



SUSTAINABLE TECHNOLOGIES AND BIOTECHNOLOGIES FOR ENERGY AND MATERIALS (STEM) AA 2020-21

Last updated February 27th 2020

Introduction

A Master degree in Chemical Engineering is a key to professional success in several innovative industrial sectors. Smart materials, sustainable processes for energy production, industrial biotechnologies, and advanced pharmaceutical applications are only some of the sectors where the expertise of chemical engineers is highly rewarded.

The traditional world players, such as the chemical and Oil&Gas industry, are undergoing increasing innovation and internationalization, thus requiring global competences and higher qualifications from the chemical engineers recruited. The STEM (Sustainable Technologies and biotechnologies for Energy and Materials) curriculum of the Masters in Chemical and Process Engineering was conceived to approach these challenges.

The program is a two-year Master “second cycle degree” entirely taught in English and officially recognized under the “Bologna Process”. The program requires the students to obtain 120 ECTS, and is divided into four semesters. At the end of the program, a degree titled "Master in Chemical and Process Engineering" (Laurea Magistrale in Ingegneria Chimica e di Processo, Classe LM-22) is awarded and is valid under the Italian law. Most classes and labs are given in the new and functional Engineering building of Via Terracini 34 in Bologna, connected via a bus line to the Central Station.



The campus and classrooms



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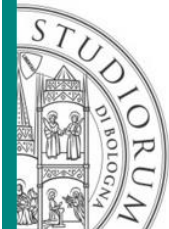
Programme Overview



The labs

- 1st year: the compulsory courses (42 ECTS) allow to strengthen the background of Chemical engineering, such as advanced thermodynamics and transport phenomena, chemical engineering equipment design, and process safety engineering. Further 12 ECTS are dedicated to electives and laboratories, both practical and computational, to provide training on the most advanced experimental and software tools.
- 2nd year: two alternatives tracks are possible: materials engineering or on pharmaceutical engineering and biotechnological processes. The compulsory courses (36 ECTS) are assigned accordingly, and focus on innovative materials, energy and environmental processes, and industrial biotechnologies, as well as pharmaceutical applications. The electives (12 ECTS) can be selected from the previous ones or other topics, ranging from structural engineering to environmental applications, offshore technologies and soft skills.
- Final project (18 ECTS): it serves to fulfill the final examination requirements to be eligible to graduate and can be performed internally or externally, either in a Research center or Company, in Italy or abroad.
- The [attendance](#) to lecture is strongly recommended.

Check the [Course structure diagram](#) and read what our [International Alumni](#) say about STEM.
Check the [QS rankings](#) of Chemical Engineering at UNIBO.



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Admission

A bachelor in Chemical Engineering is required for admission. Applicants holding a bachelor in other engineering disciplines or in industrial chemistry may be considered for admission, depending on their curricula.

Applicants with a bachelor degree from a non-EU country or one that is different from chemical engineering are requested to submit their application to the admission committee prior to applying online to the university, in order to verify the suitability of the undergraduate training to access this Masters program. A specific call is opened for this purpose between February and June each year.



The library

Enrolment is then possible each year from August to December. Students who are not EU citizens should also apply for a study permit and for pre-enrolment from the Italian embassy in their country (period is usually January to June each year). For more information visit the [Admission section](#).

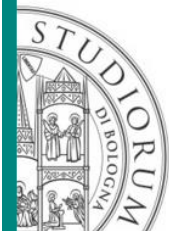
Classes begin each year around mid-September. First term is from mid-September to mid-December.

Second term is from mid-February to mid-June.

Bologna is a public university; tuition fees are set each year by the academic authorities. Fee waivers and housing grants may be available, for instance the [Unibo Actions I&2](#) and other [grants](#).

A World of opportunities in an International Environment

It is possible, and strongly encouraged, for students to spend periods of study abroad, in particular during the last semester and in fulfilment of the final examination. Students can apply for Erasmus grants in [various European destinations](#), and also to non European ones with specific funding schemes such as the [Overseas](#) and [Thesis Abroad](#) programmes. A “Dual Degree” program is currently being offered with Columbia University - New York.



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The Department is visited every year by a number of foreign Professors and Industry experts that give seminars and interact with the students. See the page of [Visiting Professors](#).

Summer schools and various events are organized regularly to attract attention and disseminate the different activities carried out.

