# UNIVERSITA' DEGLI STUDI DI MILANO
# PROGRAMME DESCRIPTION - ACADEMIC YEAR 2019/20
# SINGLE-CYCLE DEGREE
# Pharmaceutical Chemistry and Technology (Classe LM-13)
# enrolled from 2009/10 academic year

| *HEADING* | |
|---|---|
| **Degree classification - Denomination and code:** | LM-13 Pharmacy and industrial pharmacy |
| **Degree title:** | Dottore Magistrale |
| **Length of course:** | 5 years |
| **Total number of credits required to complete programme:** | 300 |
| **Years of course currently available:** | 1st , 2nd , 3rd , 4th , 5th |
| **Access procedures:** | Cap on student, student selection based on entrance test |
| **Course code:** | E25 |

## *PERSONS/ROLES*

**Head of Interdepartmental Study Programme**

Prof.ssa Egle Maria Beccalli

**Tutors - Faculty**

I ANNO
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II ANNO
Prof. Giancarlo Aldini, giancarlo.aldini@unimi.it
Prof.ssa Francesca Clerici, francesca.clerici@unimi.it

III ANNO
Ad ogni studente è stato assegnato, dal primo anno, un tutor che lo seguirà nel suo percorso di studio fino alla laurea.

IV ANNO
Prof. Sergio Romeo, sergio.romeo@unimi.it
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PER TIROCINIO IN FARMACIA
Prof.ssa Donatella Caruso
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Prof. Nico Mitro
Prof. Marco Pallavicini
Prof. Sergio Romeo
Prof.ssa Francesca Selmin

**Degree Course website**

www.farmacia.unimi.it

https://www.unimi.it/it/studiare/immatricolarsi-e-iscriversi

**Coordinatore corso di laurea: Prof.ssa Maria Luisa Gelmi**

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**Coordinatore dei trasferimenti e passaggi di corso: Prof.ssa Francesca Selmin**

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**Coordinatore ERASMUS: Prof.ssa Francesca Clerici**

Via Venezian, 21 Phone 02 503 14472 Ricevimento studenti: previo appuntamento telefonico Email: francesca.clerici@unimi.it

**Vice-presidente del Collegio Didattico Interdipartimentale: Prof.ssa Donatella Caruso**

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## *CHARACTERISTICS OF DEGREE PROGRAMME*

**General and specific learning objectives**

The Master Course in Pharmaceutical Chemistry and Technology aims to train students in chemical, pharmacological, technological and regulatory fields useful to work in positions of responsibility and coordination in all sectors directly or indirectly related to research and discovery, development, production, quality assurance and marketing of drugs and healthy products.

The course trains for the profession as community and hospital pharmacist as well as for medical information (REP). In particular, the course aims to train professionals able to satisfy the needs and requests of the pharmaceutical, cosmetics, medical devices and food supplements industry, as well as the requests of public and private institutions involved in health research and regulation.

Therefore, such a multidisciplinary degree aims to provide:

1) a preparation on the basic sciences (mathematical, physical, chemical, biological, medical sciences) necessary to acquire solid theoretical and practical skills to support specific disciplines characterizing the course

2) knowledge on medicinal chemistry, biochemistry and pharmacology to allow the design and development of novel biologically active molecules

3) knowledge on pharmaceutical technology to allow the design, the development and the quality control of drug dosage forms and healthy products.

4) knowledge ofnnational and international legislation regarding drugs and healthy products;

5) operational skills, needed to address researches in the fields characterizing the degree course, through educational activities related to the thesis;

6) useful knowledge to carry out professional pharmaceutical services under the National Health Service through the practical training activity, according to 85/432 / EEC law.

