BACHELOR IN CHEMISTRY AT PARMA UNIVERSITY
(3-year programme, 180 Credits)

The Bachelor in Chemistry at Parma University requires you to take 22 required subjects (144 credits), a subject at choice within a menu (6 credits) and two elective subjects within Parma University (12 credits). The study programme is completed with the English B1 course and a course on safety in chemical laboratories. You can go for an Internship Project (9 credits – 2 months) at a company in Italy or abroad or in a university research lab. You will conclude your Bachelor’s programme with the Laurea exam (5 credits) where you will be entitled Junior Doctor in Chemistry. For detailed information on each subjects and curriculum check out the Chemistry Bachelor Syllabi for the academic year 2017/2018 (information provided may be subject to change, year by year).

This bachelor is linked to the Department of Chemistry, Life-Sciences and Environmental Sustainability that was awarded a special funding as Italian “Department of Excellence” for the 2018-2022 five-year period.

The bachelor is acquired in three years, with subjects distributed in two terms:
• first semester: October – February
• second semester: March - June.

All subjects are given in Italian. Book Exams are available for all subjects. The Internship work can be held in English.

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<tr>
<td>ELECTIVE SUBJECTS (other subjects from the menu or any other subject within Parma University)</td>
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I YEAR SUBJECTS

ANALYTICAL CHEMISTRY AND LABORATORY OF ANALYTICAL CHEMISTRY

GENERAL AND INORGANIC CHEMISTRY
The foundations of the atomic and molecular theory; Structure of the atoms. Chemical bond; Nomenclature of the compounds; States of aggregation of the matter; Solutions; Chemical thermodynamics; Chemical equilibrium; Ionic equilibria; Chemical kinetics; Electrolytic and galvanic cells; Inorganic chemistry.

LABORATORY FOR GENERAL AND INORGANIC CHEMISTRY
The first part of the course will deal with the introduction on the chemical nomenclature, the chemical reactions, and the principal methods for stoichiometric calculations. The second part of the course will deal with numerical exercises on: gaseous systems, chemical equilibrium, theories of acids and bases. Lectures will be delivered on the description of the laboratory activities and on the safety procedures in the laboratory. These lectures will be followed, in the second part of the term, by practical activities in the chemical laboratory.

ORGANIC CHEMISTRY I
Classification, notational aspects and physical properties of mono-functional organic compounds. Basic concepts of stereochemistry. Methodological aspects for the comprehension of substitution, addition, elimination reactions of mono-functional organic compounds.

LABORATORY OF ORGANIC CHEMISTRY I
Introduction to the organic chemistry laboratory. Introduction to IR and UV-Vis spectroscopic techniques and to the most important separation techniques in the organic chemistry laboratory: theory and practice. Theoretical and practical approach to an organic synthesis reaction.

PHYSICS I
Kinematic, dynamic and static concept applied to point mass and extended objects. Mechanical waves and their interference. Statics and dynamics of fluids.

ENGLISH B1 (No vote, Threshold level)
Grammar and Vocabulary corresponding to the B1 level of English

MATHEMATICS 1 AND EXERCISES
The lectures aim at providing students with fundamental concepts of infinitesimal and integral calculus for functions of one variable, of numerical sequences and series, of Linear Algebra (paying particular attention to the theory of
linear systems and to the problem of diagonalized matrices) and of the theory or ordinary differential equations which can be solved in a elementary way.

MATHEMATICS 2 AND EXERCISES

The subject of Mathematics II and Exercises is designed to provide tools and mathematical methods useful for several applications.

