

### *Introduction*

The aim of the First Level Master Degree in **Advanced Molecular Sciences** is the training of Graduates in Chemistry with high scientific and professional qualifications. The use of the English language in all courses, besides attracting students from other countries, aims at promoting the formation of people for research centers worldwide.

The Master will offer the opportunity to acquire top level knowledge and experience in the design, synthesis and characterization of complex systems and their applications in fundamental research and in industrial activities and development. The training project is based on the internationally recognized expertise of the members of the Department of Chemistry "Ugo Schiff" of the University of Florence in the main fields of chemistry of materials and chemistry applied to life sciences. The project is aimed at overcoming the traditional dichotomy between the teachings of chemistry of synthetic materials and chemistry of biological molecules and to offer interdisciplinary skills.

At the end of the Master course the Graduates will possess the skills that derive from the two areas for the design and study of the complex systems including materials, biopharmaceuticals, probes and theranostics of the next generation.

The molecular vision, characteristic of the chemical approach, will bring about the development of new products and the precise control of their properties, providing effective and sustainable responses to the needs of the society in terms of new therapeutic approaches, new materials, new processes and new analytical methods.

The proposed goal will be achieved through a training offer that includes a set of mandatory courses in chemistry and biochemistry, necessary for the professional and cultural background of all future Graduates, and a number of integrative optional teachings.

The student will select two out of the six offered integrative courses, depending on his/her personal interests. In this way each student will have the possibility of setting up a customized plan of study.

The multidisciplinary profile offered by the Master degree will enable the Graduate to deal with the challenging demands of the industrial and academic realms. The offered education will be aimed at training both highly specialized professionals to be included in the business world and future researchers who will be able to face further training courses at the PhD and Master level in Molecular Sciences.

### *Structure of the Master Course*

The Master Course in **Advanced Molecular Sciences** is based on a single curriculum.

The training activities are organized into semesters.

In the 2019/2020 academic year, the first semester will span between **September 20, 2019** and **December 20, 2019**. The second semester will begin on **February 20, 2020** and will end on **June 20, 2020**.

### *Educational Training Goals*

The educational training aim of the Master, is to train a chemist with an extensive knowledge of the common principles that rule the structures, dynamics and functions of complex architecture systems, organized and responsive, both synthetic and natural. Graduates will also be able to modulate the properties of such systems, in order to design new items with specific desired functionalities that derive from the chemical nature of the components (of biological, organic or inorganic origin, single or combined) and from their structural organization for applications in different areas.

The course aims at providing a global vision that overcomes the common division between chemistry of materials and chemistry of life sciences and shows how the use of the knowledges of the two areas can synergistically offer new possibilities for the scientific and technological advancement. The Graduate will have full mastery of the scientific method, will know the most updated instrumental and data analysis techniques and will be able to independently manage his/her work activity.

The course is based on 54 ECTS (European Credit Transfer System) dedicated to the fundamental lecturing in chemistry and biochemistry, focusing on the synthesis and analysis and modulation of the properties of inorganic and organic materials, biological systems, biomolecules and bioactive molecules and on their qualitative and quantitative determination. These common mandatory part will be designed in such a way as to develop a training process supported by a robust practical activity.

The Laboratory experiences will be articulated in an integrated way between the various courses according to a logical sequence that will lead the student to acquire a global vision of the process of development of new products. To complete the Graduate's training the Master offers also a wide choice of supplementary courses for a more detailed study and application to some areas chosen by the student. These supplementary teachings will also guarantee a remarkable multidisciplinary.

The variety and flexibility of the course of study are further supported by some thematic short courses (indicated by the acronym "AT"). These AT courses are designed to deepen some specific features of different topics (for example management, regulatory or patent activities) and will be taught by International experts. The AT teachings can be chosen within the number of ECTS of free choice courses. Foreign students will be able to include in their course of studies educational activities aimed at achieving a level of knowledge of the Italian language equivalent to B2 of the CEFR. The course of study will end with an experimental thesis to be carried out in an Italian or foreign research laboratory or at industrial facilities.

