **General and specific learning objectives**

Graduates of the Master's degree programme in Pharmaceutical Chemistry and Technology will have the chemical, pharmacological, technological, regulatory and business management skills and knowledge to operate in leadership and coordinating roles in all areas that directly or indirectly relate to the design, development, production, control and marketing of medicinal and health products. The course also prepares students to practise as pharmacists in community and hospital settings and as medical sales representatives. Specifically, the course aims to train professionals who will have the multidisciplinary skills to meet the needs of the pharmaceutical, cosmetics, medical device and dietary supplement industries, as well as those of public and private research and regulatory institutions in the health sector.

### **Expected learning outcomes**

To achieve these educational goals, the Master's degree programme in Pharmaceutical Chemistry and Technology aims to give students:

- 1) Background knowledge of core scientific subjects (mathematics, physics, chemistry, biology, medicine) to enable them to acquire the theoretical and practical skills to advance their knowledge in the specific subjects of the degree programme;
- 2) The broad medicinal chemistry, biochemistry and pharmacology knowledge needed to design and develop new biologically active molecules;
- 3) The scientific and technological knowledge needed to design, develop and control dosage forms of medicinal and health products;
- 4) Knowledge of national and supranational regulations relating to medicinal and health products;
- 5) Knowledge of business management in the field of pharmaceuticals;
- 6) The project and operational skills needed to conduct research in the degree subjects by way of training related to the student's experimental research thesis;
- 7) Practical knowledge to work as a pharmacist within the Italian Health Service, by means of the internship pursuant to Directive 2005/36/EC;
- 8) The knowledge necessary to attend advanced courses and postgraduate schools of the pharmaceutical and pharmacological areas. To this end, the degree programme in Pharmaceutical Chemistry and Technology focuses on building knowledge of chemistry, biochemistry, pharmacology, medicinal chemistry and pharmaceutical technology, including through practical laboratory activities. Teaching also centres on issues related to the stability, toxicity and formulation of medicinal and health products.

### **Professional profile and employment opportunities**

Graduates of Pharmaceutical Chemistry and Technology will have the scientific and theoretical knowledge needed to practice as pharmacists and experts in the sector, in matters of medicinal and health products (food for special medical purposes and dietary requirements, cosmetics, herbal health products, diagnostics in vitro, medical devices and biocides).

The Master's degree in Pharmaceutical Chemistry and Technology prepares students for a wide range of professions:

- Synthesis, pharmaceutical development, manufacture and control of medicinal products in the industrial sector;
- Drug quality control in public or private laboratories;
- Production and control of biocides and medical devices;
- Formulation, production and quality control of dietary and food products;
- Formulation, production and quality control of cosmetic products;
- Analysis and control of the physicochemical and hygiene characteristics of mineral waters;
- Storage, preservation and distribution of medicinal products at the wholesale stage;
- Preparation, control, storage and distribution of medicinal products at pharmacies open to the public or hospital pharmacies;
- Dissemination of information and advice in the health products sector.

Graduates of the Master's degree in Pharmaceutical Chemistry and Technology are qualified to practice as pharmacists in accordance with Directive 2005/36/EC. With its strong chemical, technological and pharmaceutical focus, the Master's degree programme in Pharmaceutical Chemistry and Technology will open doors to career opportunities in the areas of chemical-pharmaceutical, technological-pharmaceutical, pharmacological and biotechnological research, both in the public and private sectors. The programme can also lead to careers in the development, production and quality control stages within the pharmaceutical, cosmetic and food industries.

The programme trains students for a range of professions:

- Chemists and similar professions;
- Pharmaceutical representatives with chemical expertise;
- Pharmacologists;
- Pharmacists;
- Graduate researchers and technicians in chemical and pharmaceutical sciences;
- Graduate researchers and technicians in biological sciences.

### **Initial knowledge required**

Qualifications and skills required for admission

Enrolment in the programme is capped pursuant to Law no. 264 of 2 August 1999. Admission into the Single-cycle Master's degree programme in CTF is conditional upon earning a secondary, high-school, or college-preparatory diploma, or other equivalent foreign diploma, and suitable recognised educational qualifications.