**Expected learning outcomes**

The Course in Pharmaceutical Chemistry and Technology allows the acquisition of the following skills for different professional activities:

1) discovery, synthesis and production of novel biologically active molecules
2) Formulation, production and quality control for drug
3) Formulation, production and quality control for dietetic foods
4) Formulation, production and quality control for cosmetic products
5) Microbiological and physicochemical analyses for mineral waters
6) Handling, storage of drugs during the wholesale stage
7) Preparation, quality control, storage and distribution of drugs in pharmacies and hospitals
8) Dissemination of information and advices concerning health products

**Professional profile and employment opportunities**

Graduates in Pharmaceutical Chemistry and Technology possess the scientific and theoretical expertise to operate as experts in the field of drug and healthy products (foods for special medical purposes and special diets, cosmetics, herbal, diagnostic, medical devices, etc.) and in related fields and to take on the professional role of pharmacist.

The course trains students for the following professions:
- Medicinal Chemist
- Pharmacist and similar professions
- Chemistry and pharmaceutical Company representative
- Pharmacologist
- Regulatory affairs
- Drug safety
- Clinical research marketing and sales support
- Education and training

**Notes**

In order to get their degree, students are required to certify their knowledge of the English language at the B2 level. This

level can be certified in one of the following ways:

· By submitting their language certificate, taken no more than 3
years before its submittal and attesting a B2 o higher level (for the list of the language certificates which are accepted by the University of Milan, please refer to the website: http://www.unimi.it/studenti/100312.htm).
Students can submit their language certificate during the immatriculation procedure or send it to the Language Centre of the University of Milan
(SLAM) via the Infostudente service.

· By sitting the placement test run by SLAM, during the first year
exclusively, from September to December. Should they not pass the Placement Test, students will have to attend the English language course organized by SLAM. All students who do not have a valid language certificate must sit the Placement Test. Those students who do not sit the Placement test by December or do not pass the end of course test in one of the 6 attempts granted will have to get a language certificate outside the University of Milan within their degree.

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

The University of Milan supports the international mobility of its students, offering them the opportunity to spend periods of study and training abroad, a unique opportunity to enrich their curriculum in an international context.

**Study and internships abroad**

Programs offered:
• Erasmus + Placement Programme, and Erasmus Mundus at Universities/Institutions partners in Europe and in the Balkans;
• stages at i) Departments of Medicine and Pharmacology, University of Minnesota US; ii) Institute of Advanced Energy, Kyoto University, Japan
Activities: the mobility is directed to attending courses, research internships and training in Hospital Pharmacy.
The Erasmus Programme + Placement offers the opportunity to play an internship abroad in enterprises or other organizations.
Universities and partner Companies offer the opportunity to carry out researches in a wide range of scientific topics characterizing the Course of Study. For detailed informations on the host institution and fields of studies, see the following web site: http://www.farmacia.unimi.it/CorsiDiLaurea/3125_ITA_HTML.html.
Procedure for the recognition of abroad studies. Every student must define the activity and the number of CFU in his/her Learning Agreement according to the following rules:
-an academic year: 60 credits;
-an academic semester: 30 credits;
-an academic quarter: 20 CFU.
-Internship in Hospital pharmacy could not be longer than for 4-months corresponding to 20 CFU. 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**

To gain access to mobility programs for study purposes, lasting 3-12 months, the enrolled students of the University of Milan must attend a public selection that starts usually around the month of February each year through the presentation of specific competition announcements, which contain information on available destinations, respective duration of the mobility, requirements and deadlines for submitting the online application.

The selection, aimed at evaluating the proposed study abroad program of the candidate, knowledge of a foreign language, especially when this is a preferential requirement, and the motivations behind the request, is performed by specially constituted commissions.

Each year, before the expiry of the competition announcements, the University organises information sessions for the specific study course or groups of study courses, in order to illustrate to students the opportunities and participation rules.

To finance stays abroad under the Erasmus + program, the European Union assigns to the selected students a scholarship that - while not covering the full cost of living abroad - is a useful contribution for additional costs as travel costs or greater cost of living in the country of destination.

The monthly amount of the communitarian scholarship is established annually at national level; additional contributions may be provided to students with disabilities.

In order to enable students in economic disadvantaged conditions to participate in Erasmus+ program, the University of

Milan assigns further additional contributions; amount of this contributions and criteria for assigning them are established from year to year.

The University of Milan promotes the linguistic preparation of students selected for mobility programs, organising every year intensive courses in the following languages: English, French, German and Spanish.

