Department of Mechanical, Energy, Management and Transport Engineering (DIME)
Master's degree in Energy Engineering

Class LM-30
DEGREE REGULATION
Approved by resolution of the Degree Programme Board on 29th April 2022

General Part

INDEX

Art. 1 Premise and area of competence

This Regulation, in accordance with the Statute and the University Degree Regulation (general part and special part), disciplines the organisational aspects of the teaching activity of the Master's degree course in Energy Engineering, as well as any other subject devolved to it by other legislative and regulatory sources.
The Degree Regulation of the Master's degree course in Energy Engineering is resolved, pursuant to article 25, paragraphs 1 and 4 of the University Degree Regulation, general part, by the Degree Programme Board (DPB) of Energy Engineering to the majority of the members and submitted for the approval of the Board of the DIME Department, after consultation with the Polytechnic School, with the prior favourable opinion of the Joint Committee of the School.
The resolutions of the DPB can also be taken in telematic mode according to the above-mentioned regulations and, in particular, of Article 14 "meetings with telematic mode" of the current General Regulation of the University (in force since 19/12/2018).

Art. 2 Admission requirements and procedures for verifying individual preparation

Admission to the Master's degree course in Energy Engineering is subject to the possession of specific curriculum requirements and adequate personal preparation.
In order to be admitted to the Master's Degree in Energy Engineering, all following requirements, without exception, are required:

- possession of a degree, Master's degree, referred to Ministerial Decree 509/1999 or Ministerial Decree 270/2004, or a five-year degree (prior to Ministerial Decree 509/1999), obtained at an Italian University or equivalent qualifications;

- possession of at least 36 ECTS, or equivalent knowledge, acquired in any university course (bachelor's degree, master's degree, five-year degree, first and second level university

master's degrees) in the disciplinary-scientific sectors (SSD) indicated for the basic training activities of class degrees L-9 Industrial Engineering;

- possession of at least 45 ECTS, or equivalent knowledge, acquired in any university course (bachelor's degree, master's degree, five-year master's degree, first and second level university master's degree) in the disciplinary-scientific sectors indicated for the training activities characterising engineering class degrees L-9 Industrial Engineering;

- adequate knowledge of the English language equal to B2 level.

In case of possession of degrees different from those indicated above and in case of foreign students the DPB will verify the presence of curricular requirements or equivalent knowledge on the basis of the exams taken by the student during the degree course of origin, as well as the presence of any extracurricular exams, internship activities and work experience acquired.
The curricular requirements must be met before individual preparation can be checked. In order to be admitted to the Master's degree course, students in possession of the curriculum requirements must successfully undergo a test to verify their personal preparation, except in the cases provided for in the last paragraph. The test will be carried out in the form of a written test (also through a telematic mode, if necessary) and will be aimed at ascertaining the general preparation of the student with particular reference to the knowledge of fundamental notions and of applicative and professional aspects related to engineering issues, including:

- Energy Systems and Machines
- Applied Thermodynamics and Heat Transfer
- Electric Systems
- Chemical Processes

The test will be held in front of a Committee appointed by the DPB and composed of professors belonging to the DPB.
The composition of the Examination Committee, the methods of the test, the place and date of the test, the subjects to be examined and the evaluation criteria of the candidates are indicated in the Notice of Admission to the Polytechnic School's Master's degree courses and on the website of the Master's degree course.
The result of the test involves a vote in sixtieths. The written test includes 30 closed questions, which are awarded 2 points if the answer is correct, -0.5 points if the answer is incorrect and 0 points if there is no answer. The admission test is considered passed by a vote equal to or greater than thirty-sixtieths (36/60). The adequacy of personal preparation is automatically verified for those who have obtained a Bachelor's degree, Italian or foreign, or a qualification judged equivalent according to what has been indicated about the assessment of curricular requirements, with a final grade of at least 9/10 of the maximum grade provided for by their degree or who have obtained a final grade corresponding at least to the "A" classification of the ECTS system.
Adequate knowledge of the English language is verified by appropriate certificates in the student's possession, achieved no more than 3 years before, or, in the absence thereof, by verification by the University Languages Centre (Settore Sviluppo Competenze Linguistiche di Ateneo). Possession of an English language degree satisfies the requirement of linguistic knowledge, but it is anyway suggested to pass the B2 English test, periodically organised by the University Languages Centre.
For non-EU citizens with residence abroad and foreign degree, the application for a Master program of the University of Genoa taught in English must be submitted through a dedicated web portal, selected and adequately promoted by the University. Following the upload of the documents, a check is made about their completeness. Candidates who pass the eligibility check move on to the next stage concerning the assessment of qualifications and the final evaluation, after which the student will be assessed as accepted, conditionally accepted (allocation of bridge careers) or rejected.

The maximum allowed number of registered non-EU students is established by the DPB every year, communicated to the University International Student Office (Settore Accoglienza Studenti Stranieri di Ateneo) and published on the Universitaly website.

Art. 3 Training activities

The list of the teaching units and other possible training activities, in the cohort 2022-2023, is given in the appropriate annex (Annex 1) which constitutes an integral part of this regulation. A responsible professor is identified for each teaching unit. A professor is responsible for teaching whoever is in charge of teaching according to the law, i.e. the one to whom the relative Department Board has attributed the responsibility itself when assigning teaching tasks to professors.
The language used to provide training activities (lessons, exercises, workshops) shall be Italian or another EU language, where expressly decided by the DPB.
Annex 1 to this regulation specifies the language in which each training activity is carried out.

Art. 4 Enrolment in individual training activities

In accordance with Article 5 of the University Regulations for students, students enrolling in individual training activities must have a qualification granting access to the university.

Art. 5 Curricula

The Master's degree course in Energy Engineering is not structured in curricula.

Art. 6 Total time commitment

The definition of the hourly fraction dedicated to lessons or equivalent teaching activities is established, for each teaching unit, by the DPB and specified in the special part of the regulation. In any case the following interval of variability of the between classroom hours/ECTS is assumed: 8 ÷ 10 hours of lesson or assisted teaching activity.
The definition of the assumed total time commitment, reserved for personal study or other training activities of an individual type, is laid down, for each teaching unit, in the annex (Annex 1) to this regulation.
The director of the DIME Department and the coordinator of the DPB shall be responsible for verifying compliance with the above requirements, including for the publication of course programmes.

Art. 7 Study plans and prerequisites

Students can enrol full-time or part-time; for the two types of student there are different rights and duties.
The student chooses the type of registration simultaneously with the presentation of the study plan.
The full-time student carries out his training activity considering the study plan prepared by the degree course, which is distinguished by years of the course programme and published in the Degree Programme Table of the degree course. The study plan formulated by the student must contain an indication of the training activities, with the relative credits that he intends to achieve, provided by the official study plan for this teaching period, up to a maximum of 65 credits provided in each year.
The part-time student is required to submit an individual study plan specifying the number of credits he intends to enter.
In the absence of the completion of the study plan by the due date, a standard plan will be uploaded ex officio, except in cases where it is planned to complete an individual study plan (e.g. change of course of study, previous part-time individual study plan).
The enrolment of full-time and part-time students is regulated by the University Regulations for students considering the operational provisions resolved by the Central government bodies and indicated in the Student Guide (published annually on the University's website). The educational path of the student was organized according to propaedeutic criteria, indicated in the Teaching Programmed Offer. The method and deadline for the presentation of the study plan are established annually by the Polytechnic School and reported in the Degree Programme Table.

The Course of Study may, by express and reasoned resolution, authorise students who have demonstrated particularly high academic performance in the previous academic year to include in their study plan more than 65 credits, but in any case, not more than 75.
"Particularly high performance" means that the student has passed all the exams of his/her study plan by the month of September.
The study plan, which has a shorter duration than the normal one, is approved by the Degree Programme Board.
The method and deadline for the presentation of the study plan are established annually by the Polytechnic School and reported in the Degree Programme Table - Engineering Area.

Art. 8 Attending the Classes and Teaching activity Methods

The courses take the form of: (a) lectures, including distance learning by telematic means; (b) practical exercises; (c) laboratory exercises (d) thematic seminars.
The articulated profile and the demanding nature of the lessons taught in the Course of Study make the attendance to the training activities strongly recommended for an adequate understanding of the topics and therefore for a good success in the exams.
The schedule of classes is divided into semesters. As a rule, the semester is divided into at least 12 weeks of lesson plus at least 4 weeks overall for verification tests and profit exams.
The period for profit exams ends with the beginning of the lessons of the following semester.
The lesson schedule for the entire academic year is published on the Course of Study's website before the start of the lessons of the academic year. The schedule of classes guarantees the possibility of attendance based on the years of the course programme provided for by the current Degree Programme Table. For practical reasons, the compatibility of the timetable for all formally possible optional teaching choices is not guaranteed. Students must then formulate their study plan taking into account the time of the lessons.