Visit the page of [UNIBO opportunities](#) for studying abroad and getting grants.

Browse the list of [Internships](#) available.

International destinations map

Career opportunities

The STEM degree allows graduates to pursue their professional career or continue their academic career.

Among the more important professional sectors addressed by Master studies in Chemical Engineering are:

- the Chemical and Process Industry, and in particular the petrochemical, polymers, specialty chemicals, and pharmaceutical sectors: this industry is characterized by increasing globalization and is steadily recruiting qualified chemical engineers throughout Europe.
- the Energy sector: Oil&Gas, both up-stream and down-stream, strongly requires qualified chemical engineers for design and operation in a framework of growing complexity and innovation towards increasing sustainability and environmental compatibility.
- the Materials sector, with its development towards nanomaterials and smart materials requires qualified chemical engineers to answer the demand for innovation and life-cycle sustainability.
- the Biotechnology sector, with its evolution towards large-scale production, has a growing requirement of qualified chemical engineers able to support the industrialization of biotechnological processes and their operations.
- the Environmental sector, with the growing development of processes for the recovery of wastes, the valorization of biomasses and the implementation of safe and sustainable technologies, needs qualified chemical engineers as a necessary support to its large-scale operations.
- For those who want to further study Chemical Engineering in an academic context, graduates of this program are eligible to enter into Ph.D. studies at the University of Bologna and other European and Non European Universities.



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STUDY PLAN

First Year			
Mandatory courses		Semester	Credits
73511	FLUID MECHANICS AND TRANSPORT PHENOMENA M	1	9
73513	NUMERICAL METHODS M	1	6
73514	THERMODYNAMICS OF ENERGY AND MATERIALS M	1	6
84193	SUSTAINABLE DESIGN OF CHEMICAL PROCESS M	2	6
84194	CHEMICAL ENGINEERING EQUIPMENT DESIGN M	2	9
84195	PROCESS SAFETY ENGINEERING M	2	6
Elective courses (18 Credits)			
At least 12 Credits from the list of F courses			
At least 6 Credits from the list of D courses			



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Second Year			
Mandatory Courses: Choose Option 1 or 2			
Option 1 - Materials Engineering (36 CFU)		Semester	Credits
87128	COMPOSITE MATERIALS AND TECHNOLOGY M	1	6
87126	MATERIALS CHEMISTRY M	1	9
84199	ADVANCED TRANSPORT PHENOMENA IN POLYMERS AND COMPOSITES M	1	6
87455	CERAMICS TECHNOLOGY AND MATERIALS CHARACTERIZATION M	2	9
87127	POLYMER SCIENCE AND TECHNOLOGY M	2	6
Option 2 - Industrial biotechnologies and pharmaceutical engineering (36 CFU)			
73521	BIOREACTORS AND DOWNSTREAM PROCESSES M	1	9
73520	INDUSTRIAL AND ENVIRONMENTAL BIOTECHNOLOGY M	1	9
92916	CHEMICAL REACTORS DESIGN AND BIOMEDICAL MATERIALS M	1-2	6
69996	INDUSTRIAL ECOLOGY M	2	6
87380	PHARMACEUTICAL TECHNOLOGIES M	2	6
Elective courses			
At least 6 Credits from the list of D courses			
FINAL EXAMINATION ACTIVITIES (18 CFU)			
Choose one of the following options			
60750	FINAL EXAMINATION	-	18
90054	INTERNSHIP ABROAD FOR PREPARATION OF THE FINAL EXAMINATION		12
86300	FINAL EXAMINATION	-	6
86296	INTERNSHIP FOR PREPARATION OF THE FINAL EXAMINATION		12
86300	FINAL EXAMINATION	-	6
90053	PREPARATION FOR THE FINAL EXAMINATION ABROAD		12
86300	FINAL EXAMINATION	-	6



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List of F Activities

78663	ENGLISH LANGUAGE SKILLS		3
78661	ITALIAN LANGUAGE AND CULTURE		3
78653	LABORATORY OF ADVANCED PROCESS SIMULATION*	1	3
78654	LABORATORY OF INDUSTRIAL AND ENVIRONMENTAL BIOTECHNOLOGIES*	1	3
78652	LABORATORY OF THERMODYNAMIC SIMULATION	1	3
73505	LABORATORY OF MATERIALS CHARACTERIZATION M *	2	3
78648	LABORATORY OF MOLECULAR DESIGN AND MATERIALS SIMULATION*	2	3
90049	LABORATORY OF PROCESS SAFETY M	2	3
78650	LABORATORY OF PHOTOCATALYSIS	2	3
73507	TRANSPORT PHENOMENA LABORATORY M	2	3
93347	RESEARCH AND INDUSTRIAL SEMINARS	-	3

