ENERGY ENGINEERING
UNIVERSITY OF GENOVA

Ms Course in
ENERGY ENGINEERING DIDATTICA PROGRAMMATA COORTE A.A. 2015/2017
Code **10170** REGOLAMENTO DIDATTICO PARTE SPECIALE

Syllabus

First year **LM-30**

Year	Code	Course name	Credits	SSD	Official o Elective	Language	Objectives	Teaching hours	Home study (hours)
1	66382	HEAT TRANSFER	6	ING-IND/10		English	The course introduces the fundamentals of heat-transport controlled phenomena in its fundamental mechanisms (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	6	MAT/07		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	12			English			
1						English			
1	86631	CHEMICAL PROCESSES AND TECHNOLOGIES	6	ING-IND/27		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.	48	102
1	86632	BIOCHEMICAL PROCESSES AND PLANTS	6	ING-IND/25		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	86634	ELECTRIC POWER SYSTEMS	12	ING-IND/33		English			
1	65887	POWER SYSTEMS MODELLING AND CONTROL	6	ING-IND/33		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.	48	102
1	86638	POWER SYSTEMS MANAGEMENT	6	ING-IND/33		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 smart grids and smart microgrids, with specific insight concerning with energy management platforms.	48	102
1	86640	INDUSTRIAL FLUID-DYNAMICS AND COMBUSTION	12	ING-IND/08		English			
1	80054	COMBUSTION PROCESS AND EMISSIONS	6	ING-IND/08		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.	48	102
1	86641	INDUSTRIAL FLUID-DYNAMICS	6	ING-IND/08		English	The course has two objectives, integrated and complementary to each other: first, to provide the conceptual, analytical and numerical bases of compressible flows prediction, in presence of turbulence, heat transfer and, if necessary, also chemical reactions, typically found in energy-related industrial processes, second, to provide an overview, and, in some cases, a direct operational experience (‘training’) on the application of CFD software tools (Computational Fluid Dynamics, also in the 'Reactive' version, CRFD) now so widespread and applied in industry. Since the main target of the course is to convey operational skills to the students, 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 already known in their properties and application potential.	48	102
1	86642	POWER AND INDUSTRIAL PLANTS FOR ENERGY	12			English			
1						English			
1	80053	POWER PLANTS FOR ENERGY CONVERSION	6	ING-IND/09		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.	48	102
1	86644	INDUSTRIAL PLANTS FOR ENERGY	6	ING-IND/17		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.	48	102

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Second year

2	80023	REACTION ENGINEERING OF BIOFUELS	6	ING-IND/24		English	The class provides the knowledge related to biofuels production. Students will be able to choose the most appropriate methodologies and technologies to basic design chemical reactors and processes for the production of biofuels from biomass and wastes. Students will also assess the consequences of their design choices in terms of health, environmental and economical impact.	48	102
2	80048	REMOTE SENSING	6	ING-INF/03	Elective course	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	6	ING-IND/08		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.	48	102
2	86653	RENEVABLE ENERGY IN BUILDINGS	12	ING-IND/10		English			
2	80043	SOLAR AND GEOTHERMAL ENERGY	6	ING-IND/10		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.	48	102
2	86655	ENERGY AND BUILDINGS	6	ING-IND/10		English	The course provides the basics of energy analysis of buildings and associated thermal plants, illustrates the actual European and national regulations and approaches the dynamic simulation of buildings with a software open-source.	48	102
2	86659	MACHINES AND SYSTEMS FOR RENEWABLE ENERGY	12			English			
2	86660	FUEL CELLS AND DISTRIBUTED ENERGY	6	ING-IND/09		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.	48	102
2	86661	HYDRO, WIND AND MICRO-GAS TURBINES	6	ING-IND/08		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.	48	102
2	86662	MODELS AND METHODS FOR ENERGY ENGINEERING	6	ING-INF/04		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 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.	48	102
2	86663	MASTER THESIS	5		Degree Thesis	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	125
2	86664	TRAINING AND ORIENTATION	1			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	PROPULSION SYSTEMS FOR LOW ENVIRONMENTAL IMPACT	6	ING-IND/08	Elective course	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 use of alternative fuels (biofuels, NG, hydrogen), the development of hybrid propulsion systems and the application of fuel cells to road vehicles propulsion. To provide criteria for the selection of different systems and technologies referring to several application fields, allowing a first assessment of real benefits in terms of energy consumption and environmental impact for the proposed technical solutions compared to conventional systems.	48	102
2	86666	PROJECT MANAGEMENT FOR ENERGY PRODUCTION	6	ING-IND/17	Elective course	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 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.	48	102
2	86667	POWER SYSTEMS SIMULATION AND OPTIMIZATION	6	ING-IND/33	Elective course	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 goals of this course are to provide the students the capabilities related to modelling different power system technologies in off-design and transient operating conditions, through the use of dedicated software, and to developing optimization mathematical models to design and manage distributed generation plants and smart grids.	48	102