Art. 9 Examinations and other profit exams

Profit exams can be carried out in written, oral, or written and oral, according to the methods indicated in the sheets of each teaching unit published on the website of the Master's degree course.
On request, specific learning verification arrangements may be provided which take into account the needs of disabled students and students with specific learning disorders (D. S. A.), in accordance with art. 20 paragraph 4 of the University Degree Regulation.
In the case of teaching units structured in modules with several professors, they participate collegially in the overall evaluation of the student's profit which cannot, however, be split into separate evaluations on the individual modules.
The calendar of profit exams is established by September 30th for the following academic year and is published on the website of the Degree Course. The calendar of any intermediate verification tests is established by the DPB and communicated to the students at the beginning of each teaching cycle.
Examinations are held in periods of interruption of classes. Examinations may be planned during the period of the classes only for students who, in the current academic year, have not included training activities in their study plan.
All profit examinations of training activities must be passed by the student at least twenty days before the expected date for taking the graduation exam.
The result of the examination, with the vote obtained, is verbalized in accordance with art. 20 of the University Degree Regulation.

Art. 10 Recognition of credits

The Degree Course decides on the approval of applications for change or transfer from another degree course of the university or other universities in accordance with the rules provided for in the University Degree Regulation, art. 18. It also decides the recognition, as training credits, for a maximum number of 12 ECTS, of professional knowledge and skills certified in accordance with the current legislation.

The evaluation of applications for change will take into account the didactic specificities and the actuality of the educational content of the individual exams taken, reserving to establish from time to time any forms of verification and supplementary exams.
Within the framework of the national and regional legislation on alternance education/work, it is possible for the course of study to provide, for selected students, learning paths that also take into account work experience carried out at companies under contract.

Art. 11 Mobility, studies abroad, international exchanges

The DPB strongly encourages internationalisation activities, in particular student participation in mobility and international exchange programmes. For this purpose, it shall ensure, in accordance with the rules in force, the recognition of the training credits obtained within these programmes and shall organise the training activities as appropriate in such a way as to make these activities easier and effective.
The DPB recognizes enrolled students, who have regularly completed a period of study abroad, the exams taken off-site and the achievement of the related credits with which the student intends to replace the exams of his own study plan.
For the purposes of the recognitions of these examinations, the student at the time of the compilation of the plan of training activities, he intends to follow abroad, must produce suitable documentation proving the equivalence of content between the teaching unit abroad and the teaching unit that intends to replace taught in the Master's degree course in Energy Engineering. Equivalence shall be evaluated by the DPB.
The conversion of marks will take place according to criteria approved by the DPB, in accordance with the European ECTS system. The DPB also recognises, within the credits attributed to the final examination (Master Thesis), a portion relating to the preparation of the thesis and related research and/or internship activities carried out abroad in one of the international university programmes (e.g. Erasmus Traineeship), according to the criteria adopted by the DPB in its resolutions on the proposal of the Polytechnic School.

Art. 12 Procedures for the final examination and knowledge of the foreign language

The final examination consists in the presentation and discussion of a written thesis before a special Committee, aimed at ascertaining the candidate's technical-scientific and professional preparation.
For the purposes of obtaining a Master's Degree, the final examination consists of the writing of a thesis, elaborated by the student in an original way under the guidance of one or more supervisors, on a subject defined as relevant to a discipline for which he or she has passed the exam.
In any case, the supervisors must include at least one lecturer from the Polytechnic School or the DPB.
The thesis will be carried out in English; in case of use of another EU language, the authorization of the DPB is required. In these cases, the thesis must be accompanied by the title and an extensive summary in Italian.
The thesis, carried out in university laboratories, companies and national and international research institutes, must reveal the student's ability to deal with research and/or application issues. The thesis must consist of a project and/or the development of an application that proposes innovative solutions with respect to the state of the art and demonstrates the student's analytical and design skills.
The thesis must also reveal:

- ability to deal with complex problems with a multidisciplinary approach
- correct use of sources and bibliography;
- systematic and argumentative skills;
- clarity in the exposition;
- design and experimental skills;
- critical skills.

The Committee for the final examination is composed of at least five members including the Committee president and is appointed by the Director of the DIME Department.

The procedure for the final examination consists of the oral presentation of the degree thesis by the student to the Final Examination Committee, followed by a discussion of any questions raised by the members of the Committee.
The evaluation of the final examination by the Committee takes place, in the event of passing the final exam, by assigning an increase, varying from 0 to 6 points, of which 4 points as evaluation of the final examination and 2 points related to the peculiarities of the thesis work (methodological originality and relevance of the results) and/or as evaluation of the student's career (marks with *laude*, periods of study abroad with recognition of credits and periods of study abroad for the thesis).
The recommendation for publication for the master thesis work can be requested by the supervisor to the members of the Degree Committee by letter, sent at least 15 days before the graduation session, explaining the reasons for the request. Requests are eligible for which the thesis work, thanks to the candidate's contribution, may form the basis for scientific articles at conferences or in international journals. The request must be accompanied by a thesis summary of about 10 pages, structured as a scientific article. The recommendation for publication is attributed by unanimous vote of the Committee to the degree session.

Art. 13 Guidance services and tutoring

The Polytechnic School, in agreement with the DIME Department, organizes and manages a tutoring service for the welcome and support of students, in order to prevent dispersion and delay in studies and to promote a profitable active participation in university life in all its forms.
The DPB identifies within it a number of tutors in proportion to the number of students enrolled. The names of the tutors can be found on the website of the Master's degree course.

Art. 14 Verification of obsolescence of credits

University training credits (ECTS) acquired within the framework of the degree course can be subject to obsolescence verification after 6 years. If the DPB recognizes the obsolescence of even a single part of the relative educational content, the DPB itself establishes the supplementary tests that must be taken by the student, defining the topics, the methods of verification, the composition of the Examination Committee.
Once the required tests have been passed, the DPB validates the credits acquired with a resolution. If the related training activity provides for a vote, it may be varied from the one previously obtained, on a proposal from the Examination Committee which carried out the verification.

Art. 15 Degree Programme Table

The DIME Department, after consulting the Polytechnic School, approves and publishes annually the Degree Programme Table. In the Degree Programme Table are indicated the main provisions of the didactic system and the didactic regulation of the Master's degree course, to which additional information may be added.
The Degree Programme Table of the Master's degree course in Energy Engineering contains the list of the teaching units activated for the academic year in question. The individual teaching sheets are published on the website of the degree course.

Annex 1 to the Degree Regulation of the Master's degree course in Energy Engineering
List of training activities and related training objectives

PLANNED TEACHING ACTIVITY A.Y. 2022/2023
DEGREE REGULATION SPECIAL PART COHORT 2022/2023
10170 ENERGY ENGINEERING LM-30 SV

Year	Code	Teaching course_IT	Teaching course_EN	CFU	SSD	Type	Area	Language	Prerequisites	Learning outcomes	Hours of assisted teaching activity	Hours of personal study
1	66382	HEAT TRANSFER	HEAT TRANSFER	6	ING-IND/10	CORE LEARNING ACTIVITY	Energy and Nuclear Engineering	English		The course introduces the fundamental mechanisms of heat transfer (conduction, convection and thermal radiation) and shows some examples of practical application. The student will demonstrate a deep knowledge of the different heat transfer mechanisms and to be able to apply the fundamental laws to simple engineering problems. The goal of this course is to provide to the student the basis for the thermal analysis of energy transformation and production processes.	48	102
1	86630	MATHEMATICAL MODELING FOR ENERGY SYSTEMS	MATHEMATICAL MODELING FOR ENERGY SYSTEMS	6	MAT/07	RELATED OR SUPPLEMENTARY LEARNING ACTIVITY	Related or Supplementary Learning Activity	English		The aim of the course is to provide students with an overview of the basic mathematical methods used for the solution and the qualitative study of certain types of ordinary and partial differential equations of interest in engineering. At the end of the course, the student acquires the ability to study the behavior of complex systems through the formulation of a simplified mathematical model capable of describing and predict the salient features of the phenomenon.	48	102
1	86633	CHEMICAL PLANTS AND PROCESSES FOR ENERGY	CHEMICAL PLANTS AND PROCESSES FOR ENERGY	12		CORE LEARNING ACTIVITY // RELATED OR SUPPLEMENTARY LEARNING ACTIVITY	Energy and Nuclear Engineering // Related or Supplementary Learning Activity	English			0	0

