

Programme of "Chimica Industriale" Industrial Chemistry		
<ul style="list-style-type: none"> <li>• Code: 11H005</li> <li>• type of course unit: Compulsory</li> <li>• level of course unit): second cycle</li> <li>• year of study: 2nd , semester: 2nd</li> </ul>		
Number of ECTS credits: 9 (workload is 225 hours; 1 credit = 25 hours)		
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<b>1</b>	<b>Course objectives</b>	Industrial Chemistry covers all fields of commercial production of chemicals and related products from natural raw materials and their derivatives, the exploitation of materials and energy production. The bases of industrial chemical studies consist on the evaluation of the processes as a whole: thermodynamics of involved reactions, analysis of kinetic and catalytic aspects, criteria of reactor selection and separation and purification methods including safety and environmental impact, elements of instrumental methods of analysis. These aspects are illustrated through proper training examination of some important examples of the chemical industry.
<b>2</b>	<b>Course content and Learning outcomes (Dublin descriptors)</b>	<p>The list of topics are:</p> <p>First part: The Italian and worldwide chemical industry. General criteria for chemical processes realization. Air separation. HCl synthesis from the elements. Absorption of corrosive gases. Synthesis gas: gasification of biomass and coal. H<sub>2</sub> production. Bio-methane. Ammonia synthesis. Nitric acid. Sulfuric acid and sulfur. Phosphoric acid. NKP fertilizers. Sodium carbonate. Electrochemical processes.</p> <p>Second part: Instrumental Analysis. General and selection criteria of measuring instrument. Theory of errors: overview. Introduction to the analytical methods. Spectroscopy. Characterization by X-radiation. Thermal analysis: DSC , TG, DTA . Measurements of porosity and pores distribution. Measurements of surface area. Light and electron microscopy. Gas and liquid Chromatography.</p> <p>On successful completion of this module, the student should:</p> <ul style="list-style-type: none"> <li>- understand and deeply study important industrial processes for base chemicals.</li> <li>- be stimulated to apply the basic chemical concepts to industrial processes;</li> <li>- improve knowledge and understanding of industrial chemical processes;</li> <li>- be provided with calculation methods for equilibria, mass, and energy balances involved in chemical processes;</li> <li>- to assess criteria for developing sustainable chemical processes.</li> </ul> <p>Through attending the course, students will acquire:</p> <ul style="list-style-type: none"> <li>- a knowledge of the chemical reactions and unit operations supporting the major processes of industrial chemistry;</li> <li>- understanding of aspects of chemical processes (thermodynamics, kinetics, catalysis, reactor types, operating conditions, plant schemes, safety, environmental and economic aspects);</li> <li>- skill to carry out properly laboratory projects on instrumental methods of analysis.</li> </ul>
<b>3</b>	<b>Prerequisites and learning activities</b>	Students attending the course must have a knowledge of general chemistry, in particular the concepts of chemical equilibrium, mass action law, theory of acid-base and solubility equilibria, redox reactions, basic electrochemistry, chemical thermodynamics and kinetics, chemical reactor technologies. They should be able to write a report and process experimental data using appropriate mathematical tools. They should preferably be able to perform literature search on English sources.
<b>4</b>	<b>Teaching methods and language</b>	<p>Lectures, team work, laboratory projects</p> <p>Reference text books:</p> <p>Combustion and Gasification in Fluidized Beds, P. Basu, CRC Press, 2006</p> <p>Chimica industriale, I. Pasquon, CittàStudi, 1993</p> <p>Instrumental Methods of Analysis, H.H. Willard, Wadsworth Publishing Company</p> <p>Concise Encyclopedia of Materials Characterization, R.W. Cahn, Pergamon Press (ING)</p> <p>Analisi Chimica: Moderni Metodi Strumentali, Cozzi (SCI)</p> <p>Lecture notes provided by the teachers</p>
<b>5</b>	<b>Assessment methods and criteria</b>	Oral exam, short report.