II YEAR SUBJECTS

CHEMISTRY AND POLYMER TECHNOLOGY AND LABORATORY


ANALYTICAL CHEMISTRY II AND CHEMOMETRICS

Types of scale and measurements; Normal distribution, other distributions; Comparisons between rates and probability; Alpha and beta errors; a priori and a posteriori power; Student t test; Analysis of variance (ANOVA); Analysis of variance with two or more criteria; Descriptive statistics for bivariate distributions; Sample treatment; Analytical Method selection; Voltammetry; Potentiometry; Amperometry

PHYSICAL CHEMISTRY I AND LABORATORY

The zero law of thermodynamics and the gas properties. The First law of Thermodynamics. The second law of Thermodynamics. The Gibbs energy and the chemical potentials. Physical transformations of pure substances. The solutions. Phase diagrams. Chemical equilibrium. Chemical kinetics. The Lab course constitutes an adequate support and integration of the Physical Chemistry 1 course. The subjects developed in this ambit will be applied to the resolution of problems and to the laboratory practice.

INORGANIC CHEMISTRY AND LABORATORY

Inorganic Chemistry Laboratory: safety rules, synthesis of coordination compounds and their characterization by means of spectroscopic techniques. Theory: coordination compounds, infrared spectroscopy, heteronuclear NMR spectroscopy, UV-vis spectroscopy, VSEPR theory and molecular geometries. Periodic system and chemical properties of the elements; block s and p elements; d-transition elements, coordination compounds.

ORGANIC CHEMISTRY II

Heteroaromatic compounds; Aldehydes and ketones properties and reactivity; Conjugated α,β-unsaturated systems. Michael addition. Carboxylic acids and derivatives. Electrophilic rearrangements towards C, N and O electron deficient atoms. Alkylation of enolates; Condensation reactions of carbonyl compounds. Condensations in biological field. Amines: Synthesis and reactivity. Amino acids, peptides, proteins; Carbohydrates; Lipids; Nucleic Acids. Synthesis of mono-and polyfunctional molecules will be discussed according to the retrosynthetic approach.
LABORATORY FOR ORGANIC CHEMISTRY II

The course will provide the students the theoretical knowledge and the practical ability to perform an organic reaction in the lab and to determine the molecular structure of a simple compound from spectroscopic (NMR, IR, Mass) data.

PHYSICS II


PRINCIPLES OF INDUSTRIAL CHEMISTRY

Elements of thermodynamics and kinetics: finding the right operating conditions (pressure, temperature, contact time) in conducting a chemical reaction in some examples of industrial processes. Concepts of yield, conversion and selectivity. Parallel and consecutive reactions. Mass and energy balances applied to chemical industry. Multiphase reactions. Use of homogeneous and heterogeneous catalysts in industrial field (examples from petroleum industry). From laboratory to industry: problems associated with the scale-up. Raw materials, sustainability and safety of a chemical plant. Considerations on the overall costs of a process. Illustration of some important industrial processes (separation of air gases; syngas; methanol production; Fischer-Tropsch Process; ammonia, hydrazine, nitric acid; sulfuric acid; Claus process; chlorine and sodium hydroxide, hydrochloric acid, sodium carbonate; Acetylene).

III YEAR SUBJECTS

BIOCHEMISTRY


ANALYTICAL CHEMISTRY AND INSTRUMENTAL


PHYSICAL CHEMISTRY II


LABORATORY OF PHYSICAL CHEMISTRY II

Particle-in-box model: application to organic dyes. Introduction to Fourier transform. FT-IR spectrophotometer. Rotovibrational spectra of diatomic molecules. Group theory: definition of a group, symmetry elements, symmetry groups,

**SUBJECTS FROM THE MENU**

**CHEMISTRY AND SUSTAINABLE TECHNOLOGIES OF INORGANIC MATERIALS**


**COMPLEMENTS OF INORGANIC CHEMISTRY**


**COMPLEMENTS OF ORGANIC CHEMISTRY**


**COMPUTATIONAL METHODS IN CHEMISTRY**

Numerical methods: Numerical differentiation; Quadrature methods; Methods for the search of roots; Ordinary differential equations; Resolution of chemical kinetics equations; Numerical analysis of UV/Vis spectra. van der Waals equation of state.