1	72562	CHEMICAL AND BIOCHEMICAL PROCESSES AND PLANTS FOR ENERGY	CHEMICAL AND BIOCHEMICAL PROCESSES AND PLANTS FOR ENERGY	6	ING-IND/25	CORE LEARNING ACTIVITY	Energy and Nuclear Engineering	English		The course describes the major alternative energy conversion processes. The course will be focused on chemical and biochemical processes to produce sustainable and clean energy for example biodiesel from microalgae, bioethanol from cellulosic and lignocellulosic biomasses and biogas from anaerobic digestion.	48	102
1	86631	CHEMICAL PROCESSES AND TECHNOLOGIES	CHEMICAL PROCESSES AND TECHNOLOGIES	6	ING-IND/27	RELATED OR SUPPLEMENTARY LEARNING ACTIVITY	Related or Supplementary Learning Activity	English		The course aims to provide an in-depth knowledge of the main processes of industrial chemistry related to energy production, a critical analysis of the motivations of the solutions used in the production of the main products and the criteria for a correct approach to the design of a chemical process in terms productivity, safety and protection of environment.	54	96
1	86634	ELECTRIC POWER SYSTEMS	ELECTRIC POWER SYSTEMS	12	ING-IND/33	CORE LEARNING ACTIVITY	Energy and Nuclear Engineering	English			0	0
1	65887	POWER SYSTEMS MODELLING AND CONTROL	POWER SYSTEMS MODELLING AND CONTROL	6	ING-IND/33	CORE LEARNING ACTIVITY	Energy and Nuclear Engineering	English		The course is designed to provide the theoretical and methodological skills necessary for the understanding of the most important problems of modern electrical power systems, with particular reference to the integration of renewable energy sources (RES) and the impact that the change in the characteristics of the generating units determines in the electrical network management. The course, with strong interactive features, is proposed to support theoretical lectures with a large "experiential" part in which, through the use of dedicated software, the student can apply personally what learnt during the theoretical explanations.	54	96
1	86638	POWER SYSTEMS MANAGEMENT	POWER SYSTEMS MANAGEMENT	6	ING-IND/33	CORE LEARNING ACTIVITY	Energy and Nuclear Engineering	English		The course is designed to provide theoretical and methodological skills for the economic analyses related to the development of projects in the sustainable energy sector. In this context, it encompasses the fundamentals of energy markets, the procedures to calculate high efficiency cogeneration and the levelized cost of electricity. A special focus is devoted to new power production and distribution infrastructures such as	48	102

										smart grids and smart microgrids, with specific insight concerning with energy management platforms.		
1	86640	INDUSTRIAL FLUID-DYNAMICS AND COMBUSTION	INDUSTRIAL FLUID-DYNAMICS AND COMBUSTION	12	ING-IND/08	CORE LEARNING ACTIVITY	Energy and Nuclear Engineering	English			0	0
1	80054	COMBUSTION PROCESS AND EMISSIONS	COMBUSTION PROCESS AND EMISSIONS	6	ING-IND/08	CORE LEARNING ACTIVITY	Energy and Nuclear Engineering	English		Acquisition of the theoretical, technical and methodological skills necessary for the understanding and proper interpretation of most industrially and energetically relevant combustion phenomena. Acquisition of theoretical tools useful to the comprehension of the physical phenomena to which the combustion processes are subjected to, as well as on the implications connected with their industrial exploitation. Acquisition of fundmentale skills related to environmental issues, linked to the combustive processes. Basic competences on the main combustion diagnostic techniques.	54	96
1	86641	INDUSTRIAL FLUID-DYNAMICS	INDUSTRIAL FLUID-DYNAMICS	6	ING-IND/08	CORE LEARNING ACTIVITY	Energy and Nuclear Engineering	English		The course has two complementary objectives: first, to provide the conceptual, analytical and numerical bases of compressible flows prediction, in presence of turbulence, heat transfer and also chemical reactions and multiphase flows, typically found in energy-related industrial processes, second, to provide an overview, with practical training on the application of CFD software tools (Computational Fluid Dynamics) that are nowadays a fundametal industrial technology for product development. The main target of the course is to convey operational and critical skills to the student; the emphasis will be more centred on the correct methodological approach to perform a sound CFD analysis, even complex, as well as on a proper 'engineering' interpretation of results, in terms of their physical consistency, trends' capturing and validation capability, rather than to provide	54	96

										students with competences related to turbulent Navier-Stokes equations' numerical programming. On the other hand, these equations, at least at a basic level, must be already known in their properties and application potential.		
1	86642	POWER AND INDUSTRIAL PLANTS FOR ENERGY	POWER AND INDUSTRIAL PLANTS FOR ENERGY	12		CORE LEARNING ACTIVITY // RELATED OR SUPPLEMENTARY LEARNING ACTIVITY	Energy and Nuclear Engineering // Related or Supplementary Learning Activity	English			0	0
1	80053	POWER PLANTS FOR ENERGY CONVERSION	POWER PLANTS FOR ENERGY CONVERSION	6	ING-IND/09	CORE LEARNING ACTIVITY	Energy and Nuclear Engineering	English		The aim of the course is to provide students with a detailed knowledge of the operating principles and system lay-out of power plants for energy conversion, such as gas turbine systems, steam power plant and combined cycles. Moreover, the course will give the basis for the plant performances calculation, system behaviour understanding and plant management knowledge, with particular regard to the current national and international energy scenario.	54	96
1	86644	INDUSTRIAL PLANTS FOR ENERGY	INDUSTRIAL PLANTS FOR ENERGY	6	ING-IND/17	RELATED OR SUPPLEMENTARY LEARNING ACTIVITY	Related or Supplementary Learning Activity	English		Provide students with operational tools for the design and operation of service systems of industrial processes in accordance with the Community rules in force. Particular emphasis is placed on safety concepts for evolving systems group 1 fluids (dangerous fluids) and group 2 (fluids under pressure) and related risk analysis.	54	96
2	80048	REMOTE SENSING	REMOTE SENSING	6	ING-INF/03	A SCELTA	A Scelta dello Studente	English		Introducing the key concepts associated with Earth observation through remote sensing images for renewable energy applications. Providing the students with basic knowledge about remote sensing image acquisition and about mapping, through remote sensing image analysis, bio/geophysical parameters associated with renewable energy sources, including vegetation biomass, wind velocity field over sea water, solar irradiance, and air surface temperature.	48	102

2	80081	ENERGY LABORATORY	ENERGY LABORATORY	6	ING-IND/08	CORE LEARNING ACTIVITY	Energy and Nuclear Engineering	English		Acquisition of the theoretical, technical, methodological and practical skills necessary for the experimental investigation of combustive processes. Acquisition of the theoretical basis of the modern measurements and diagnostic techniques applicable to the combustion field as well as of operative skills in utilizing an experimental infrastructure and the measurement techniques theoretically introduced, taking advantage of the equipment present at the Savona Campus. The course foresees also the realization of a simple combustor project and its characterization by means of the most proper experimental techniques.	54	96
2	86653	RENEVABLE ENERGY IN BUILDINGS	RENEVABLE ENERGY IN BUILDINGS	12	ING-IND/10	CORE LEARNING ACTIVITY	Energy and Nuclear Engineering	English			0	0
2	80043	SOLAR AND GEOTHERMAL ENERGY	SOLAR AND GEOTHERMAL ENERGY	6	ING-IND/10	CORE LEARNING ACTIVITY	Energy and Nuclear Engineering	English		The aim of the course is provide the students the engineering knowledge on renewable energies as a whole and to the technologies and engineering methods to exploit the solar (thermal, photovoltaics) and low enthalpy geothermal resources in the high efficiency building contest. The goals of this course are to provide the students the capabilities related to modelling and design criteria definition, energy production estimation analysis, national and international standard knowledge and application, basic economic and financial investment analysis.	54	96
2	86655	ENERGY AND BUILDINGS	ENERGY AND BUILDINGS	6	ING-IND/10	CORE LEARNING ACTIVITY	Energy and Nuclear Engineering	English		The course provides the basics of the energy analysis of buildings; in particular, all the contributions for the evaluation of the heating and cooling loads are explained in detail. With the final aim of energy saving and sustainability, possible actions on the envelope and on the operative conditions are suggested to reduce the energy request of the building. Moreover, some elements about thermal plants are provided and the dynamic simulation of buildings is introduced with the use of a software open-source.	48	102