The University in order to facilitate the organisation of the stay abroad and to guide students in choosing their destination offers a specific support service.

More information in Italian are available on www.unimi.it > Studenti > Studiare all¿estero > Erasmus+

For assistance please contact:
Ufficio Accordi e relazioni internazionali
via Festa del Perdono 7 (ground floor)
Tel. 02 503 13501-12589-13495-13502
Fax 02 503 13503
E-mail: mobility.out@unimi.it
Desk opening hour: Monday-friday 9 - 12

### *1st COURSE YEAR Core/compulsory courses/activities common*

| Learning activity | Ects | Sector |
|---|---|---|
| ANALYTICAL CHEMISTRY | 6 | CHIM/01 |
| Animal Biology and Plant Biology | 9 | BIO/15, BIO/13 |
| Calculus | 7 | MAT/05 |
| Computer skills | 3 | INF/01 |
| English proficiency B2 (2 ECTS) | 2 | L-LIN/12 |
| General and Inorganic Chemistry and Stoichiometry | 10 | CHIM/03 |
| Human Anatomy and Physiology | 11 | BIO/09, BIO/16 |
| Physics | 8 | FIS/01 |
| Total compulsory credits | 56 | |

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

| Learning activity | Ects | Sector |
|---|---|---|
| Applied Microbiology | 6 | BIO/19 |
| Biochemistry | 8 | BIO/10 |
| DRUG ANALYSIS 1 AND LABORATORY OF DRUG ANALYSIS 1 AND FOOD CHEMISTRY | 12 | CHIM/10, CHIM/08 |
| General Pathology | 6 | MED/04 |
| Organic Chemistry 1 | 10 | CHIM/06 |
| PHARMACOGNOSY | 8 | BIO/15 |
| PHYSICAL CHEMISTRY | 6 | CHIM/02 |
| QUALITATIVE ANALYSIS OF INORGANIC DRUGS | 6 | CHIM/08 |
| Total compulsory credits | 62 | |

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

| Learning activity | Ects | Sector |
|---|---|---|
| Applied Biochemistry | 8 | BIO/10 |
| Extractive and Synthetic Preparation of Drugs and Laboratory of Extractive and Synthetic Preparation of Drugs | 6 | CHIM/08 |
| Medicinal Chemistry 1 | 10 | CHIM/08 |
| Organic Chemistry 2 and Organic Chemistry Laboratory | 10 | CHIM/06 |
| PHARMACOLOGY AND PHARMACOTHERAPY | 8 | BIO/14 |
| Spectroscopic methods in organic chemistry | 7 | CHIM/06 |
| Toxicology | 8 | BIO/14 |
| Total compulsory credits | 57 | |

### *4th COURSE YEAR Core/compulsory courses/activities common*

| Learning activity | Ects | Sector |
|---|---|---|
| DRUG ANALYSIS 2 AND LABORATORY OF DRUG ANALYSIS 2 | 10 | CHIM/08 |
| Medicinal Chemistry 2 | 10 | CHIM/08 |
| Pharmaceutical Technology and Legislation I | 9 | CHIM/09 |
| Pharmaceutical Technology and Legislation II | 9 | CHIM/09 |
| Total compulsory credits | 38 | |

### *Elective courses*

**Al quarto anno di corso, lo studente dovrà scegliere uno tra i sette profili professionalizzanti, ciascuno di sedici crediti. La segnalazione della preferenza dovrà essere effettuata compilando l'apposito modulo disponibile sul sito o presso la Segreteria Didattica Interdipartimentale e riconsegnando il modulo stesso entro il 15 dicembre 2017. I corsi si svolgono tutti nel secondo semestre del IV anno.**