#### *Admission requirements and verification of the adequacy of the background. Education qualification*

In order to access the First Level Master in **Advanced Molecular Sciences** of the LM-54 class the student must possess a degree in Chemical Sciences and Technologies (class L-27, ex-DM 270/04), or in Chemical Sciences and Technologies (class 21, ex-DM 509/99).

The access to the Master is also granted to those who acquired a good basic scientific knowledge in Mathematics and physical disciplines and a suitable preparation in chemical sciences and who possess a 3-year University degree, or another qualification received in a foreign country. In the latter case the qualification must be acknowledged and approved by the Administration Offices for the admission to the Master Course.

#### *Curriculum requirements*

The requirements necessary to access the Master Course in **Advanced Molecular Sciences**, are:

- The achievement of at least 20 ECTS in mathematical, physical and computer science disciplines (in Scientific Disciplinary Sectors or SSD indicated as MAT/xx, FIS/xx, INF/01, ING-INF/05. Please note that these abbreviations refer to the current Italian legislation).
- The achievement of at least 50 ECTS in chemical disciplines (SSD CHIM/xx), industrial and technological chemical disciplines (ING-IND/21, ING-IND/22, ING-IND/25) and

biochemical disciplines (BIO/10, BIO/11, BIO/12) with theoretical and experimental activities in these SSDs: CHIM/01, CHIM/02, CHIM/03, CHIM/06.

- The achievement of at least 15 ECTS for traineeship, professional activities, other activities, including the final exam and the knowledge of English. The knowledge of English must be at the B2 level. The level can be certified by International Institutions or by the University Language Center of the University of Florence.

#### *Suitable individual preparation*

The suitable preparation of all those who possess the qualifications and curricular qualifications mentioned above will be assessed individually by the Didactic Committee established of the Master Course in Advanced Molecular Sciences.

Particular elements of evaluation will be:

- The type of the previous examinations undertaken by the student, both those included in the scientific disciplinary sectors of the curricular requirements and those that are included in the personal study plan that are considered to be useful for the admission to the Master Course.
- The evaluation obtained on previous examinations, especially those included in the scientific disciplinary sectors of the curriculum requirements.
- The type of final exam.

Each student will be asked for an individual interview in order to assess the applicant's preparation. The interview of foreign students can take place through an electronic communication mean for foreign students. The admission to the Master Course in **Advanced Molecular Sciences** will be subject to the positive outcome of this interview.

Otherwise, the Didactic Committee will define the additional requirements that will have to be satisfied before the enrollment in the Master Course. The procedure, timing and other details of the Interview will be published by the end of August in the Master website.

After approving the student's preparation, the Didactic Committee will deliberate the admission to the Master Course in **Advanced Molecular Sciences** in the LM-54 class of the First Level Degrees, and issue the official authorization (*nulla-osta*).

The procedures, the terms and the list of the documentation to be prepared for the enrollment application for the Master Course will be specified every year in the General Program "*Manifesto degli Studi*" of the University of Florence, that is available online in the homepage of the University website. The amount of the fees to be paid is established according to the University Fees and Contributions Regulations issued annually. The summary picture of the courses planned for the two-year course is shown in Table I.