2	86659	MACHINES AND SYSTEMS FOR RENEWABLE ENERGY	MACHINES AND SYSTEMS FOR RENEWABLE ENERGY	12		CORE LEARNING ACTIVITY	Energy and Nuclear Engineering	English			0	0
2	86660	FUEL CELLS AND DISTRIBUTED GENERATION SYSTEMS	FUEL CELLS AND DISTRIBUTED GENERATION SYSTEMS	6	ING-IND/09	CORE LEARNING ACTIVITY	Energy and Nuclear Engineering	English		The purpose of this course is to provide the students with the fundamental know-how related to fuel cells and to the concept of distributed generation systems. The attention is mainly focused on thermodynamic theory and component performance. Fuel cells are presented putting emphasis on different technology types, hybrid system plant layouts, technological and environmental aspects. This course also proposes to provide students with basic knowledge and operative elements to design different small size systems (internal combustion engines, microturbines, stirling engines, fuel cells) for applications in distributed generation grids. For this part of the course, special attention is devoted to combined heat and power generation providing students with laboratory experiences.	54	96
2	86661	HYDRO, WIND AND MICRO-GAS TURBINES	HYDRO, WIND AND MICRO-GAS TURBINES	6	ING-IND/08	CORE LEARNING ACTIVITY	Energy and Nuclear Engineering	English		Provide general knowledge on energy conversion systems from renewable sources, with particular reference to the technologies and methodologies related to the conversion of energy from wind power, hydraulic and engine plants based on the technology of gas turbines. Provide the operative tools for the dimensioning of plants and machines for energy conversion from renewable energy sources. Hydraulic and Wind Energy and distributed Cogeneration from fossil fuel or biofuel by means of micro gas turbines. Provide tools for calculating energy producibility from wind farms, hydraulic and micro gas turbine. Provide knowledge for economic and financial analysis simplified to compare different energy conversion systems.	54	96
2	86662	MODELS AND METHODS FOR	MODELS AND METHODS FOR	6	ING-INF/04	RELATED OR SUPPLEMENTARY	Related or Supplement	English		To provide the essential methodological tools for the statement and the solution of management and control problems relevant to energy and environmental systems. To provide an introduction	54	96

		ENERGY ENGINEERING	ENERGY ENGINEERING			LEARNING ACTIVITY	ary Learning Activity			to widespread and flexible software tools (such as, for instance, LINGO and MATLAB) for the solution of optimization and control problems, and for the simulation and performance analysis of the controlled dynamic systems.		
2	86663	MASTER THESIS	MASTER THESIS	11		FINAL EXAMIN	For the final examination	English		Master Thesis is addressed at developing students' skills in analyzing, modelling, solving and presenting the results related to energy engineering complex problems. Master Thesis consists in the realization of a detailed Report on given engineering topics thus enhancing the students' abilities in preparing professional reports and projects for their next professional career.	0	275
2	86664	TRAINING AND ORIENTATION	TRAINING AND ORIENTATION	1		OTHER ACTIVITY	Training and Orientation Traineeships	English		Training and Orientation is addressed at developing students' further skills in design, specific software knowledge and measurement techniques for their next professional career.	0	25
2	86665	ADVANCED PROPULSION SYSTEMS AND GREEN FUELS	ADVANCED PROPULSION SYSTEMS AND GREEN FUELS	6	ING-IND/08	ELECTIVE LEARNING ACTIVITY	Student's elective learning activity	English		The main objectives of the course are: to provide an adequate and critical knowledge on environmental friendly propulsion systems for different applications, taking into account energy-related and economic issues. To develop skills for the analysis and comparison of advanced systems and technologies for ultra-low emissions Internal Combustion Engines (ICE), the development of hybrid propulsion systems and the application of fuel cells to road vehicles propulsion. To define criteria for the selection of different systems and technologies referring to several application fields. To assess real benefits in terms of energy consumption and environmental impact for the proposed technical solutions compared to conventional systems. To outline characteristics and properties of alternative fuels to guide for their selection and use.	54	96
2	86666	PROJECT MANAGEMENT FOR ENERGY PRODUCTION	PROJECT MANAGEMENT FOR ENERGY	6	ING-IND/17	ELECTIVE LEARNING ACTIVITY	Student's elective learning activity	English		The course aims to provide a significant background to EPC (Engineering, Procurement and Construction about the job manage) Project Managers starting from the overall definition of the methodology based on international standards (PMI/IPMA) and focusing to bidding phase with	54	96

			PRODUCTIO N							associated economic risks evaluation (contingencies). The student will learn to achieve an optimized management of the project ranging from the construction phase, to the suppliers selection and qualification up to the final commissioning according to corporate policies. The proposed models, which use the Monte Carlo simulation, Design of Experiments and other appropriate business tools, will enable students to acquire the skills needed to deal with the difficulties arising from acting in stochastic regime.		
2	86667	POWER SYSTEMS SIMULATION AND OPTIMIZATION	POWER SYSTEMS SIMULATION AND OPTIMIZATIO N	6	ING-IND/33	ELECTIVE LEARNING ACTIVITY	Student's elective learning activity	English		The course is designed to provide the students the theoretical and methodological skills necessary for the development of power system simulation and optimization models. The course aims to provide the students the capabilities to model different power system technologies in off-design and transient operating conditions, through the use of dedicated software, and to develop optimization mathematical models for the design and the operation of energy communities, microgrids, nanogrids, and smart charging infrastructures for electric vehicles.	54	96
2	94763	NUCLEAR ENERGY	NUCLEAR ENERGY	6	ING-IND/19	ELECTIVE LEARNING ACTIVITY	Student's elective learning activity	English		The class provides a comprehensive knowledge of the most up-to-date technologies related to the nuclear energy. The class helps to achieve the educational objectives of the course with regard to the energy uses of nuclear technology. Particularly the class provides the following contents: basics of nuclear energy and radioprotection; design and operation of nuclear fission power plants; front-end and back-end of nuclear fission fuel cycles; innovative systems for the minimization of the nuclear fission waste; hydrogen production by nuclear energy; fundamentals of nuclear fusion engineering	48	102

Dipartimento di Ingegneria Meccanica, Energetica, Gestionale e dei Trasporti
Corso di Laurea Magistrale in Energy Engineering
Classe LM-30: Ingegneria Energetica e Nucleare
REGOLAMENTO DIDATTICO
Deliberato dal Consiglio del Corso di Studi del 29.04.2022

Parte generale

INDICE

Art. 1. Premessa e ambito di competenza

Il presente Regolamento, in conformità allo Statuto ed al Regolamento Didattico di Ateneo (parte generale e parte speciale), disciplina gli aspetti organizzativi dell'attività didattica del corso di laurea magistrale in Energy Engineering, nonché ogni diversa materia ad esso devoluta da altre fonti legislative e regolamentari.

Il Regolamento didattico del corso di laurea magistrale in Energy Engineering è deliberato, ai sensi dell'articolo 25, commi 1 e 4 del Regolamento Didattico di Ateneo, parte generale, dal Consiglio dei Corsi di Studio (CCS) di Energy Engineering a maggioranza dei componenti e sottoposto all'approvazione del consiglio del dipartimento di riferimento, sentita la scuola previo parere favorevole della commissione paritetica di scuola e di dipartimento, ove esistente.

Art. 2. Requisiti di ammissione e modalità di verifica della preparazione individuale

L'ammissione alla Laurea Magistrale in Energy Engineering è subordinata al possesso di specifici requisiti curricolari e di adeguatezza della preparazione personale.

Per l'accesso al Corso di Laurea Magistrale in Energy Engineering sono richiesti, senza esclusione, tutti i seguenti requisiti curricolari:

- possesso di Laurea, Laurea Specialistica o Laurea Magistrale, di cui al DM 509/1999 o DM 270/2004, oppure di una Laurea quinquennale (ante DM 509/1999), conseguita presso una Università italiana o titolo equivalente;
- possesso di almeno 36 CFU, o conoscenze equivalenti, acquisiti in un qualunque corso universitario (Laurea, Laurea Specialistica, Laurea Magistrale, Master Universitari di primo e secondo livello) nei settori scientifico-disciplinari indicati per le attività formative di base previste dalle Lauree della Classe L9-Ingegneria Industriale;

- possesso di almeno 45 CFU, o conoscenze equivalenti, acquisiti in un qualunque corso universitario (Laurea, Laurea Specialistica, Laurea Magistrale, Master Universitari di primo e secondo livello) nei settori scientifico-disciplinari indicati per le attività formative caratterizzanti delle Lauree della Classe L9-Ingegneria Industriale;
- adeguata conoscenza della lingua inglese pari a livello B2 o equivalente.