In particular, candidates must have a broad general knowledge base and must know the fundamentals of mathematics, physics, chemistry and biology as envisaged by the high-school syllabus. Candidates must be fluent in Italian (written and spoken).

Admission assessment

To gain entry to Year I of the Pharmaceutical Chemistry and Technology degree programme, candidates must take an online TOLC-F assessment test. Candidates will be ranked based on their scores, with the number of successful candidates capped. Candidates must sit this test before matriculation. A schedule of the TOLC-F tests offered by UNIMI and other participating Italian universities can be found at <https://tolc.cisiaonline.it/calendario.php>.

For more information on admissions to degree programme, please refer to the call for applications available on the University of Milan website at <https://ctf-cu.cdl.unimi.it/it/iscrivarsi>

Any exemptions from sitting the TOLC-F test and the process for gaining entry to Year II or subsequent years can be found in the call for applications. For more information, please visit <https://ctf-cu.cdl.unimi.it/it/iscrivarsi>

Additional learning requirements (OFA) and remedial activities

Newly matriculated students who did not achieve a grade of at least 4 in the Mathematics module of the TOLC-F test will be set Additional Learning Requirements (OFA). To fulfil these requirements, students may attend University-organised preparatory courses, followed by a test in which they must demonstrate an improved level of aptitude. Students who have been designated OFAs will not be able to take the Mathematics exam until the OFAs have been cleared.

For more information, please visit <https://ctf-cu.cdl.unimi.it/it/studiare/le-matricole>

For candidates who were unsuccessful in the selection test, a maximum of 30 places are available on a limited number of single courses, in accordance with the Academic Regulations of the University of Milan. By enrolling on those courses, they will gain credits that count towards the degree programme for which they may enrol at a future date after having passed the entrance test, if applicable.

For information on the enrolment process, please refer to the notice published at <https://ctf-cu.cdl.unimi.it/it/iscrivarsi>

### **Compulsory attendance**

Attendance is mandatory for laboratory courses, and strongly recommended for other courses.

### **Internship criteria**

Commencing Year IV, students must undertake a clinical internship at a pharmacy which is open to the public or within a hospital's pharmaceutical service. All internships must comply with the requirements of EU directives and Italian Interministerial Decree 651/2022. During their training, students will take part in the activities of the host pharmacy. Internships are intended to give students of Pharmaceutical Chemistry and Technology the specific know-how and professional skills needed to work as pharmacists within the Italian health service.

In accordance with Article 44(2)(b) of Directive 2005/36/EC, trainings will have a total duration of six months with working hours of no more than 40 hours a week, for a total of 900 hours. At least 50 percent of the internship must be served in a pharmacy which is open to the public. The internship is worth 30 CFUs.

Internships may be served with up to three different host organisations and may be split into separate blocks, which cannot be briefer than one month. Internships may also be served abroad, subject to the University's consent: the University will first check that the teaching content complies with current regulations, after having consulted with the local professional association.

Students may serve their internship from the second semester of Year IV, provided they have already earned at least 160 CFUs and have passed the exams in Pharmacology and Pharmacotherapy with Laboratory and Medicinal and Toxicological Chemistry I and attended the Laboratory of galenic preparations. Before beginning any internship, students must attend the general safety training offered by the University and the specialised safety courses organised by the Pharmacists' Association. In addition, students must have obtained the consent of the head of the host pharmacy, hospital pharmacy or local pharmaceutical service to undergo the internship. Students must also gain the consent of their professional tutor and academic tutor and must have collected the "Intern's Diary" from the University, which must be in the form approved by the Federation of Italian Pharmacists' Association, as agreed with the Conference of Italian University Rectors (CRUI).

For more information, please visit our page on Pharmacy internships <https://www.unimi.it/it/node/12683/>.

### **Degree programme final exams**

To graduate with the Master's degree (Articles 1 and 3 of Italian Law 163/2021), students must pass a Practical Evaluation Test (PPV) which tests the professional skills acquired during the student's internship and the level of clinical competency

required to qualify as a pharmacist. Students must pass the PPV examination before going on to defend their thesis.