*Suggested in the 2nd year



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List of D Activities

78663	ENGLISH LANGUAGE SKILLS		3
78661	ITALIAN LANGUAGE AND CULTURE		3
93347	RESEARCH AND INDUSTRIAL SEMINARS		3
75385	INTERNSHIP		6

Terracini Campus - Bologna City

84199	ADVANCED TRANSPORT PHENOMENA IN POLYMERS AND COMPOSITES M	2	6
78652	LABORATORY OF THERMODYNAMIC SIMULATION	1	3
78653	LABORATORY OF ADVANCED PROCESS SIMULATION	1	3
78654	LABORATORY OF INDUSTRIAL AND ENVIRONMENTAL BIOTECHNOLOGIES	1	3
78648	LABORATORY OF MOLECULAR DESIGN AND MATERIALS SIMULATION	2	3
69996	INDUSTRIAL ECOLOGY M	2	9
73505	LABORATORY OF MATERIALS CHARACTERIZATION M	2	3
78650	LABORATORY OF PHOTOCATALYSIS	2	3
90049	LABORATORY OF PROCESS SAFETY M	2	3
90050	MEMBRANE SCIENCE AND TECHNOLOGY	2	3
93347	RESEARCH AND INDUSTRIAL SEMINARS	-	3
92912	MOLECULAR SIMULATIONS IN PROCESS ENGINEERING	2	6
73507	TRANSPORT PHENOMENA LABORATORY M	2	3

Risorgimento Campus - Bologna City

84200	PHYSICS OF SEMICONDUCTOR DEVICES AND MEMORIES M	1	6
73577	COMPUTATIONAL MECHANICS M	2	6
81799	PROJECT MANAGEMENT AND SOFT SKILLS M **	2	3
73387	CREATIVITY AND INNOVATION **	2	3

Ravenna City Campus

88296	COASTAL AND MARINE FLUID DYNAMICS	1	6
78484	MONITORING AND POSITIONING IN OFF-SHORE ENGINEERING	1	6
78486	OFFSHORE HSE MANAGEMENT	1	6
88261	OFFSHORE OIL&GAS TECHNOLOGIES	1	6
73578	PETROLEUM GEOSYSTEM M	1	6



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78494	MODELLING OF OFFSHORE STRUCTURES	1	6
86305	DESIGN OF OFFSHORE STRUCTURES Integrated Course:	2	
	a) DESIGN PROJECT B (88494)	2	3
	b) DESIGN OF OFFSHORE STRUCTURES (84189)	2	6
81510	LABORATORY OF OFFSHORE OPERATIONS	2	6
88249	MATERIALS AND CORROSION OF OFFSHORE STRUCTURES AND EQUIPMENT M	2	6
88246	OFFSHORE ENGINEERING EQUIPMENT DESIGN	2	6
88247	TURBOMACHINES AND OFFSHORE GENERATION	2	3
81511	PROJECT MANAGEMENT IN OFFSHORE ACTIVITIES	2	6

**Soft skills



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LEARNING OUTCOMES

Code	Learning outcomes	Course (alphab. ord.)
84199	Students will acquire knowledge of experimental characterization methods and modeling tools for mechanical, rheological, as well as heat and mass diffusion properties, in polymeric and composite systems. Students will be able to understand the relevance of thermodynamic and transport properties in polymer/solute mixtures and polymer-based micro- and nano-composites and to discuss their effects in relation to the performances of polymeric and composite materials in industrial processes and in energetic, environmental and biomedical applications.	ADVANCED TRANSPORT PHENOMENA IN POLYMERS AND COMPOSITES M
81633	This course aims to provide knowledge on conventional and innovative biotechnological processes for the production of chemicals, biopolymers and biofuels from biomasses and organic by-products and wastes, and for the sustainable remediation of contaminated sites, sediments and industrial wastewaters.	ADVANCES IN INDUSTRIAL AND ENVIRONMENTAL BIOTECHNOLOGY M
73521	The course aim is to provide students with techniques for reactor and bioreactors analysis, as well as knowledge of downstream and purification processes.	BIOREACTORS AND DOWNSTREAM PROCESSES M
87455	Introduction to the characteristics, the properties, the manufacturing, the application and the recycling of ceramic materials. Knowledge of basic and advanced techniques for mechanical, thermal and morphological characterization of materials.	CERAMICS TECHNOLOGY AND MATERIALS CHARACTERIZATION M
87379	The course will introduce the design of chemical reactors, as well as material properties, technologies and selection in the pharmaceutical sector.	CHEMICAL REACTORS DESIGN AND MATERIALS M