Nel caso di possesso di lauree differenti da quelle sopra indicate e in caso di studenti stranieri il CCS verificherà la presenza dei requisiti curricolari o delle conoscenze equivalenti, sulla base degli esami sostenuti dallo studente nel corso di laurea di provenienza, nonché la presenza di eventuali esami extracurricolari, le attività di stage e le esperienze lavorative maturate.

I requisiti curricolari devono essere posseduti prima della verifica della preparazione individuale. Ai fini dell'ammissione al corso di laurea magistrale, gli studenti, in possesso dei requisiti curricolari, dovranno sostenere con esito positivo una prova per la verifica della preparazione personale, salvo i casi disposti dall'ultimo comma. La prova di verifica sarà svolta sotto forma di test scritto (eventualmente anche in modalità telematica) e sarà finalizzata ad accertare la preparazione generale dello studente con particolare riferimento alla conoscenza di nozioni fondamentali e di aspetti applicativi e professionali relativi alle tematiche proprie dell'ingegneria, tra cui:

- Sistemi Energetici e Macchine
- Fisica Tecnica
- Sistemi Elettrici
- Processi Chimici

La prova è sostenuta davanti ad una Commissione nominata dal CCS e composta da docenti afferenti al CCS. Nell' avviso per Ammissione ai corsi di Laurea magistrale della Scuola Politecnica e sul sito web del corso di laurea magistrale sono indicati: la composizione della Commissione d'esame, le modalità della prova, il luogo e la data, gli argomenti oggetto d'esame, i criteri di valutazione dei candidati. L'esito della prova prevede una votazione in sessantesimi. La prova scritta prevede 30 domande chiuse, a cui vengono assegnati 2 punti se la risposta è corretta, -0,5 punti se la risposta è errata e 0 punti in caso di nessuna risposta. La prova di ammissione si intende superata per votazione uguale o maggiore di trentasei sessantesimi (36/60). L'adeguatezza della preparazione personale è automaticamente verificata per coloro che hanno conseguito la laurea triennale, italiana od estera, o titolo giudicato equivalente in sede di accertamento dei requisiti curricolari, con una votazione finale di almeno 9/10 del voto massimo previsto dalla propria laurea o che hanno conseguito una votazione finale corrispondente almeno alla classifica "A" del sistema ECTS.

L'adeguata conoscenza della lingua inglese è verificata tramite opportune attestazioni in possesso dello studente, conseguite da non più di 3 anni, o, in assenza di esse, tramite verifica da parte del Settore Sviluppo Competenze Linguistiche di Ateneo. Il possesso di una laurea in lingua inglese soddisfa il requisito della conoscenza linguistica, ma è in ogni caso consigliato il superamento del test inglese B2 periodicamente organizzato dal suddetto Settore.

Per gli studenti di nazionalità extra-UE, con residenza e titolo di studio esteri, la procedura di presentazione della propria candidatura ai fini della verifica dell'ammissibilità ad una LM in inglese deve passare attraverso un portale web dedicato, selezionato dall'Ateneo e adeguatamente pubblicizzato. A seguito del caricamento della documentazione nel portale viene effettuata la verifica della completezza dei documenti.
I candidati che superano la verifica dei requisiti passano alla fase successiva, relativa alla valutazione dei titoli e alla valutazione finale del candidato, a valle della quale lo studente verrà ritenuto ammissibile, ammissibile sotto condizione (attribuzione di carriere ponte) o non ammissibile.
Il numero massimo ammissibile di studenti iscritti provenienti da paesi non appartenenti all'Unione Europea viene stabilito annualmente dal CCS, comunicato al Settore Accoglienza Studenti Stranieri di Ateneo e pubblicato sul sito Universitaly.

Art. 3. Attività formative

L'elenco degli insegnamenti e delle altre attività formative attivabili per la coorte 2022/2023, è riportato nell'apposito allegato (Allegato 1) che costituisce parte integrante del presente regolamento.

Per ogni insegnamento è individuato un docente responsabile. E' docente responsabile di un insegnamento chi ne sia titolare a norma di legge, ovvero colui al quale il Consiglio di Dipartimento di afferenza abbia attribuito la responsabilità stessa in sede di affidamento dei compiti didattici ai docenti.

La lingua usata per erogare le attività formative (lezioni, esercitazioni, laboratori) è l'inglese come specificato nella parte speciale del presente regolamento (Allegato 1).

Art. 4 Iscrizione a singole attività formative

In conformità con l'articolo 5 del Regolamento di Ateneo, gli studenti che vogliano iscriversi a singole attività formative, devono essere in possesso di un titolo di studio che permetta l'accesso all'Università.

Art. 5. Curricula

Il corso di laurea magistrale in Energy Engineering non è articolato in curricula.

Art. 6. Impegno orario complessivo

La definizione della frazione oraria dedicata a lezioni o attività didattiche equivalenti è stabilita, per ogni insegnamento, dal CCS e specificata nella parte speciale del presente regolamento (Allegato 1). In ogni caso si assumono i seguenti intervalli di variabilità della corrispondenza ore aula/ CFU: 8 ÷ 10 ore di lezione o di attività didattica assistita.

La definizione dell'impegno orario complessivo riservato allo studio personale o ad altre attività formative di tipo individuale è stabilita, per ogni insegnamento, nella parte speciale del presente regolamento (Allegato 1).

Il Direttore del Dipartimento di Ingegneria Meccanica, Energetica, Gestionale e dei Trasporti e il Coordinatore del CCS sono incaricati di verificare il rispetto delle predette prescrizioni, anche ai fini della pubblicazione dei programmi dei corsi.

Art. 7. Piani di studio e propedeuticità

Gli studenti possono iscriversi a tempo pieno o a tempo parziale; per le due tipologie di studente sono previsti differenti diritti e doveri.

Lo studente sceglie la tipologia di iscrizione contestualmente alla presentazione del piano di studi.

Lo studente a tempo pieno svolge la propria attività formativa tenendo conto del piano di studio predisposto dal corso di laurea magistrale, distinto per anni di corso e pubblicato nel Manifesto degli studi. Il piano di studio formulato dallo studente deve contenere l'indicazione delle attività formative, con i relativi crediti che intende conseguire, previsti dal piano di studio ufficiale per tale periodo didattico, fino ad un massimo di 65 crediti previsti in ogni anno.

Lo studente a tempo parziale è tenuto a presentare un piano di studio individuale specificando il numero di crediti che intende inserire.

L'iscrizione degli studenti a tempo pieno e a tempo parziale è disciplinata dal regolamento di Ateneo per gli studenti tenuto conto delle disposizioni operative deliberate dagli Organi centrali di governo ed indicate nella Guida dello studente (pubblicata annualmente e disponibile presso il Servizio Orientamento, lo Sportello dello Studente della Scuola Politecnica e sul sito web dell'Università).

Il percorso formativo dello studente può essere vincolato attraverso un sistema di propedeuticità, indicate per ciascun insegnamento nel Manifesto degli studi.

La modalità e il termine per la presentazione del piano di studio sono stabiliti annualmente dalla Scuola Politecnica e riportate nel Manifesto degli studi.

Art. 8. Frequenza e modalità di svolgimento delle attività didattiche

Gli insegnamenti possono assumere la forma di: (a) lezioni; (b) esercitazioni pratiche; (c) esercitazioni in laboratorio.

Il profilo articolato e la natura impegnativa delle lezioni tenute nell'ambito dei vari corsi di studio offerti dalla Scuola Politecnica rendono la frequenza alle attività formative fortemente consigliata per una adeguata comprensione degli argomenti e quindi per una buona riuscita negli esami.

Il calendario delle lezioni è articolato in semestri. Di norma, il semestre è suddiviso in almeno 12 settimane di lezione più almeno 4 settimane complessive per prove di verifica ed esami di profitto.

Il periodo destinato agli esami di profitto termina con l'inizio delle lezioni del semestre successivo.

Per un periodo di una settimana, a metà semestre, la normale attività didattica (lezioni, esercitazioni, laboratori) può essere interrotta per lo svolgimento di esami di laurea, di prove in itinere, seminari, attività di tutorato e attività didattica di recupero.

Il calendario delle attività didattiche (lezioni, esami di profitto, periodi intra-semestrali di sospensione delle lezioni) per l'intero anno accademico è pubblicato sul sito web della Scuola Politecnica. L'orario delle lezioni garantisce la possibilità di frequenza per anni di corso previsti dal vigente Manifesto degli studi. Per ragioni pratiche non è garantita la compatibilità dell'orario per tutte le scelte formalmente possibili degli insegnamenti opzionali. Gli studenti devono quindi formulare il proprio piano di studio tenendo conto dell'orario delle lezioni.