Students will begin preparing their thesis during the second semester of Year IV after providing their thesis supervisors with a self-certification of all the exams taken. Students must pass at least 20 exams before moving on to their thesis. This number refers to exams of integrated courses, not of single modules. The final examination is worth 25 credits and is open to students who have earned 275 credits. In this examination, students will present and discuss a paper on the experimental research they have done under the guidance of a supervisor. The research project has to be undertaken at the University laboratories or at public or private institutions. In this sense, experimental research means work undertaken by the student under the supervision of a tutor to articulate and prove a hypothesis, resulting in an original paper on a chosen topic. The supervisor must always be a lecturer at the Faculty. The final mark (from a minimum pass mark of 66 to a maximum of 110 with distinction) will be decided by a Board which will meet publicly to evaluate each student's performance throughout the degree programme.

## **Campus**

Milan

## **Notes**

For-credit assessment B2

In order to obtain their degree, students must be proficient in English at a B2 level under the Common European Framework of Reference for Languages (CEFR). This proficiency level may be certified as follows:

- By submitting a language certificate attesting B2 or higher level in English and issued no more than three years before the date of submission. You will find the list of language certificates recognized by the University at: <https://www.unimi.it/en/node/39322>). The certificate must be uploaded during the enrolment procedure, or subsequently to the portal <http://studente.unimi.it/uploadCertificazioniLingue>;
- By taking a placement test offered by the University Language Centre (SLAM) between October and January of the first year. Students who fail the test will be required to take a SLAM course.

The placement test is mandatory for all those who do not hold a valid certificate attesting to B2 or higher level.

Those who have not taken the placement test by the end of January or fail the end-of-course exam six times must obtain the necessary certification privately before graduating.

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

The University of Milan supports international mobility by providing its students with the opportunity to spend study and internship periods abroad. It is a unique chance to enrich your educational path in a new exciting environment.

The agreements entered into by the University with over 300 universities from the 27 EU member countries under the European Erasmus+ programme allow regularly enrolled students to carry out part of their studies at one of the partner universities or to undertake internships at companies, training and research centres and other organizations.

Similar international mobility opportunities are provided outside Europe, through agreements with a number of prestigious institutions.

### **Study and internships abroad**

Programs offered:

- Erasmus + studio and Erasmus+Traineeship at Universities/Institutions partners in Europe and in the Balkans;
- stages at i) Departments of Medicine and Pharmacology, University of Minnesota US; ii) Université de Montréal (Canada); Tokushima University (Giappone).

The offer is continuously updated. Call for new position abroad can be found on the University website (Cerca una opportunità internazionale | Università degli Studi di Milano Statale ([unimi.it](http://unimi.it)))

Activities: the mobility is directed to attending courses, research internships and training in Hospital Pharmacy.

The Erasmus + Studio programme offers the opportunity to study or play an internship abroad. The Erasmus traineeship allows to carry out research in Universities and partner Companies in a wide range of scientific topics characterizing the Course of Study. For detailed information on the host institution and fields of studies, see the following web site: <https://www.unimi.it/en/education/pharmaceutical-chemistry-and-technology>.

Activities that will be carried out abroad must be defined in the Learning Agreement along with the CFU, based on the time that students will spend in the foreign University. The following rules to assign CFU hold:

- 12 months: 60 credits
- 6 months: 30 credits
- 3 months: 20 CFU.

Thesis/Stage

- 3 months 20 ECTS (6 ECTS in the student study programme + 14 ECTS complementary)
- 6 months 30 ECTS (18 in the student study programme + 12 complementary)
- 9 months 45 CFU (24 in the student study programme + 21 complementary)

Internship in Hospital pharmacy

Internship in Hospital pharmacy could not be longer than for 3-months corresponding to 20 CFU (15 in the student study programme + 5 complementary). Students need to contact the Ordine dei Farmacisti to verify that the Hospital pharmacy chosen is appropriate and must open the “libretto di tirocinio” before departure. This activity follows the rules of the prerequisites reported in the Manifesto.

Recognition of the abroad studies: students must acquire at least 70% of the credits specified in the Learning Agreement. For thesis/internship researches, the student must acquire all the credits reported in the Learning Agreement.