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88296	The course will introduce and describe the processes that characterize the oceanic environment, as wind, tide, wave and currents, and their loads and interaction with the structures. In particular the student will be able to analyze the sea conditions (waves, currents).	COASTAL AND MARINE FLUID DYNAMICS
87128	The aim of the course is the knowledge of properties, application and manufacturing technology of main composite materials and the comprehension of the mechanisms which allow to obtain particular properties on the basis of material components and their architecture.	COMPOSITE MATERIALS AND TECHNOLOGY M
73577	The course is an introduction to computational mechanics of solids and structures. The goal of the course is to provide the students with the fundamental concepts and operating tools to solve current structural problems using computer technology.	COMPUTATIONAL MECHANICS M
88249	The aim of the course is to introduce the student to the metallic materials used for off-shore installations and equipment. Knowledge on construction technologies, corrosion protection and materials for the protection from fire will also be provided.	MATERIALS AND CORROSION OF OFFSHORE STRUCTURES AND EQUIPMENT
88494	In the course the students will develop a structural project related to a simplified off-shore structure. The project will be done by the student alone or in small groups, under the supervision of the instructor.	DESIGN PROJECT B
84189	The aim of the course is to provide for the basic and some advanced elements for design of offshore structures. After an extensive illustration of requirements and protocols for certification of steel for construction, the elements of design of steel structures will be given, including strength requirements, instability verification, design of connections (bolted and welded), with particular emphasis to those typical of offshore structures. Criteria for life extension of existing off shore platforms will be also given.	DESIGN OF OFFSHORE STRUCTURES



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78657	At the end of the course the student has knowledge of downstream and purification processes used for the industrial production of biological molecules.	DOWNSTREAM PROCESSING OF BIOLOGICAL MOLECULES
78663	At the end of the activity, the student has obtained improved language skills on the English language.	ENGLISH LANGUAGE SKILLS
60750	Ability of managing a study or research activity in the field of industrial processes analysis, materials characterization and production or sensors development.	FINAL EXAMINATION
73511	This course aim to provide students with advanced tools for analyzing and modelling momentum, energy and mass transport in fluid or solid media. Successful learner in this course will be able to understand the role of local form of total mass, momentum, energy and species balance equations.	FLUID MECHANICS AND TRANSPORT PHENOMENA M
73520	This course aims to provide students with fundamental knowledge of applied biochemistry and microbiology, necessary to understand the role of biological agents in main industrial and environmental biotechnology processes.	INDUSTRIAL AND ENVIRONMENTAL BIOTECHNOLOGY M
69996	The course introduces the student to the connection between technological, environmental, economic and social impacts of industrial production processes, in the light of sustainable development and circular economy. The student will gain knowledge on the evaluation of the life-cycle environmental impacts from industrial activities, on the EU environmental policy and on the main pollution prevention and control techniques applicable to energy production.	INDUSTRIAL ECOLOGY M
75385	At the end of the internship, the student has acquired experience in close contact with one of the professional fields of possible future employment.	INTERNSHIP
90054	Promoting students' knowledge of the work field through thesis preparation abroad, based on a internship project agreed with the supervisor.	INTERNSHIP ABROAD FOR PREPARATION OF THE FINAL EXAMINATION