Art. 9. Esami e altre verifiche del profitto

Gli esami di profitto possono essere svolti in forma scritta, orale, o scritta e orale, secondo le modalità indicate nelle schede di ciascun insegnamento pubblicato sul sito web del corso di laurea magistrale.
A richiesta, possono essere previste specifiche modalità di verifica dell'apprendimento che tengano conto delle esigenze di studenti disabili e di studenti con disturbi specifici dell'apprendimento (D.S.A.), in conformità all'art. 20 comma 4 del Regolamento Didattico di Ateneo.

Nel caso di insegnamenti strutturati in moduli con più docenti, questi partecipano collegialmente alla valutazione complessiva del profitto dello studente che non può, comunque, essere frazionata in valutazioni separate sui singoli moduli.

Il calendario degli esami di profitto è stabilito entro il 30 settembre per l'anno accademico successivo e viene pubblicato sul sito web del corso di laurea magistrale. Il calendario delle eventuali prove di verifica in itinere è stabilito dal CCS e comunicato agli studenti all'inizio di ogni ciclo didattico.

Gli esami si svolgono nei periodi di interruzione delle lezioni. Possono essere previsti appelli durante il periodo delle lezioni soltanto per gli studenti che, nell'anno accademico in corso, non abbiano inserito attività formative nel proprio piano di studio.

Tutte le verifiche del profitto relative alle attività formative debbono essere superate dallo studente almeno venti giorni prima della data prevista per il sostenimento della prova finale.

L'esito dell'esame, con la votazione conseguita, è verbalizzato secondo quanto previsto all'art. 20 del regolamento didattico di Ateneo.

Art. 10. Riconoscimento di crediti

Il CCS delibera sull'approvazione delle domande di passaggio o trasferimento da un altro corso di studi dell'Ateneo o di altre Università secondo le norme previste dal Regolamento didattico di Ateneo, art. 18. Delibera altresì il riconoscimento, quale credito formativo, per un numero massimo di 12 CFU, di conoscenze e abilità professionali certificate ai sensi della normativa vigente.

Nella valutazione delle domande di passaggio si terrà conto delle specificità didattiche e dell'attualità dei contenuti formativi dei singoli esami sostenuti, riservandosi di stabilire di volta in volta eventuali forme di verifica ed esami integrativi.

Nel quadro della normativa nazionale e regionale su alternanza formazione/lavoro, è possibile per il corso di studio prevedere, per studenti selezionati, percorsi di apprendimento che tengano conto anche di esperienze lavorative svolte presso aziende convenzionate.

Art. 11. Mobilità, studi compiuti all'estero, scambi internazionali

Il CCS incoraggia fortemente le attività di internazionalizzazione, in particolare la partecipazione degli studenti ai programmi di mobilità e di scambi internazionali. A tal fine garantisce, secondo le modalità previste dalle norme vigenti, il riconoscimento dei crediti formativi conseguiti all'interno di tali programmi, e organizza le attività didattiche opportunamente in modo da rendere agevoli ed efficaci tali attività.

Il CCS riconosce agli studenti iscritti, che abbiano regolarmente svolto e completato un periodo di studi all'estero, gli esami sostenuti fuori sede e il conseguimento dei relativi crediti che lo studente intenda sostituire ad esami del proprio piano di studi.

Ai fini del riconoscimento di tali esami, lo studente all'atto della compilazione del piano delle attività formative che intende seguire nell'ateneo estero, dovrà produrre idonea documentazione comprovante l'equivalenza dei contenuti tra l'insegnamento impartito all'estero e l'insegnamento che intende sostituire, impartito nel corso di laurea magistrale in Energy Engineering. L'equivalenza è valutata dal CCS.

La conversione dei voti avverrà secondo criteri approvati dal CCS, congruenti con il sistema europeo ECTS.

Il CCS riconosce inoltre, nell'ambito dei crediti attribuiti alla prova finale (Master Thesis) una quota parte relativa ad attività di preparazione della tesi con relative attività di ricerca e/o di tirocinio svolte all'estero in uno dei programmi internazionali di ateneo (e.g. Erasmus Traineeship), secondo i criteri adottati dal CCS nelle proprie delibere su proposta della Scuola Politecnica.

Art. 12. Modalità della prova finale

La prova finale consiste nella presentazione e discussione di un elaborato scritto, di fronte ad apposita Commissione, tendente ad accertare la preparazione tecnico-scientifica e professionale del candidato.

Ai fini del conseguimento della laurea magistrale, l'elaborato finale consiste nella redazione di una tesi, elaborata dallo studente in modo originale sotto la guida di uno o più relatori, su un argomento definito attinente ad una disciplina di cui abbia superato l'esame.

Tra i relatori deve essere presente almeno un docente della Scuola Politecnica o del Corso di studi.

La tesi sarà svolta in lingua inglese; in caso di utilizzo di altra lingua della UE è necessaria l'autorizzazione del CCS. In questi casi la tesi deve essere corredata dal titolo e da un ampio sommario in inglese.

La tesi, svolta presso laboratori universitari, Aziende, Enti di ricerca nazionali o internazionali, dovrà rivelare le capacità dello studente nell'affrontare tematiche di ricerca e/o di tipo applicativo. La tesi

dovrà essere costituita da un progetto e/o dallo sviluppo di un'applicazione che proponga soluzioni innovative rispetto allo stato dell'arte e dimostri le capacità di analisi e di progetto dello studente.

La tesi dovrà altresì rivelare:

- ✓ capacità di affrontare problemi complessi con approccio multidisciplinare
- ✓ corretto uso delle fonti e della bibliografia;
- ✓ capacità sistematiche e argomentative;
- ✓ chiarezza nell'esposizione;
- ✓ capacità progettuale e sperimentale;
- ✓ capacità critica.

La Commissione per la prova finale è composta da almeno cinque componenti compreso il Presidente ed è nominata dal Direttore del dipartimento di Ingegneria Meccanica, Energetica, Gestionale e dei Trasporti.

Le modalità di svolgimento della prova finale consistono nella presentazione orale della tesi di laurea da parte dello studente alla commissione per la prova finale, seguita da una discussione sulle questioni eventualmente poste dai membri della commissione.

La valutazione della prova finale da parte della commissione avviene, in caso di superamento della stessa, attribuendo un incremento, variabile da 0 a 6 punti, di cui 4 punti come valutazione della Prova Finale e 2 punti legati alle peculiarità del lavoro di tesi (originalità metodologica e rilevanza dei risultati) e/o come valutazione della carriera dello studente (votazioni con lode, periodi di studio svolti dallo studente all'estero con riconoscimento di crediti formativi e periodi di studio all'estero per lo svolgimento della Tesi).

La dignità di stampa per il lavoro di tesi magistrale può essere richiesta dal relatore ai membri della Commissione di Laurea con lettera, fatta pervenire almeno 15 giorni prima della seduta di laurea, che illustri le motivazioni della richiesta. Sono ammissibili richieste per le quali il lavoro di tesi, grazie al contributo del candidato, possa costituire la base per articoli scientifici a Conferenza o su Journal Internazionali. La richiesta deve essere accompagnata da una sintesi della Tesi di circa 10 pagine, strutturata come un articolo scientifico. La dignità di stampa viene attribuita con voto unanime della Commissione alla seduta di Laurea.

Art. 13. Orientamento e tutorato

La Scuola Politecnica, di concerto con il Dipartimento di Ingegneria Meccanica, Energetica, Gestionale e dei Trasporti, organizza e gestisce un servizio di tutorato per l'accoglienza e il sostegno degli studenti, al fine di prevenire la dispersione e il ritardo negli studi e di promuovere una proficua partecipazione attiva alla vita universitaria in tutte le sue forme.

Il CCS individua al suo interno un numero di tutor in proporzione al numero degli studenti iscritti. I nominativi dei tutor sono reperibili nel sito web del corso di laurea magistrale.

Art. 14. Verifica dell'obsolescenza dei crediti

I crediti acquisiti nell'ambito del corso di laurea magistrale hanno validità per 4 anni.

Trascorso il periodo indicato, i crediti acquisiti debbono essere convalidati con apposita delibera qualora il CCS riconosca la non obsolescenza dei relativi contenuti formativi.

Qualora il CCS riconosca l'obsolescenza anche di una sola parte dei relativi contenuti formativi, lo stesso CCS stabilisce le prove integrative che dovranno essere sostenute dallo studente, definendo gli argomenti delle stesse e le modalità di verifica.