*Table I. Structure of the Degree Course*

The optional courses (in blue) will account for 12 ECTS, 6 ECTS will be provided by traineeships activities, and 36 ECTS for the final examination (30 ECTS for the experimental work in the Lab and 6 ECTS for writing and discussing the thesis).

| Year                                                                       | Semester | Course                                                                                         |         |
|----------------------------------------------------------------------------|----------|------------------------------------------------------------------------------------------------|---------|
| 1                                                                          | 1        | Advanced and innovative analytical methods for applications in life sciences                   | CHIM01  |
| 1                                                                          | 1        | Methods and Materials for Cultural Heritage Conservation                                       | CHIM12  |
| 1                                                                          | 1        | Advanced Coordination Chemistry                                                                | CHIM03  |
| 1                                                                          | 1        | Advanced synthetic methods                                                                     | CHIM06  |
| 1                                                                          | 1        | Protein Engineering and Recombinant Proteins                                                   | BIO/10  |
| 1                                                                          | 2        | Computational modelling of complex systems*                                                    | CHIM/02 |
| 1                                                                          | 2        | Experimental methods for the study of nanostructured materials*                                | CHIM/02 |
| 1                                                                          | 2        | Soft matter materials*                                                                         | CHIM/02 |
| 1                                                                          | 2        | Superstructures and multi-components architectures in Life and Material Sciences               | CHIM/03 |
| 1                                                                          | 2        | Methods for decoration of materials and bioconjugation                                         | CHIM/06 |
| 12 ECTS (two courses) to be chosen among those marked with an asterisk (*) |          |                                                                                                |         |
| 2                                                                          | 1        | Solid state and material chemistry#                                                            | CHIM/07 |
| 2                                                                          | 1        | Medicinal Chemistry#                                                                           | CHIM/08 |
| 2                                                                          | 1        | Advanced Polymeric Materials#                                                                  | CHIM/04 |
| 2                                                                          | 1        | Chemistry and the Omic Science#                                                                | MED/46  |
| 2                                                                          | 1        | Chemical Biotechnology#                                                                        | BIO/12  |
| 2                                                                          | 1        | Soft matter materials applied to drug delivery systems, food supplements and cosmetic science# | CHIM/09 |
| 12 ECTS (two courses) to be chosen among those marked with an #            |          |                                                                                                |         |

*Training activities chosen by the student: 12 ECTS*

Two more courses (12 ECTS overall) are reserved to activities chosen by the student. The choice of courses will be specified in the personal Study Plan, according to the procedure indicated in the following paragraph, that will be evaluated by the Didactic Committee.

*Final test: 36 ECTS*

The final exam for the achievement of the Master Degree will provide 36 CFUs to be achieved during the two-year activities. The training activities related to the preparation of the final exam consist in practical laboratory activity corresponding to 30 ECTS (Final exam: experimental work) to be performed at a University Department, Center or Laboratory or in

a public research Institution or an external accredited company, under the guidance of a university Tutor and one or more co-tutors.

The activity related to the final exam must be agreed upon with a Tutor and followed by the Tutor him/herself.

To obtain the title of the Master Degree, the student will have to pass a final exam, consisting in the writing and discussion of an original research work on experimental or theoretical activities in the field of chemical sciences. (Final exam: writing and discussion, 6 ECTS). The final grading will be expressed in 110/110. Students who achieve the 110-point degree mark can be given honors by a unanimous vote of the Commission.

To access the final exam the candidate must have acquired at least 84 ECTS.

#### *Other activities: 6 ECTS*

6 ECTS are reserved for research activities in university laboratories or for training internships activities at university laboratories or industries, public and private Institutions affiliated with the University whose names will be provided by the teaching structure.

Presentation of a personalized study plan.

The presentation of the Study Plan takes place in November during the first year of the course. In the study plan, in addition to the compulsory courses listed in the "Manifesto degli Studi", the student will specify the educational activities and the traineeship activities. Changes to the study plan can still be presented at the beginning of the second year of the course. The presented Plan will be evaluated by the competent teaching structure take will make a decision within thirty days after the submission deadline. The Board of the teaching structure, or other competent commission, must approve any change to the plan.

#### *Active tutoring services*

The members of the Didactic Committee will be available for at least two hours a week, at fixed times and according to their own teaching/scientific skills, to answer any question the students may have about the content of the courses and to solve any problem related to the organization of the studies. Forms of electronic tutoring will be encouraged.