Incentives: An additional score (1-3 points depending on the duration of the study period, the amount of credits attained and the obtained results) will be proposed by the tutor and awarded by the thesis committee to the students who have satisfactorily accomplished the training program.

### How to participate in Erasmus mobility programs

The students of the University of Milan can participate in mobility programmes, through a public selection procedure.

Ad hoc commissions will evaluate:

Academic career

the candidate's proposed study programme abroad

his/her foreign language proficiency

the reasons behind his/her application

Call for applications and informative meetings

The public selection for Erasmus+ mobility for study generally begins around February each year with the publication of a call for applications specifying destinations and requirements. Regarding the Erasmus+ Mobility for Traineeship, the University of Milan usually publishes two calls a year enabling students to choose a destination defined by an inter-institutional agreement or to find a traineeship position on their own.

The University organizes informative meetings to illustrate mobility opportunities and rules for participation.

Erasmus+ scholarship

The European Union grants the winners of the Erasmus+ programme selection a scholarship to contribute to their mobility costs, which may be supplemented by the University funding for disadvantaged students.

Language courses

Students who pass the selections for mobility programmes can benefit from intensive foreign language courses offered each year by the University Language Centre (SLAM).

<https://www.unimi.it/en/node/8/>

Learn more at <https://www.unimi.it/en/node/274/>

For assistance, please contact:

International Mobility Office

Via Santa Sofia 9 (second floor)

Tel. 02 503 13501-12589-13495-13502

Contacts: InformaStudenti; [mobility.out@unimi.it](mailto:mobility.out@unimi.it)

Student Desk booking through InformaStudenti

| <b>1st COURSE YEAR Core/compulsory courses/activities common</b>                          |                          |                                    |
|---|--------------------------|------------------------------------|
| <b>Learning activity</b>  | <b>Ects</b>              | <b>Sector</b>                      |
| Analytical Chemistry and Physical Chemistry   | 6                        | (3) CHIM/01, (3) CHIM/02           |
| Animal Biology and Plant Biology  | 9                        | (3) BIO/15, (6) BIO/13             |
| Applied Microbiology  | 6                        | BIO/19                             |
| English proficiency B2 (2 ECTS)   | 2                        | ND                                 |
| General and Inorganic Chemistry and Stoichiometry   | 9                        | CHIM/03                            |
| Human Anatomy and Physiology  | 11                       | (6) BIO/09, (5) BIO/16             |
| Mathematics and Physics with elements of Computer Science                                 | 10                       | (6) FIS/07, (1) INF/01, (3) MAT/05 |
|   | Total compulsory credits | 53                                 |
| <b>2nd COURSE YEAR Core/compulsory courses/activities common</b>                          |                          |                                    |
| <b>Learning activity</b>  | <b>Ects</b>              | <b>Sector</b>                      |
| Biochemistry  | 8                        | BIO/10                             |
| Fundamentals of pharmaceutical preformulation and formulation with laboratory             | 6                        | CHIM/09                            |
| General Pathology   | 6                        | MED/04                             |
| General Pharmacology and Pharmacognosy  | 8                        | BIO/14                             |
| Organic Chemistry 1   | 10                       | CHIM/06                            |
| Pharmaceutical analysis I with Laboratory of Pharmaceutical analysis I and Food chemistry | 11                       | (3) CHIM/10, (8) CHIM/08           |
| Principles and Methods of Pharmaceutical Analysis with Laboratory                         | 6                        | CHIM/08                            |
|   | Total compulsory credits | 55                                 |

**3rd COURSE YEAR (available as of academic year 2025/26) Core/compulsory courses/activities common**

| Learning activity   | Ects                     | Sector  |
|---|--------------------------|---------|
| Applied Biochemistry and laboratory   | 8                        | BIO/10  |
| Medicinal And Toxicological Chemistry I   | 10                       | CHIM/08 |
| Organic Chemistry 2 and Organic Chemistry Laboratory                              | 10                       | CHIM/06 |
| Pharmaceutical technology and legislation with laboratory of galenic preparations | 12                       | CHIM/09 |
| Pharmacology and pharmacotherapy with laboratory                                  | 9                        | BIO/14  |
| Spectroscopic methods in organic chemistry  | 7                        | CHIM/06 |
| Toxicology  | 8                        | BIO/14  |
|   | Total compulsory credits | 64      |