**a) Science of drug development profile**

| | | |
|---|---|---|
| Advanced methodologies in Medicinal Chemistry | 8 | CHIM/08 |
| Analytical methods in drug discovery and development and validation of analytical procedures in pharmaceutical industry | 8 | CHIM/08 |
| **b) Pharmaceutics and pharmaceutical technology profile** | | |
| Advances in Drug Delivery Systems (modules I and II) | 8 | CHIM/09 |
| Formulation and Regulatory Affairs of Health Products and Pharmaceutical Regulatory Affairs and Patents | 8 | CHIM/09 |
| **c) Experimental pharmacology profile** | | |
| Molecular and Cellular Pharmacology and Experimental Pharmacology | 8 | BIO/14 |
| Pharmacological in biotechnology and Molecular Biology | 8 | (4) BIO/11, (4) BIO/14 |
| **d) Pharmacological and therapeutic profile** | | |
| Biotechnological drugs: pharmaco-toxicological aspects and Pharmaceutical Regulatory Affairs and Patents | 8 | (4) BIO/14, (4) CHIM/09 |
| Clinical Pharmacology and Pharmacoepidemiology and Pharmacoeconomics | 8 | BIO/14 |
| **e) Molecular and supramolecular chemistry: analysis and synthesis profile** | | |
| Inorganic nanoparticles in life sciences and advanced characterization techniques | 8 | (4) CHIM/03, (4) CHIM/06 |
| Organometallic chemistry and fine chemical applications | 8 | (4) CHIM/03, (4) CHIM/06 |
| **f) Chemical methods applied to biomolecules profile** | | |
| Innovative methods for synthesis and analysis | 8 | CHIM/06 |
| Synthetic Aspects in Biomolecules Preparation and Application of biomolecules in biological systems studies | 8 | (4) BIO/10, (4) CHIM/06 |
| **g) Endocrinology and metabolism profile** | | |
| Endocrinolgy and metabolism | 8 | MED/13 |
| Nutritional requirement during lifetime and pathological aspects of nutrition | 8 | (5) BIO/09, (3) MED/05 |
| **Nei profili professionalizzanti potranno, in alternativa, essere utilizzati i seguenti insegnamenti: (tradurre)** | | |
| BIOETHICS | 4 | MED/02 |
| Clinical Biochemistry and clinical molecular biology | 4 | BIO/12 |
| Fermentation chemistry and biotechnology | 4 | CHIM/11 |
| Management company organization | 4 | SECS-P/10 |
| Statistics for sperimental and technological research | 4 | SECS-S/02 |

## *5th COURSE YEAR Core/compulsory courses/activities common*

| Learning activity | | Ects | Sector |
|---|---|---|---|
| Industrial Pharmacy and Laboratory of Pharmaceutical Technology | | 8 | CHIM/09 |
| | Total compulsory credits | 8 | |

## *Elective courses*

**Lo studente dovrà scegliere un insegnamento, del valore di otto crediti, o due insegnamenti, ciascuno del valore di quattro crediti, tra quelli di seguito elencati. Gli insegnamenti a scelta libera saranno attivati sulla base delle richieste degli studenti. Le eventuali propedeuticità saranno indicate dai docenti titolari dei corsi. (tradurre)**

| | | |
|---|---|---|
| Analysis of bioactive compounds in complex matrices and drug master file | 8 | CHIM/08 |
| Biological therapy | 8 | BIO/14 |
| Biomarkers and laboratory tests | 8 | (4) MED/05, (4) BIO/12 |
| Biosynthesis of natural compounds and biocatalysis applied to organic synthesis | 8 | CHIM/06 |
| Biotechnological drugs and Industrial preparation of pharmaceutical substances by fermentation or extraction | 8 | CHIM/08 |
| Cosmetic Products | 8 | CHIM/09 |
| Dietary supplements, functional and novel foods | 8 | CHIM/10 |
| Experimental laboratory | 8 | ND |
| Health products and medical devices | 8 | CHIM/09 |
| 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 |
| Introduction to Economics and Marketing of Drug Products and Generic drug products | 8 | CHIM/09 |
| Metallorganic chemistry and sterocontrolled catalysis | 8 | CHIM/03 |
| Methodologies and experimental models for therapy with hormones | 8 | (4) MED/13, (4) BIO/13 |
| Pharmaceutical stereochemistry and computer assisted drug design | 8 | CHIM/08 |
| Physiology of Integrated systems I | 8 | BIO/09 |
| Receptors chemistry and pharmaceutical nanotechnologies | 8 | CHIM/08 |
| Special Systems Pharmacology | 8 | BIO/14 |

