

DEGREE PROFILE OF  
**Laurea Magistrale in INGEGNERIA CHIMICA**  
**Second Cycle Degree in CHEMICAL ENGINEERING**

TYPE OF DEGREE & LENGTH	Single Degree (120 ECTS-credits), 2 years
INSTITUTION(S)	Università degli Studi dell'Aquila - <i>University of L'Aquila</i> , ITALY
ACCREDITATION ORGANISATION(S)	Italian Ministry of Education and Research Register of Engineers (Albo degli Ingegneri)
PERIOD OF REFERENCE	Programme validated for 2 years for cohorts starting in October 2012
CYCLE /LEVEL	QF for EHEA: Second Cycle; EQF level: 7; NQF for Italy: Laurea Magistrale

<b>A</b>	<b>PURPOSE</b>
	<p>Graduates of this second cycle course, in accordance with the Italian Ministry Degree n.270/2009, are licensed professionals and high-profile specialists in the field of Chemical Engineering, able to plan and manage complex chemical production plants applying research findings and promoting innovation.</p> <p>The Master degree in Chemical Engineering provides the students with knowledge of applied mathematics, chemistry, physics, biology, and other natural sciences and with the technical/scientific skills for solving complex problems in innovative and interdisciplinary contexts and developing economic ways of using materials and energy for the benefit of humankind.</p> <p>The programme meets the requirements of European and National laws and Directives. Degree holders, after a national exam, can be enrolled in the Italian Register of the Engineers (Albo degli Ingegneri), established with <i>D.P.R. 328/2001</i> and join the <i>Associazione Italiana di Ingegneria Chimica (A.I.D.I.C.)</i> ¶</p>

<b>B</b>	<b>CHARACTERISTICS</b>								
1	<table border="1"> <tr> <td style="text-align: center;">DISCIPLINE(S) / SUBJECT AREA(S)</td> <td>Strong theoretical basis on Mathematics, Physics, Chemistry, other Natural Sciences and on the application of these to design, analyze, and control chemical, physical, and biological processes</td> </tr> <tr> <td style="text-align: center;">2</td> <td>GENERAL / SPECIALIST FOCUS</td> </tr> <tr> <td style="text-align: center;">3</td> <td>ORIENTATION</td> </tr> <tr> <td style="text-align: center;">4</td> <td>DISTINCTIVE FEATURES</td> </tr> </table>	DISCIPLINE(S) / SUBJECT AREA(S)	Strong theoretical basis on Mathematics, Physics, Chemistry, other Natural Sciences and on the application of these to design, analyze, and control chemical, physical, and biological processes	2	GENERAL / SPECIALIST FOCUS	3	ORIENTATION	4	DISTINCTIVE FEATURES
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	Specialist on chemical and biochemical processes management with focus on environment preservation and sustainability.								
	Academic degree with a strong professional orientation, according to International and National Directives on Engineering profession.								
	This degree has a strong scientific component in an interdisciplinary learning context and is developed in a stimulating research environment. Students have a 3/6-months placement in companies in Italy and/or abroad for on-field working experiences and research activities.								

<b>C</b>	<b>EMPLOYABILITY &amp; FURTHER EDUCATION</b>		
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2	FURTHER STUDIES	The Master Degree in <b>Chemical Engineering</b> normally gives direct access to a wide range of PhD degree programmes in the fields encompassed on Engineering Professionals. It also gives access to some specializing professional courses.
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<b>D EDUCATION STYLE</b>		
1	LEARNING & TEACHING APPROACHES	Lectures, group-work, individual study and autonomous learning, interprofessional learning, self directed study, work placement.
2	ASSESSMENT METHODS	Assessment is normally by means of an oral or written examination. The final exam consists in the presentation of a thesis (modeling and/or experimental) and a discussion aimed at demonstrate that the candidate has acquired the essential professional skills and competences related to the professional profile. Degree holders obtain the credentials for National Certification as Chemical Engineers.