**4th COURSE YEAR (available as of academic year 2026/27) Core/compulsory courses/activities common**

| Learning activity   | Ects                     | Sector  |
|---|--------------------------|---------|
| Extractive and Synthetic Preparation of Drugs and Laboratory of Extractive and Synthetic Preparation of Drugs | 6                        | CHIM/08 |
| Medicinal And Toxicological Chemistry II  | 10                       | CHIM/08 |
| Modified-release dosage forms and manufacturing of drug products  | 7                        | CHIM/09 |
| Pharmaceutical Analysis II with Laboratory of Pharmaceutical Analysis II                                      | 10                       | CHIM/08 |
|   | Total compulsory credits | 33      |

**Elective courses**

**In Year IV, students must choose one of nine professional profiles, each worth 16 ECTS credits. Courses are taught in the second semester of Year IV.**

**Drug discovery**

|  |   |         |
|--|---|---------|
| Advanced methods applied to design and synthesis in the medicinal chemistry research | 8 | CHIM/08 |
| Computational, biophysical and analytical approaches in drug discovery               | 8 | CHIM/08 |

**From design to market of food supplements, functional and special foods**

|   |   |                                     |
|---|---|-------------------------------------|
| Design, development and application of food supplements, functional foods and foods for specific groups | 8 | (6) CHIM/10, (1) BIO/15, (1) BIO/14 |
| Dietary supplements: formulation, manufacturing, quality controls and regulatory aspects                | 8 | (4) CHIM/09, (4) CHIM/08            |

**Industrial development of medicinal and health products**

|   |   |         |
|---|---|---------|
| Formulation and production development of medicinal products with laboratory of pilot-plant manufacturing | 8 | CHIM/09 |
| Technological and regulatory aspects of health products   | 8 | CHIM/09 |

**Chemistry of transition metal complexes and synthetic applications**

|  |   |                          |
|--|---|--------------------------|
| Chemistry of coordination compounds and organometallic chemistry | 8 | (4) CHIM/03, (4) CHIM/06 |
| Nanomaterials for applications in biology and medicine           | 8 | (4) CHIM/03, (4) CHIM/06 |

**Organic and biomolecular chemistry**

|  |   |                         |
|--|---|-------------------------|
| Advanced Synthesis Methodologies and Laboratory of Advanced Synthesis and Analysis methodologies | 8 | CHIM/06                 |
| Synthesis and characterization of biomolecules and Biomolecules applied to biological systems    | 8 | (4) BIO/10, (4) CHIM/06 |

**Experimental and preclinical pharmacology**

|  |   |                        |
|--|---|------------------------|
| Biotechnology in Pharmacology and Biochemistry of informational macromolecules | 8 | (4) BIO/10, (4) BIO/14 |
| Methodologies and experimental models in preclinical pharmacology              | 8 | BIO/14                 |

**Pharmacological and therapeutic innovations**

|   |   |                         |
|---|---|-------------------------|
| Clinical pharmacology, advanced therapies and regulatory and patent aspects | 8 | (4) BIO/14, (4) CHIM/09 |
| Pharmaco-toxicology of biotechnological drugs                               | 8 | BIO/14                  |

**Precision pharmacology**

|  |   |                        |
|--|---|------------------------|
| Biology and genetics applied to precision pharmacology | 8 | (4) BIO/14, (4) BIO/13 |
| Personalized Medicine                                  | 8 | (4) MED/04, (4) MED/13 |

**Endocrinology and nutritional aspects**

|  |   |  |
|--|---|--|
| Molecular endocrinology and metabolism               | 8 | MED/13                                 |
| Physiopathological aspects of personalized nutrition | 8 | (1.5) MED/13, (1.5) MED/04, (5) BIO/09 |