Una volta superate le verifiche previste, il CCS convalida i crediti acquisiti con apposita delibera. Qualora la relativa attività formativa preveda una votazione, la stessa potrà essere variata rispetto a quella precedentemente ottenuta, su proposta della Commissione d'esame che ha proceduto alla verifica.

Art. 15 Manifesto degli Studi

Il Dipartimento di Ingegneria Meccanica, Energetica, Gestionale e dei Trasporti, sentita la Scuola, pubblica annualmente il Manifesto degli studi. Nel Manifesto, finalizzato alla massima trasparenza dell'offerta didattica, sono indicate le principali disposizioni dell'ordinamento didattico e del regolamento didattico del corso di laurea magistrale, a cui eventualmente si aggiungono indicazioni integrative.

Il Manifesto degli studi del Corso di laurea magistrale in Energy Engineering contiene l'elenco delle attività formative attivate per l'anno accademico, con l'indicazione di eventuali propedeuticità, la denominazione, la tipologia, i crediti formativi, il settore scientifico-disciplinare, il semestre di svolgimento, il docente o i docenti che svolgeranno l'attività didattica, nonché, attraverso le relative schede degli insegnamenti, il programma e le modalità di accertamento dei risultati di apprendimento acquisiti dallo studente.

Allegato 1 Parte speciale del Regolamento didattico del Corso di Laurea Magistrale in Energy Engineering della Scuola Politecnica

Elenco delle attività formative attivabili e relativi obiettivi formativi

Anno di corso	Codice Ins.	Nome insegnamento ITA	Nome insegnamento ENG	CFU	SSD	Tipologia	Ambito	Lingua	Propedeuticità	Obiettivi formativi	Ore riservate attività didattica assistita	Ore riservate allo studio personale
1	66382	HEAT TRANSFER	HEAT TRANSFER	6	ING-IND/10	CARATTERIZZANTI	Ingegneria Energetica e Nucleare	Inglese		The course introduces the fundamental mechanisms of heat transfer (conduction, convection and thermal radiation) and shows some examples of practical application. The student will demonstrate a deep knowledge of the different heat transfer mechanisms and to be able to apply the fundamental laws to simple engineering problems. The goal of this course is to provide to the student the basis for the thermal analysis of energy transformation and production processes.	48	102
1	86630	MATHEMATICAL MODELING FOR ENERGY SYSTEMS	MATHEMATICAL MODELING FOR ENERGY SYSTEMS	6	MAT/07	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative	Inglese		The aim of the course is to provide students with an overview of the basic mathematical methods used for the solution and the qualitative study of certain types of ordinary and partial differential equations of interest in engineering. At the end of the course, the student acquires the ability to study the behavior of complex systems through the formulation of a simplified mathematical model capable of describing and predict the salient features of the phenomenon.	48	102
1	86633	CHEMICAL PLANTS AND PROCESSES FOR ENERGY	CHEMICAL PLANTS AND PROCESSES FOR ENERGY	12		CARATTERIZZANTI // AFFINI O INTEGRATIVE	Ingegneria Energetica e Nucleare // Attività Formative Affini o Integrative	Inglese			0	0
1	72562	CHEMICAL AND BIOCHEMICAL PROCESSES	CHEMICAL AND BIOCHEMICAL PROCESSES	6	ING-IND/25	CARATTERIZZANTI	Ingegneria Energetica e Nucleare	Inglese		The course describes the major alternative energy conversion processes. The course will be focused on chemical and biochemical processes to produce sustainable and clean energy for example biodiesel from microalgae,	48	102

		AND PLANTS FOR ENERGY	AND PLANTS FOR ENERGY							bioethanol from cellulosic and lignocellulosic biomasses and biogas from anaerobic digestion.		
1	86631	CHEMICAL PROCESSES AND TECHNOLOGIES	CHEMICAL PROCESSES AND TECHNOLOGIES	6	ING-IND/27	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative	Inglese		The course aims to provide an in-depth knowledge of the main processes of industrial chemistry related to energy production, a critical analysis of the motivations of the solutions used in the production of the main products and the criteria for a correct approach to the design of a chemical process in terms productivity, safety and protection of environment.	54	96
1	86634	ELECTRIC POWER SYSTEMS	ELECTRIC POWER SYSTEMS	12	ING-IND/33	CARATTERIZZANTI	Ingegneria Energetica e Nucleare	Inglese			0	0
1	65887	POWER SYSTEMS MODELLING AND CONTROL	POWER SYSTEMS MODELLING AND CONTROL	6	ING-IND/33	CARATTERIZZANTI	Ingegneria Energetica e Nucleare	Inglese		The course is designed to provide the theoretical and methodological skills necessary for the understanding of the most important problems of modern electrical power systems, with particular reference to the integration of renewable energy sources (RES) and the impact that the change in the characteristics of the generating units determines in the electrical network management. The course, with strong interactive features, is proposed to support theoretical lectures with a large "experiential" part in which, through the use of dedicated software, the student can apply personally what learnt during the theoretical explanations.	54	96
1	86638	POWER SYSTEMS MANAGEMENT	POWER SYSTEMS MANAGEMENT	6	ING-IND/33	CARATTERIZZANTI	Ingegneria Energetica e Nucleare	Inglese		The course is designed to provide theoretical and methodological skills for the economic analyses related to the development of projects in the sustainable energy sector. In this context, it encompasses the fundamentals of energy markets, the procedures to calculate high efficiency cogeneration and the levelized cost of electricity. A special focus is devoted to new power production and distribution infrastructures such as smart grids and smart microgrids, with specific insight concerning with energy management platforms.	48	102

1	86640	INDUSTRIAL FLUID-DYNAMICS AND COMBUSTION	INDUSTRIAL FLUID-DYNAMICS AND COMBUSTION	12	ING-IND/08	CARATTERIZZANTI	Ingegneria Energetica e Nucleare	Inglese			0	0
1	80054	COMBUSTION PROCESS AND EMISSIONS	COMBUSTION PROCESS AND EMISSIONS	6	ING-IND/08	CARATTERIZZANTI	Ingegneria Energetica e Nucleare	Inglese		Acquisition of the theoretical, technical and methodological skills necessary for the understanding and proper interpretation of most industrially and energetically relevant combustion phenomena. Acquisition of theoretical tools useful to the comprehension of the physical phenomena to which the combustion processes are subjected to, as well as on the implications connected with their industrial exploitation. Acquisition of fundmentale skills related to environmental issues, linked to the combustive processes. Basic competences on the main combustion diagnostic techniques.	54	96
1	86641	INDUSTRIAL FLUID-DYNAMICS	INDUSTRIAL FLUID-DYNAMICS	6	ING-IND/08	CARATTERIZZANTI	Ingegneria Energetica e Nucleare	Inglese		The course has two complementary objectives: first, to provide the conceptual, analytical and numerical bases of compressible flows prediction, in presence of turbulence, heat transfer and also chemical reactions and multiphase flows, typically found in energy-related industrial processes, second, to provide an overview, with practical training on the application of CFD software tools (Computational Fluid Dynamics) that are nowadays a fundametal industrial technology for product development. The main target of the course is to convey operational and critical skills to the student; the emphasis will be more centred on the correct methodological approach to perform a sound CFD analysis, even complex, as well as on a proper 'engineering' interpretation of results, in terms of their physical consistency, trends' capturing and validation capability, rather than to provide students with competences related to turbulent Navier-Stokes equations' numerical programming. On the other hand, these equations, at least at a basic level, must be	54	96

										already known in their properties and application potential.		
1	86642	POWER AND INDUSTRIAL PLANTS FOR ENERGY	POWER AND INDUSTRIAL PLANTS FOR ENERGY	12		CARATTERIZZANTI // AFFINI O INTEGRATIVE	Ingegneria Energetica e Nucleare // Attività Formative Affini o Integrative	Inglese			0	0
1	80053	POWER PLANTS FOR ENERGY CONVERSION	POWER PLANTS FOR ENERGY CONVERSION	6	ING-IND/09	CARATTERIZZANTI	Ingegneria Energetica e Nucleare	Inglese		The aim of the course is to provide students with a detailed knowledge of the operating principles and system lay-out of power plants for energy conversion, such as gas turbine systems, steam power plant and combined cycles. Moreover, the course will give the basis for the plant performances calculation, system behaviour understanding and plant management knowledge, with particular regard to the current national and international energy scenario.	54	96
1	86644	INDUSTRIAL PLANTS FOR ENERGY	INDUSTRIAL PLANTS FOR ENERGY	6	ING-IND/17	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative	Inglese		Provide students with operational tools for the design and operation of service systems of industrial processes in accordance with the Community rules in force. Particular emphasis is placed on safety concepts for evolving systems group 1 fluids (dangerous fluids) and group 2 (fluids under pressure) and related risk analysis.	54	96
2	80048	REMOTE SENSING	REMOTE SENSING	6	ING-INF/03	A SCELTA	A Scelta dello Studente	Inglese		Introducing the key concepts associated with Earth observation through remote sensing images for renewable energy applications. Providing the students with basic knowledge about remote sensing image acquisition and about mapping, through remote sensing image analysis, bio/geophysical parameters associated with renewable energy sources, including vegetation biomass, wind velocity field over sea water, solar irradiance, and air surface temperature.	48	102
2	80081	ENERGY LABORATORY	ENERGY LABORATORY	6	ING-IND/08	CARATTERIZZANTI	Ingegneria Energetica e Nucleare	Inglese		Acquisition of the theoretical, technical, methodological and practical skills necessary for the experimental investigation of combustive processes. Acquisition of the theoretical basis of the modern	54	96