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86296	Promoting students' knowledge of the work field through thesis preparation, based on a internship project agreed with the supervisor	<p>INTERNSHIP FOR PREPARATION FOR THE FINAL EXAMINATION</p> <p>ITALIAN LANGUAGE AND CULTURE</p> <p>LABORATORY OF ADVANCED PROCESS SIMULATION</p> <p>LABORATORY OF INDUSTRIAL AND ENVIRONMENTAL BIOTECHNOLOGIES</p> <p>LABORATORY OF MATERIALS CHARACTERIZATION M</p> <p>LABORATORY OF MOLECULAR DESIGN AND MATERIALS SIMULATION</p> <p>LABORATORY OF OFFSHORE OPERATIONS</p> <p>LABORATORY OF PHOTOCATALYSIS</p> <p>LABORATORY OF PROCESS SAFETY M</p>
78661	At the end of the activity, the student has obtained skills on Italian Language and Culture.	
78653	At the end of the course the student has skills on the static and dynamic simulation of chemical processes.	
78654	At the end of the course the student will have knowledge on: -the new trends and developments of White Biotechnology for the modern chemical, textile, pharma, cosmetic and bioenergy industry (multipurpose biomass and biowaste Biorefinery); -the biotechnology approaches for the sustainable remediation of contaminated sites, sediments and industrial wastewaters.	
73505	Ability of performing basic characterization of mechanical, thermal and morphological properties of materials.	
78648	At the end of the course the student has skills on the molecular foundations of thermodynamics and on statistical mechanics laws.	
81510	The student will be introduced to the main construction and maintenance operations in off-shore activities with the aim of understanding the specificities required by off-shore operations.	
78650	At the end of the course the student has knowledge about the fundamentals of photocatalytic reaction and design of photocatalytic processes and the about use of materials suitable for the photocatalytic application in environmental protection.	
90049	The course introduces the student to the application of techniques for hazard identification and quantitative risk assessment, by the analysis of process safety case-studies.	



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78652	At the end of the course the student has skills on the selection of thermodynamic models for process simulation and on the thermodynamic analysis of processes.
88249	The aim of the course is to introduce the student to the metallic materials used for off-shore installations and equipment. Knowledge on construction technologies, corrosion protection and materials for the protection from fire will also be provided.
73543	Knowledge of basic and advanced techniques for mechanical, thermal and morphological characterization of materials.
73512	This course is intended to provide (engineering students) with a good comprehension of the principles of chemistry and shows how they apply in describing the behaviour of the solid state. A relationship between electronic structure, chemical bonding, and crystal structure is developed.
90050	This course will enable students to understand membrane separation mechanisms and solve membrane-based separation problems by acquiring in-depth knowledge in the area of transport models, membrane permeability, membrane types and modules, membrane design and preparation.
78494	In the course, element for modelling of offshore structures will be given. Three main parts of the course will be: equivalent static and dynamic modelling of the actions, including wave action and wind, both in the time and frequency domains; finite element modelling of the structure, stress and displacement recovery and verifications; modelling and verifications against cyclic loadings, with special emphasis to fatigue and damage of metallic materials.
92912	At the end of the course, the student knows the molecular foundations of thermodynamics and the main concepts of statistical mechanics. The student is able to determine the molecular and macroscopic quantities of interest in process engineering and materials science with molecular

LABORATORY OF
THERMODYNAMIC SIMULATION

MATERIALS AND CORROSION
OF OFFSHORE STRUCTURES
AND EQUIPMENT

MATERIALS
CHARACTERIZATION M

MATERIALS CHEMISTRY M

MEMBRANE SCIENCE AND
TECHNOLOGY M

MODELLING OF OFFSHORE
STRUCTURES

MOLECULAR SIMULATIONS IN
PROCESS ENGINEERING



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	<p>approaches (Molecular Dynamics and MonteCarlo), making use of a commercial software.</p>	
78484	<p>This course provides theoretical and operative knowledges concerning the monitoring and positioning aspects in the offshore engineering. In particular, different techniques for an accurate positioning based on GNSS technology will be introduced both for monitoring of off-shore structures and for geolocalization of off-shore infrastructures. Examples of real applications regarding the monitoring or the positioning of offshore structures will be discussed.</p>	MONITORING AND POSITIONING IN OFF-SHORE ENGINEERING
73513	<p>A successful learner from this course will be able to: a) deal with numerical analysis topics such as: accuracy, truncation and round-off errors, condition numbers, convergence, stability, curve-fitting, interpolation, numerical differentiation and integration, numerical linear algebra; b) deal with numerical methods for solving ordinary and partial differential equations, with finite difference and finite element methods for parabolic and elliptic partial differential equations.</p>	NUMERICAL METHODS M
88296	<p>The course will introduce and describe the processes that characterize the oceanic environment, as wind, tide, wave and currents, and their loads and interaction with the structures. In particular the student will be able to analyze the sea conditions (waves, currents).</p>	COASTAL AND MARINE FLUID DYNAMICS
88246	<p>The course aims at introducing the students to the design of process equipment. Criteria and procedures for equipment selection and sizing will be introduced. Equipment design techniques will be applied to the more important unit operations used in offshore processes.</p>	OFFSHORE ENGINEERING EQUIPMENT DECISION
78486	<p>The aim of the course is to provide specific knowledge on the Health, Environmental and Safety issues in off-shore operations, also focusing on those related to the production of Oil&Gas resources.</p>	OFFSHORE HSE MANAGEMENT