**5th COURSE YEAR (available as of academic year 2027/28) Core/compulsory courses/activities common**

| Learning activity  | Ects                     | Sector                     |
|--|--------------------------|----------------------------|
| Drug discovery and industrial medicinal chemistry              | 10                       | CHIM/08                    |
| Regulatory sciences and economics of pharmaceutical industries | 6                        | (2) SECS-P/07, (4) CHIM/09 |
|  | Total compulsory credits | 16                         |

**Further elective courses**

**In Year V, students must earn 8 ECTS for elective activities. These can be freely chosen from those offered by the University, provided they are coherent with their study programme. The courses available are listed below and will be taught during the 2nd semester of Year V. Courses will be activated if they are chosen by a minimum of 5 students. of the Faculty of Pharmaceutical Sciences. Course lecturers will indicate whether any prerequisites apply.**

|   |   |                  |
|---|---|------------------|
| Cosmetic Products   | 8 | CHIM/09          |
| Experimental laboratory   | 8 | ND               |
| Heterocyclic compounds and application of organometallic chemistry in synthesis | 8 | (4) CHIM/03, (4) |

|   |                          |                        |
|---|--------------------------|------------------------|
|   |                          | CHIM/06                |
| Innovative drugs and radiopharmaceuticals   | 8                        | CHIM/08                |
| Innovative molecular approaches for the identification of pharmacological targets | 8                        | BIO/10                 |
| Methodologies and experimental models for therapy with hormones                   | 8                        | (4) MED/13, (4) BIO/13 |
| Physiology of Integrated systems  | 8                        | BIO/09                 |
| Special pharmacology  | 8                        | BIO/14                 |
| <b>End of course requirements</b>   |                          |                        |
| Final exam  | 25                       | NA                     |
| Professional training in pharmacy   | 30                       | NA                     |
|   | Total compulsory credits | 55                     |

## COURSE PROGRESSION REQUIREMENTS

Removal of prerequisites - Where a prerequisite exam was included in a prior year's Programme Description but is absent from the current year's Programme Description, all students will be exempt from the prerequisite regardless of their year of matriculation.

Addition of prerequisites - Where a new prerequisite exam is included in the Programme Description, students must abide by the prerequisite only if it was included in the Programme Description for the year before they sit the exam.

### YEAR I

There are no prerequisites for subjects of Year I.

### YEAR II

To attend the LABORATORY OF PRINCIPLES AND METHODS OF PHARMACEUTICAL ANALYSIS, students must first have passed the GENERAL AND INORGANIC CHEMISTRY AND STOICHIOMETRY exam. To attend the LABORATORY OF PHARMACEUTICAL ANALYSIS I, students must also have attended the LABORATORY OF PRINCIPLES AND METHODS OF PHARMACEUTICAL ANALYSIS.

### YEAR III

To attend the LABORATORY OF ORGANIC CHEMISTRY, students do not need to have passed the ORGANIC CHEMISTRY I exam.

To attend the LABORATORY OF GALENIC PREPARATIONS, students must also have attended the LABORATORY OF PHARMACEUTICAL PREFORMULATION AND FORMULATION.

### YEAR IV

To attend the LABORATORY OF PHARMACEUTICAL ANALYSIS II, students must first have passed the ORGANIC CHEMISTRY I exam (by the course start date) and must have attended the LABORATORY PHARMACEUTICAL ANALYSIS I.

To attend the LABORATORY OF EXTRACTIVE AND SYNTHETIC PREPARATION OF DRUGS, students must also have attended the ORGANIC CHEMISTRY LABORATORY and must first have passed the exam in ORGANIC CHEMISTRY I (by the start of the 2nd semester of Year IV).

To attend the Laboratory of PILOT-PLANT MANUFACTURING (professional profile), students must also have attended the LABORATORY OF GALENIC PREPARATIONS.

### Professional profiles

In Year IV, students must choose one of nine professional profiles, each worth 16 credits. Courses are taught in the second semester of Year IV.

### Other elective courses

In Year V, students must earn at least 8 CFUs for elective activities. These can be freely chosen from those offered by the University, provided they are coherent with their study programme. The courses available are listed below and will be taught during the 2nd semester of Year V. Courses will be activated if they are chosen by a minimum of 5 students. of the Faculty of Pharmaceutical Sciences. Course lecturers will indicate whether any prerequisites apply.