<b>E PROGRAMME COMPETENCES</b>		
1	GENERIC	<p>During the two-year master, students in <b>Chemical Engineering</b> acquire a very broad general and specific education. Upon the successful completion of the degree they become Chemical Engineers. The degree programme meets the competences and quality assurance procedures required by <i>Italian Register of Engineers</i> and by the National Higher Education Quality Assurance Agency (AVA) for degree courses at second level. This includes the Generic Competences expected for the second cycle graduated, as follows:</p> <ul style="list-style-type: none"> <li>— <b>Analysis and synthesis:</b> Knowledge and understanding of complex issues regarding their profession; ability to critically and systematically integrate knowledge for analyzing assessing and dealing with complex phenomena, issues and situations even with limited information;</li> <li>— <b>Creativity:</b> ability to conduct experiments, and analyze and report results in accordance with the applicable standards in or across more than one technical area, autonomously and creatively, using appropriate methods;</li> <li>— <b>Leadership, Management and Team-working:</b> ability to assume and hold privileged and responsible positions in public or private organizations or self-employed, to demonstrate awareness of ethical aspects of the own role and contribution within this; ability to work, both independently and in teams, with technical and scientific problems of high complexity and to put the work into a broader context of industry and society;</li> <li>— <b>Communication skills:</b> Ability to communicate both orally and in writing, in first language and in another European language using appropriate scientific terminology to a wide variety of audiences and practice professional;</li> <li>— <b>Learning ability:</b> ability to identify the personal need for further knowledge and take responsibility for his/her ongoing learning; Capacity to consult specialized literature, to permanently update knowledge and skills and to be familiar with recent scientific findings and developments in Chemical Engineering, and ability to formulate a critical opinion;</li> <li>— <b>Problem solving:</b> Ability to identify engineering problems, understand existing requirements and/ or constraints, articulate the problem through technical communication and formulate alternative creative solutions.</li> </ul>
2	SUBJECT SPECIFIC	<p>The Programme meets all the Specific Competences as established and agreed in collaboration with the field stakeholders taking into consideration the standards for the second cycle recommended by EUR-ACE for accreditation of engineering programmes, clustered within the key overarching competences summarized below. The graduates must demonstrate:</p> <p><b>Knowledge of</b></p> <ul style="list-style-type: none"> <li>- the principal branches of mathematics relevant to chemical engineering (arithmetic, geometry, algebra, trigonometry, analysis, calculus, differential equations, numerical methods, linear algebra, probability and statistics, and optimization),</li> <li>- basic sciences, including chemistry, physics and biology, for the deep understanding of the properties of matter, and the transformations and interactions of matter and energy,</li> <li>- Physics for understanding the structure of the natural world and governing principles and for obtaining solutions to problems,</li> </ul> <p><b>Comprehension of</b></p>

	<ul style="list-style-type: none"> <li>- the chemical engineering principles and conservation laws governing physical and chemical transformation of matter and energy ;</li> <li>- the relationship between microscopic properties of materials and useful properties of products;</li> </ul> <p><b>Application</b></p> <ul style="list-style-type: none"> <li>-ability to apply logical reasoning and quantitative calculation, and to use mathematical language;</li> <li>-ability to solve chemical engineering problems using differential equations, numerical methods, calculus-based physics, chemistry, and statistics;</li> </ul> <p><b>Analysis</b></p> <ul style="list-style-type: none"> <li>- ability to safely conduct chemical engineering experiments according to established procedures, and analyze, interpret, and report the results;</li> <li>-ability to analyse and solve chemical engineering creatively and effectively using basic principles, modern techniques and system approach;</li> </ul> <p><b>Synthesis</b></p> <ul style="list-style-type: none"> <li>- ability to design chemical engineering experiments to investigate a phenomenon, conduct the experiment safely, and analyze and interpret the results;</li> <li>-capacity to contribute to innovation and practical implementation of ideas for new chemical processes and concepts in research and industry;</li> <li>-ability to perform a process feasibility study by calculations of mass and energy balances, simpler investment analyses and other process-economic considerations;</li> </ul> <p><b>Evaluation</b></p> <ul style="list-style-type: none"> <li>- ability to assess the need to implement changes in processing plants by improving unit operations in terms of product quality, environmental impacts and increased production;</li> <li>-ability to assess the impact of engineering solutions in societal context and to apply engineering principles for the development of sustainable processes.</li> </ul>
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<b>F</b>	<b>COMPLETE LIST OF PROGRAMME LEARNING OUTCOMES</b>
	<p>Upon successful completion of the 2<sup>nd</sup> Cycle degree in <b>Chemical Engineering</b> the graduates will:</p> <ul style="list-style-type: none"> <li>-have acquired extensive and profound knowledge of mathematics, chemical engineering and other sciences which enable them to carry out scientific work and to act responsibly in their professions and in society;</li> <li>- understand and apply chemical engineering principles and conservation laws governing physical and chemical transformation of matter and energy;</li> <li>- understand the relationship between microscopic properties of materials and useful properties of products;</li> <li>-analyse and solve problems scientifically, even if the definitions are incomplete or are formulated in an unusual way and show competing specifications;</li> <li>- design, size and optimize the processes to carry out the synthesis and formulation of these products, while meeting safety and pollution prevention standards;</li> <li>- develop models to simulate and optimize chemical process equipment</li> <li>- examine and evaluate the application of new and emerging technologies;</li> <li>- plan, manage and monitor the operation of a chemical production plant;</li> <li>-plan and carry out theoretical and experimental research independently;</li> <li>-evaluate data critically and to draw conclusions from it;</li> <li>-apply innovative methods in solving problems based on fundamental principles;</li> <li>-develop new products, equipment, processes or methods;</li> <li>-use their powers of judgment as engineers in order to work with complex and possibly incomplete information, to recognise discrepancies and to deal with them;</li> <li>-tackle a real chemical engineering problem by a scientific approach;</li> <li>-classify knowledge from various fields methodically and draw systematic conclusions from it and also to deal with complexity;</li> <li>-find solutions which require very considerable competence as far as methods are concerned;</li> <li>-function effectively as a member of a team that may be composed of different disciplines and levels;</li> <li>-think systematically about the non-technical effects of an engineer's job and to include these aspects responsibly in what they do;</li> <li>- assess the economic, energy and environmental performance of various processes and products;</li> <li>-familiarise themselves with new tasks systematically and without taking too long;</li> </ul>

<p>-plan and carry out experimental research within their field of study including necessary risk assessments for health, safety and the environment;</p> <p>-communicate efficiently about their own work to the general public as well as to experts by writing well structured reports and contributions for scientific publications and by oral presentations and posters.</p>
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