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88261	The aim of the course is to introduce the student to the processes and technologies for the production of offshore Oil&Gas resources. The student will gain knowledge on the offshore upstream operations and on sub-sea, top-side and floating production technologies.	OFFSHORE OIL&GAS TECHNOLOGIES
73578	The course is addressed to provide the basic knowledge of petroleum systems and petroleum engineering, with special reference to exploration, drilling and production engineering. These topics represent strategic elements as far as world energy supply is concerned. The Course is completed with an introduction to the study of petroleum economics, project management and engineering phases of the petroleum industry, with applicative exercises and laboratory practices.	PETROLEUM GEOSYSTEM M
87380	The course aims at introducing the design of unit operations and equipment specific of the pharmaceutical industry. Criteria and procedures for process design, quality control and certification will be introduced.	PHARMACEUTICAL TECHNOLOGIES M
84200	Knowledge about the fundamentals of quantum mechanics and band theory of solids; knowledge about the physical phenomena underlying the transport of charged carriers in solids and about the basic semiconductor devices and solid-state memories.	PHYSICS OF SEMICONDUCTOR DEVICES AND MEMORIES M
87127	The course provides notions on the correlations between chemical, mechanical and thermal behaviour of macromolecules and their structure and microstructure. The complete life-cycle of polymeric material is analysed and discussed.	POLYMER SCIENCE, TECHNOLOGY M
90053	With the preparation for the final examination abroad, the students get a direct knowledge of the possible professional developments linked to the specific work and research field in line with master's programme.	PREPARATION FOR THE FINAL EXAMINATION ABROAD



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73523	The course gives an introduction to and training in the critical analysis of chemical and energy processes; application of knowledge in thermodynamics, kinetics, heat transfer, equipment selection are also deepen. Concerted application of skills in the mentioned technical areas in an economical framework while considering constraints like environmental, raw-materials and energy availability will be addressed.
84195	After the course students will be able to assess the risks due to industrial installations (i.e. chemical and process industries), through the application of basic concepts about: classification of hazardous substances, hazard identification, probabilistic assessment of top events and consequence assessment.
81511	The student will be introduced to the management of projects in the specific framework of the off-shore industry, with the aim of understanding the activities required to effectively manage a large-scale offshore project.
93347	At the end of the course the student has actively participated to a significant and documented number of lectures on the most recent advances in chemical and process engineering research, as well as industrial case studies, and placement workshops. The student, at the end of this course, has a clearer idea about the future directions of his/her professional career, based on the information gathered during the lectures and is able to perform and compile a bibliographic work.
73527	Knowledge about thermodynamic properties of fluids and materials and their use in phase equilibrium and reaction problems. Knowledge about the fundamentals of thermodynamic analysis for energy and process industry applications.
73514	Knowledge about thermodynamic properties of fluids and materials and their use in phase equilibrium and reaction problems. Knowledge about the process industry applications.

PROCESS ANALYSIS FOR
ENERGY AND ENVIRONMENT
M

PROCESS SAFETY
ENGINEERING M

PROJECT MANAGEMENT IN
OFFSHORE ACTIVITIES

RESEARCH AND INDUSTRIAL
SEMINARS

TECHNOLOGY AND
SUSTAINABILITY OF
COMPOSITE MATERIALS M

THERMODYNAMICS OF
ENERGY AND MATERIALS M



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73507	Knowledge of techniques for the solution of equations for transport processes and direct experience of analysis of examples of transport phenomena.	TRANSPORT PHENOMENA LABORATORY M TURBOMACHINES AND POWER GENERATION FOR OFF-SHORE APPLICATIONS
78493	The course is aimed at providing basic principles for design and operation of typical fluid machines used for island application in off-shore installations.	