### Nine professional profiles

- Drug discovery
- From design to market of food supplements, functional and special foods
- Industrial development of medicinal and health products
- Chemistry of transition metal complexes and synthetic applications
- Organic and biomolecular chemistry
- Experimental and preclinical pharmacology
- Pharmacological and therapeutic innovations
- Precision pharmacology
- Endocrinology and nutritional aspects

### Learning activity

### Prescribed foundation courses

### O/S

|   |   |                 |
|---|---|-----------------|
| Pharmaceutical analysis I with Laboratory of Pharmaceutical analysis I and Food chemistry | Analytical Chemistry and Physical Chemistry       | Core/compulsory |
|   | General and Inorganic Chemistry and Stoichiometry | Core/compulsory |
| Biochemistry  | Human Anatomy and Physiology                      | Core/compulsory |

|   |   |                 |
|---|---|-----------------|
|   | Animal Biology and Plant Biology  | Core/compulsory |
| General Pathology   | Human Anatomy and Physiology  | Core/compulsory |
|   | Animal Biology and Plant Biology  | Core/compulsory |
| Fundamentals of pharmaceutical preformulation and formulation with laboratory                                 | General and Inorganic Chemistry and Stoichiometry   | Core/compulsory |
| Medicinal And Toxicological Chemistry I   | Organic Chemistry 1   | Core/compulsory |
| Pharmaceutical technology and legislation with laboratory of galenic preparations                             | Fundamentals of pharmaceutical preformulation and formulation with laboratory             | Core/compulsory |
|   | Organic Chemistry 1   | Core/compulsory |
|   | General Pharmacology and Pharmacognosy  | Core/compulsory |
| Applied Biochemistry and laboratory   | Biochemistry  | Core/compulsory |
|   | Organic Chemistry 1   | Core/compulsory |
| Organic Chemistry 2 and Organic Chemistry Laboratory  | Organic Chemistry 1   | Core/compulsory |
| Pharmacology and pharmacotherapy with laboratory  | Biochemistry  | Core/compulsory |
|   | General Pathology   | Core/compulsory |
|   | General Pharmacology and Pharmacognosy  | Core/compulsory |
| Spectroscopic methods in organic chemistry  | Organic Chemistry 1   | Core/compulsory |
| Toxicology  | General Pharmacology and Pharmacognosy  | Core/compulsory |
| Medicinal And Toxicological Chemistry II  | Medicinal And Toxicological Chemistry I   | Core/compulsory |
|   | Organic Chemistry 2 and Organic Chemistry Laboratory                                      | Core/compulsory |
| Pharmaceutical Analysis II with Laboratory of Pharmaceutical Analysis II                                      | Pharmaceutical analysis I with Laboratory of Pharmaceutical analysis I and Food chemistry | Core/compulsory |
|   | Organic Chemistry 1   | Core/compulsory |
| Modified-release dosage forms and manufacturing of drug products  | Pharmaceutical technology and legislation with laboratory of galenic preparations         | Core/compulsory |
| Extractive and Synthetic Preparation of Drugs and Laboratory of Extractive and Synthetic Preparation of Drugs | Organic Chemistry 2 and Organic Chemistry Laboratory                                      | Core/compulsory |
| Advanced methods applied to design and synthesis in the medicinal chemistry research                          | Pharmaceutical analysis I with Laboratory of Pharmaceutical analysis I and Food chemistry | Core/compulsory |
|   | Medicinal And Toxicological Chemistry I   | Core/compulsory |
|   | Spectroscopic methods in organic chemistry  | Core/compulsory |
| Computational, biophysical and analytical approaches in drug discovery  | Pharmaceutical analysis I with Laboratory of Pharmaceutical analysis I and Food chemistry | Core/compulsory |
|   | Medicinal And Toxicological Chemistry I   | Core/compulsory |
|   | Spectroscopic methods in organic chemistry  | Core/compulsory |
| Formulation and production development of medicinal products with laboratory of pilot-plant manufacturing     | Pharmaceutical analysis I with Laboratory of Pharmaceutical analysis I and Food chemistry | Core/compulsory |
|   | Pharmaceutical technology and legislation with laboratory of galenic preparations         | Core/compulsory |