## *End of course requirements*

| | | | |
|---|---|---|---|
| FINAL EXAM | | 21 | NA |
| FINAL EXAM | | 4 | NA |
| Professional training in pharmacy (first part) | | 5 | NA |
| Professional training in pharmacy (second part) | | 25 | NA |
| | Total compulsory credits | 55 | |

## *COURSE PROGRESSION REQUIREMENTS*

***The course contains the following obligatory or advised prerequisites***

| Learning activity | Prescribed foundation courses | O/S |
|---|---|---|
| Spectroscopic methods in organic chemistry | Organic Chemistry 1 | Core/compulsory |

| | | |
|---|---|---|
| Applied Microbiology | 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 |
| QUALITATIVE ANALYSIS OF INORGANIC DRUGS | ANALYTICAL CHEMISTRY | Core/compulsory |
| DRUG ANALYSIS 2 AND LABORATORY OF DRUG ANALYSIS 2 | DRUG ANALYSIS 1 AND LABORATORY OF DRUG ANALYSIS 1 AND FOOD CHEMISTRY | Core/compulsory |
| Medicinal Chemistry 1 | Organic Chemistry 1 | Core/compulsory |
| Medicinal Chemistry 2 | Medicinal Chemistry 1 | Core/compulsory |
| | Organic Chemistry 2 and Organic Chemistry Laboratory | Core/compulsory |
| Extractive and Synthetic Preparation of Drugs and Laboratory of Extractive and Synthetic Preparation of Drugs | Organic Chemistry 1 | Core/compulsory |
| Pharmaceutical Technology and Legislation I | Physics | Core/compulsory |
| | Organic Chemistry 1 | Core/compulsory |
| | PHARMACOLOGY AND PHARMACOTHERAPY | Core/compulsory |
| | DRUG ANALYSIS 1 AND LABORATORY OF DRUG ANALYSIS 1 AND FOOD CHEMISTRY | Core/compulsory |
| Pharmaceutical Technology and Legislation II | Physics | Core/compulsory |
| | Organic Chemistry 1 | Core/compulsory |
| | PHARMACOLOGY AND PHARMACOTHERAPY | Core/compulsory |
| | DRUG ANALYSIS 1 AND LABORATORY OF DRUG ANALYSIS 1 AND FOOD CHEMISTRY | Core/compulsory |
| Industrial Pharmacy and Laboratory of Pharmaceutical Technology | Pharmaceutical Technology and Legislation I | Core/compulsory |
| Biochemistry | Human Anatomy and Physiology | Core/compulsory |
| Physics | Calculus | Recommended |
| Human Anatomy and Physiology | Animal Biology and Plant Biology | Recommended |
| Toxicology | PHARMACOGNOSY | Core/compulsory |
| PHARMACOGNOSY | Human Anatomy and Physiology | Core/compulsory |
| | Animal Biology and Plant Biology | Core/compulsory |
| Applied Biochemistry | Biochemistry | Core/compulsory |
| | Organic Chemistry 1 | Core/compulsory |
| ANALYTICAL CHEMISTRY | General and Inorganic Chemistry and Stoichiometry | Recommended |
| Organic Chemistry 1 | General and Inorganic Chemistry and Stoichiometry | Core/compulsory |
| PHARMACOLOGY AND PHARMACOTHERAPY | General Pathology | Core/compulsory |
| | Biochemistry | Core/compulsory |
| | PHARMACOGNOSY | Core/compulsory |
| Organic Chemistry 2 and Organic Chemistry Laboratory | Organic Chemistry 1 | Core/compulsory |
| DRUG ANALYSIS 1 AND LABORATORY OF DRUG ANALYSIS 1 AND FOOD CHEMISTRY | ANALYTICAL CHEMISTRY | Core/compulsory |
| PHYSICAL CHEMISTRY | General and Inorganic Chemistry and Stoichiometry | Core/compulsory |