#### *Attendance obligations*

Attendance for all courses is highly recommended for rapid and profitable learning of the subjects which are taught. For laboratory courses, attendance is compulsory and is certified with passing the relative exam.

Students engaged in work activities and part-time students

With regard to working or part-time students, the Master Course will evaluate the possibility of enrolling students who are engaged in other working activities. The teachers will collaborate in the initiatives proposed by the University concerning courses and lessons with a schedule different from that provided in the "Manifesto degli Studi".

#### *Examination procedures and other forms of credits assignment*

The student acquires the credits for each teaching course by passing the exam. In some courses there are ongoing checks.

Each exam of the Master Course will give rise to a final grading expressed in 30/30 and to the acquisition of the related credits.

Exams and interviews are carried out:

- during the break between the two semesters.
- in April during the period in which lessons are suspended.
- at the end of the second semester.
- in September before the start of the following academic year courses.
- for traineeship activities, the successful completion of the test is certified with a judgment of suitability.

Semesters calendar, graduation sessions and official holidays

For the 2019-2020 academic year the semester calendar is the following one:

- I Semester: September 20, 2019 - December 20, 2019
- II Semester: February 20, 2020 - June 20, 2020

The dates for the thesis sessions will be published in the website of the Master Course.

Official holidays during lesson periods will be published on the website

### *Educational services*

The teaching activities of the Master Course will take place in Sesto Fiorentino, *Polo Scientifico* of the University of Florence.

The Polo Scientifico in Sesto is connected to the Firenze Rifredi and Sesto Fiorentino railway stations and with Calenzano by ATAF-LINEA bus companies, lines 59 and 66, respectively.

Routes and timetables can be found in the Internet at: <http://www.polosci.unifi.it>, <http://www.ataf.net> and <http://www.trenitalia.it>.

The cafeteria and the sports facilities (basketball court, soccer, five-a-side soccer, volleyball, tennis, rugby and gym, for information <http://www.cus.firenze.it>) are available in the Polo Scientifico for all enrolled students.

The University Language Center (Centro Linguistico di Ateneo) periodically organizes elementary and advanced English language courses at the Polo Scientifico (for information visit <http://www.cla.unifi.it>).

### *Classrooms*

All classes will take place in the Polo Scientifico in via Gilberto Bernardini, 6 (Classroom and Library Building), and at the Department of Chemistry "Ugo Schiff", via della Lastruccia, 3-13

### *Laboratories*

All Laboratories are hosted by the Department of Chemistry, via della Lastruccia 3-13, and by the Department of Physics, via Sansone 1, at the Polo Scientifico.

### *Library*

The Library is located in via Gilberto Bernardini 6, at the Polo Scientifico (<http://www.sba.unifi.it/CMpro-v-p-347.html>). Some terminals for bibliographic research are available to students.

### *Departments*

The facilities of Department of Chemistry "Ugo Schiff" are available to the students of the Master Course and are of fundamental help for the teaching activities. At these facilities, teachers are available to students during office hours and for demonstrations and exercises on research equipments.

### *Computer room*

The Master Course will provide students, who wish to carry out independent learning activities, internet research, e-mail, with a computer room at the Classroom and Library Building, via Gilberto Bernardini 6.

The use of the computers is free and under the supervision of students appointed by the Structure manager.

### *Erasmus Plus programs*

Students wishing to spend a period of study abroad under the Erasmus Plus program will have to submit the study plan to the Master Course before leaving. The Person in Charge for the Erasmus Plus program at the Department of Chemistry is Prof. Anna Maria Papini (email: [annamaria.papini@unifi.it](mailto:annamaria.papini@unifi.it)).

### *Classrooms for Students*

At the Polo Scientifico wide study spaces are available for students in the Classroom and Library Building and in the Department of Chemistry.

### *Topics of the Courses*

Short summaries on the nature and contents of the activated courses are shown online. Further questions can be addressed directly to the lecturers.