										measurements and diagnostic techniques applicable to the combustion field as well as of operative skills in utilizing an experimental infrastructure and the measurement techniques theoretically introduced, taking advantage of the equipment present at the Savona Campus. The course foresees also the realization of a simple combustor project and its characterization by means of the most proper experimental techniques.		
2	86653	RENEVABLE ENERGY IN BUILDINGS	RENEVABLE ENERGY IN BUILDINGS	12	ING-IND/10	CARATTERIZZANTI	Ingegneria Energetica e Nucleare	Inglese			0	0
2	80043	SOLAR AND GEOTHERMAL ENERGY	SOLAR AND GEOTHERMAL ENERGY	6	ING-IND/10	CARATTERIZZANTI	Ingegneria Energetica e Nucleare	Inglese		The aim of the course is provide the students the engineering knowledge on renewable energies as a whole and to the technologies and engineering methods to exploit the solar (thermal, photovoltaics) and low enthalpy geothermal resources in the high efficiency building contest. The goals of this course are to provide the students the capabilities related to modelling and design criteria definition, energy production estimation analysis, national and international standard knowledge and application, basic economic and financial investment analysis.	54	96
2	86655	ENERGY AND BUILDINGS	ENERGY AND BUILDINGS	6	ING-IND/10	CARATTERIZZANTI	Ingegneria Energetica e Nucleare	Inglese		The course provides the basics of the energy analysis of buildings; in particular, all the contributions for the evaluation of the heating and cooling loads are explained in detail. With the final aim of energy saving and sustainability, possible actions on the envelope and on the operative conditions are suggested to reduce the energy request of the building. Moreover, some elements about thermal plants are provided and the dynamic simulation of buildings is introduced with the use of a software open-source.	48	102
2	86659	MACHINES AND SYSTEMS FOR	MACHINES AND SYSTEMS FOR	12		CARATTERIZZANTI	Ingegneria Energetica e Nucleare	Inglese			0	0

		RENEWABLE ENERGY	RENEWABLE ENERGY									
2	86660	FUEL CELLS AND DISTRIBUTED GENERATION SYSTEMS	FUEL CELLS AND DISTRIBUTED GENERATION SYSTEMS	6	ING-IND/09	CARATTERIZZANTI	Ingegneria Energetica e Nucleare	Inglese		The purpose of this course is to provide the students with the fundamental know-how related to fuel cells and to the concept of distributed generation systems. The attention is mainly focused on thermodynamic theory and component performance. Fuel cells are presented putting emphasis on different technology types, hybrid system plant layouts, technological and environmental aspects. This course also proposes to provide students with basic knowledge and operative elements to design different small size systems (internal combustion engines, microturbines, stirling engines, fuel cells) for applications in distributed generation grids. For this part of the course, special attention is devoted to combined heat and power generation providing students with laboratory experiences.	54	96
2	86661	HYDRO, WIND AND MICRO-GAS TURBINES	HYDRO, WIND AND MICRO-GAS TURBINES	6	ING-IND/08	CARATTERIZZANTI	Ingegneria Energetica e Nucleare	Inglese		Provide general knowledge on energy conversion systems from renewable sources, with particular reference to the technologies and methodologies related to the conversion of energy from wind power, hydraulic and engine plants based on the technology of gas turbines. Provide the operative tools for the dimensioning of plants and machines for energy conversion from renewable energy sources. Hydraulic and Wind Energy and distributed Cogeneration from fossil fuel or biofuel by means of micro gas turbines. Provide tools for calculating energy producibility from wind farms, hydraulic and micro gas turbine. Provide knowledge for economic and financial analysis simplified to compare different energy conversion systems.	54	96
2	86662	MODELS AND METHODS FOR ENERGY ENGINEERING	MODELS AND METHODS FOR ENERGY ENGINEERING	6	ING-INF/04	AFFINI O INTEGRATIVE	Attività Formative Affini o Integrative	Inglese		To provide the essential methodological tools for the statement and the solution of management and control problems relevant to energy and environmental systems. To provide an introduction to widespread and flexible software tools (such as, for instance, LINGO and	54	96

										MATLAB) for the solution of optimization and control problems, and for the simulation and performance analysis of the controlled dynamic systems.		
2	86663	MASTER THESIS	MASTER THESIS	11		PROVA FINALE	Per la Prova Finale	Inglese		Master Thesis is addressed at developing students' skills in analyzing, modelling, solving and presenting the results related to energy engineering complex problems. Master Thesis consists in the realization of a detailed Report on given engineering topics thus enhancing the students' abilities in preparing professional reports and projects for their next professional career.	0	275
2	86664	TRAINING AND ORIENTATION	TRAINING AND ORIENTATION	1		ALTRE ATTIVITA'	Tirocini Formativi e di Orientamento	Inglese		Training and Orientation is addressed at developing students' further skills in design, specific software knowledge and measurement techniques for their next professional career.	0	25
2	86665	ADVANCED PROPULSION SYSTEMS AND GREEN FUELS	ADVANCED PROPULSION SYSTEMS AND GREEN FUELS	6	ING-IND/08	A SCELTA	A Scelta dello Studente	Inglese		The main objectives of the course are: to provide an adequate and critical knowledge on environmental friendly propulsion systems for different applications, taking into account energy-related and economic issues. To develop skills for the analysis and comparison of advanced systems and technologies for ultra-low emissions Internal Combustion Engines (ICE), the development of hybrid propulsion systems and the application of fuel cells to road vehicles propulsion. To define criteria for the selection of different systems and technologies referring to several application fields. To assess real benefits in terms of energy consumption and environmental impact for the proposed technical solutions compared to conventional systems. To outline characteristics and properties of alternative fuels to guide for their selection and use.	54	96
2	86666	PROJECT MANAGEMENT FOR ENERGY PRODUCTION	PROJECT MANAGEMENT FOR ENERGY PRODUCTION	6	ING-IND/17	A SCELTA	A Scelta dello Studente	Inglese		The course aims to provide a significant background to EPC (Engineering, Procurement and Construction about the job manage) Project Managers starting from the overall definition of the methodology based on international standards (PMI/IPMA) and focusing to bidding	54	96

										phase with associated economic risks evaluation (contingencies). The student will learn to achieve an optimized management of the project ranging from the construction phase, to the suppliers selection and qualification up to the final commissioning according to corporate policies. The proposed models, which use the Monte Carlo simulation, Design of Experiments and other appropriate business tools, will enable students to acquire the skills needed to deal with the difficulties arising from acting in stochastic regime.		
2	86667	POWER SYSTEMS SIMULATION AND OPTIMIZATIO N	POWER SYSTEMS SIMULATION AND OPTIMIZATION	6	ING-IND/33	A SCELTA	A Scelta dello Studente	Inglese		The course is designed to provide the students the theoretical and methodological skills necessary for the development of power system simulation and optimization models. The course aims to provide the students the capabilities to model different power system technologies in off-design and transient operating conditions, through the use of dedicated software, and to develop optimization mathematical models for the design and the operation of energy communities, microgrids, nanogrids, and smart charging infrastructures for electric vehicles.	54	96
2	94763	NUCLEAR ENERGY	NUCLEAR ENERGY	6	ING-IND/19	A SCELTA	A Scelta dello Studente	Inglese		The class provides a comprehensive knowledge of the most up-to-date technologies related to the nuclear energy. The class helps to achieve the educational objectives of the course with regard to the energy uses of nuclear technology. Particularly the class provides the following contents: basics of nuclear energy and radioprotection; design and operation of nuclear fission power plants; front-end and back-end of nuclear fission fuel cycles; innovative systems for the minimization of the nuclear fission waste; hydrogen production by nuclear energy; fundamentals of nuclear fusion engineering	48	102