



**UNIVERSITA' DEGLI STUDI DI MILANO**  
**PROGRAMME DESCRIPTION - ACADEMIC YEAR 2020/21**  
**SINGLE-CYCLE DEGREE**  
**Pharmaceutical Chemistry and Technology (Classe LM-13)**  
**enrolled from 2009/10 academic year**

### 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 , 3rd , 4th , 5th
<b>Access procedures:</b>	Cap on student, student selection based on entrance test
<b>Course code:</b>	E25

### PERSONS/ROLES

#### Head of Interdepartmental Study Programme

Prof.ssa Egle Beccalli, +39 02 503 14479 [egle.beccalli@unimi.it](mailto:egle.beccalli@unimi.it) Ricevimento studenti: tutti i giorni ore 12.00

#### Tutors - Faculty

Tutors per l'orientamento e piani di studio:

Prof. Giancarlo Aldini, [giancarlo.aldini@unimi.it](mailto:giancarlo.aldini@unimi.it)

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Tutors per stage e tirocini:

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Prof. Sergio Romeo, [sergio.romeo@unimi.it](mailto:sergio.romeo@unimi.it)

#### Degree Course website

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

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

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

#### Tutor per la mobilità internazionale e l'ERASMUS: Prof.ssa Francesca Clerici

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

#### Tutor per trasferimenti e riconoscimento crediti: Prof.ssa Francesca Selmin

Via Colombo, 71 Phone 02 503 24645 Ricevimento studenti: previo appuntamento telefonico o email

Email: [francesca.selmin@unimi.it](mailto:francesca.selmin@unimi.it)

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

Via Balzaretti, 9 Phone 02 503 18323 Ricevimento studenti: previo appuntamento telefonico Email: [donatella.caruso@unimi.it](mailto:donatella.caruso@unimi.it)

### 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 of national 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 or higher level (for the list of the language certificates which are accepted by the University of Milan, please refer to the website: <https://www.unimi.it/en/node/297/>). Students can submit their language certificate during the immatriculation procedure.

· 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 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 30 different 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 + 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: <https://www.unimi.it/en/education/pharmaceutical-chemistry-and-technology>.

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

The students of the University of Milan can participate in mobility programmes, which last 3 to 12 months, through a public selection procedure.

Ad hoc commissions will evaluate:

- 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 generally begins around February each year with the publication of a call for applications specifying the destinations, with the respective programme duration, requirements and online application deadline.

Every year, before the deadline for the call, the University organizes informative meetings to illustrate opportunities and rules for participation to students.

Erasmus+ scholarship

The European Union grants the winners of the Erasmus+ programme selection a scholarship to contribute to their mobility costs, which is 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.

Learn more at <https://www.unimi.it/en/international/study-abroad/studying-abroad-erasmus>.

For assistance, please contact:

International Mobility Office

Via Santa Sofia 9 (second floor)

Tel. 02 503 13501-12589-13495-13502

E-mail: [mobility.out@unimi.it](mailto:mobility.out@unimi.it)

Desk opening hours: Monday to Friday 9 am - 12 noon

<b>1st COURSE YEAR Core/compulsory courses/activities common</b>		
<b>Learning activity</b>	<b>Ects</b>	<b>Sector</b>

ANALYTICAL CHEMISTRY	6	CHIM/01
Animal Biology and Plant Biology	9	BIO/15, BIO/13
Calculus	7	MAT/05
Computer Science Course	3	INF/01
English proficiency B2 (2 ECTS)	2	ND
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 16 dicembre 2020. 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 Pharmacoeconomics 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**

Endocrinology and metabolism	8	MED/13
Nutritional requirement during lifetime and pathological aspects of nutrition	8	(5) BIO/09, (3) MED/05

**Nei profili professionalizzanti potrà, in alternativa, essere utilizzato uno dei 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
<b>5th COURSE YEAR Core/compulsory courses/activities common</b>		
<b>Learning activity</b>	<b>Ects</b>	<b>Sector</b>
Industrial Pharmacy and Laboratory of Pharmaceutical Technology	8	CHIM/09
	Total compulsory credits	8
<b>Elective courses</b>		
<b>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.</b>		
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 I	8	BIO/09
Special Systems Pharmacology	8	BIO/14
<b>End of course requirements</b>		
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
	Organic Chemistry 1	Recommended
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
	Organic Chemistry 1	Recommended
PHYSICAL CHEMISTRY	General and Inorganic Chemistry and Stoichiometry	Core/compulsory