| Technological and regulatory aspects of health products   | Pharmaceutical analysis I with Laboratory of Pharmaceutical analysis I and Food chemistry | Core/compulsory |
|   | Pharmaceutical technology and legislation with laboratory of galenic preparations         | Core/compulsory |
| Advanced Synthesis Methodologies and Laboratory of Advanced Synthesis and Analysis methodologies              | Applied Biochemistry and laboratory   | Core/compulsory |
|   | Organic Chemistry 2 and Organic Chemistry Laboratory                                      | Core/compulsory |
| Methodologies and experimental models in preclinical pharmacology   | Pharmacology and pharmacotherapy with laboratory  | Core/compulsory |
| Pharmaco-toxicology of biotechnological drugs   | Pharmacology and pharmacotherapy with laboratory  | Core/compulsory |
| Molecular endocrinology and metabolism  | General Pathology   | Core/compulsory |
| Drug discovery and industrial medicinal chemistry   | Pharmaceutical analysis I with Laboratory of Pharmaceutical analysis I and Food chemistry | Core/compulsory |
|   | Medicinal And Toxicological Chemistry I   | Core/compulsory |
|   | Medicinal And Toxicological Chemistry II  | Core/compulsory |
| Design, development and application of food supplements, functional foods and foods for specific groups       | Pharmaceutical analysis I with Laboratory of Pharmaceutical analysis I and Food chemistry | Core/compulsory |
|   | Biochemistry  | Core/compulsory |
|   | Pharmaceutical technology and legislation with laboratory of galenic preparations         | Core/compulsory |
|   | Organic Chemistry 1   | Core/compulsory |
| Dietary supplements: formulation, manufacturing, quality controls and regulatory aspects                      | Pharmaceutical analysis I with Laboratory of Pharmaceutical analysis I and Food chemistry | Core/compulsory |
|   | Biochemistry  | Core/compulsory |
|   | Pharmaceutical technology and legislation with laboratory of galenic preparations         | Core/compulsory |
|   | Organic Chemistry 1   | Core/compulsory |
| Chemistry of coordination compounds and organometallic chemistry  | Organic Chemistry 2 and Organic Chemistry Laboratory                                      | Core/compulsory |
| Nanomaterials for applications in biology and medicine  | Organic Chemistry 2 and Organic Chemistry Laboratory                                      | Core/compulsory |
| Synthesis and characterization of biomolecules and Biomolecules applied to biological systems                 | Applied Biochemistry and laboratory   | Core/compulsory |
|   | Organic Chemistry 2 and Organic Chemistry Laboratory                                      | Core/compulsory |
| Biotechnology in Pharmacology and Biochemistry of informational macromolecules                                | Pharmacology and pharmacotherapy with laboratory  | Core/compulsory |
| Clinical pharmacology, advanced therapies and regulatory and patent aspects                                   | Pharmacology and pharmacotherapy with laboratory  | Core/compulsory |



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| Biology and genetics applied to precision pharmacology            | Pharmacology and pharmacotherapy with laboratory                                  | Core/compulsory |
| Personalized Medicine   | Pharmacology and pharmacotherapy with laboratory                                  | Core/compulsory |
| Physiopathological aspects of personalized nutrition              | General Pathology   | Core/compulsory |
| Regulatory sciences and economics of pharmaceutical industries    | Pharmaceutical technology and legislation with laboratory of galenic preparations | Core/compulsory |
| Organic Chemistry 1   | General and Inorganic Chemistry and Stoichiometry                                 | Core/compulsory |
| General Pharmacology and Pharmacognosy                            | Human Anatomy and Physiology  | Core/compulsory |
|   | Animal Biology and Plant Biology  | Core/compulsory |
| Principles and Methods of Pharmaceutical Analysis with Laboratory | Analytical Chemistry and Physical Chemistry                                       | Core/compulsory |
|   | General and Inorganic Chemistry and Stoichiometry                                 | Core/compulsory |