



UNIVERSITY OF L'AQUILA



Department of Industrial and Information
Engineering and Economics

Profile of

2nd Cycle Degree in
CHEMICAL ENGINEERING

Laurea Magistrale in
INGEGNERIA CHIMICA

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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), Associazione Italiana di Ingegneria Chimica - AIDIC (www.aidic.it)
PERIOD OF REFERENCE	Programme validated for 3 years for cohorts starting in October 2012
CYCLE /LEVEL	QF for EHEA: Second Cycle; EQF level: 7; NQF for Italy: Laurea Magistrale

A	PURPOSE
	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. The Master degree in Chemical Engineering provides the students with knowledge of 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. 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>

B	CHARACTERISTICS		
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		chemical, biochemical and process engineering professionals worldwide. Graduates carry out their professional activities in planning components, tools and equipment in chemical plants, in managing processes requiring energy production and transformation, production of new materials, site rehabilitation, etc. in Companies, services and public administrations, both as employee or freelance.
2	FURTHER STUDIES	The Master Degree in <i>Chemical Engineering</i> 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.

D	EDUCATION STYLE	
1	LEARNING & TEACHING APPROACHES	Lectures, group-work, individual study and autonomous learning, interprofessional learning, self directed study, work placement.
2	ASSESSMENT METHODS	The final exam consists in the preparation and discussion of a written text and in a skill test aimed at demonstrating 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.

E	PROGRAMME COMPETENCES	
1	GENERIC	
	During the two-year master, students in <i>Chemical Engineering</i> 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: — Analysis and synthesis: Knowledge and understanding of complex issues regarding their profession identifying relationships between the various domains of science; ability to critically and systematically integrate knowledge and analyse, assess and deal with complex phenomena, issues and situations even with limited information; — Creativity: 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; — Leadership, Management and Team-working: 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; — Communication skills: 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; — Learning ability: 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; — Problem solving: Ability to identify engineering problems, understand existing requirements and/ or constraints, articulate the problem through technical communication and formulate alternative creative solutions.	
2	SUBJECT SPECIFIC	
	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 of 2nd Cycle Degree in Chemical Engineering must demonstrate: Knowledge of - 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), - 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, - Physics for understanding the structure of the natural world and governing principles and for obtaining solutions to problems, Comprehension of	

	- the chemical engineering principles and conservation laws governing physical and chemical transformation of matter and energy ; - the relationship between microscopic properties of materials and useful properties of products; Application -ability to apply logical reasoning and quantitative calculation, and to use mathematical language; -ability to solve chemical engineering problems using differential equations, numerical methods, calculus-based physics, chemistry, and statistics; Analysis - ability to safely conduct chemical engineering experiments according to established procedures, and analyze, interpret, and report the results; -ability to analyse and solve chemical engineering creatively and effectively using basic principles, modern techniques and system approach; Synthesis - ability to design chemical engineering experiments to investigate a phenomenon, conduct the experiment safely, and analyze and interpret the results; -capacity to contribute to innovation and practical implementation of ideas for new chemical processes and concepts in research and industry; -ability to perform a process feasibility study by calculations of mass and energy balances, simpler investment analyses and other process-economic considerations; Evaluation - 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; -ability to assess the impact of engineering solutions in societal context and to apply engineering principles for the development of sustainable processes.
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F	COMPLETE LIST OF PROGRAMME LEARNING OUTCOMES
	Upon successful completion of the 2nd Cycle degree in <i>Chemical Engineering</i> the graduates will: - 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; - understand and apply chemical engineering principles and conservation laws governing physical and chemical transformation of matter and energy; - understand the relationship between microscopic properties of materials and useful properties of products; -analyse and solve chemical engineering problems scientifically, using differential equations, numerical methods, calculus-based physics, chemistry, and statistics, even if the definitions are incomplete or are formulated in an unusual way and show competing specifications; - design, size and optimize the processes to carry out the synthesis and formulation of these products, while meeting safety and pollution prevention standards; - develop models to simulate and optimize chemical process equipment; - plan, manage and monitor the operation of a chemical production plant; -plan and carry out theoretical and experimental research independently, evaluate data critically and draw conclusions from it; - examine and evaluate the application of new and emerging technologies; -apply innovative methods in solving problems based on fundamental principles; -develop new products, equipment, processes or methods; -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; -tackle a real chemical engineering problem by a scientific approach; -classify knowledge from various fields methodically and draw systematic conclusions from it and also to deal with complexity; -find solutions which require very considerable competence as far as methods are concerned; -function effectively as a member of a team that may be composed of different disciplines and levels; -think systematically about the non-technical effects of an engineer's job and to include these aspects responsibly in what they do; - assess the economic, energy and environmental performance of various processes and products; -familiarise themselves with new tasks systematically and without taking too long; -plan and carry out experimental research within their field of study including necessary risk assessments for health, safety and the environment; -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;

Comprehensive Scheme of the Second Cycle Degree in CHEMICAL ENGINEERING

YEAR	CODE	COURSE	Credits (ECTS)	Semester
I	I0738	Analysis of Chemical Engineering Systems	6	1
	I0740	Safety in Process Plant Design	9	1
	I1H005	Chemical Process Analysis and Control	9	2
	I2H009	Chemical Engineering Principles II	6	2
	I0291	Chemical Reaction Engineering	9	2
	<i>One elective course within the following:</i>			
	B2F020	Biomaterials	6	2
	I0317	Biochemical Reaction Engineering	6	1
	I0739	Chemistry of Surfaces and Interfaces	6	1
	<i>Free choice Courses</i>		9	1/2
	I0592	<i>English Level B2</i>	3	3
II	DG0004	Industrial Bioprocesses	9	1
	I2H014	Chemical Plants II	6	1
	I2H026	Industrial Chemistry	9	2
	I0305	Corrosion and Materials Protection	9	2
	I0726	Laboratory of Chemical Engineering	3	2
	<i>One elective course within the following:</i>			
	I0301	Design and Process Analysis of Environmental and Biochemical Processes	9	1
	I0593	Science and Technology of Materials II	9	1
	I2HAT0	<i>Other Activities</i>	6	1/2
	I2HPF0	<i>Thesis</i>	18	2