**Operational Program European Social Fund - Regione Liguria 2014-2020**
**ASSE 3 "Education and training"**

UNIVERSITÀ DEGLI STUDI
DI GENOVA

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| EXCERPT OF INFORMATION SHEET<br>**MACHINES AND SYSTEMS ENGINEERING FOR ENERGY, THE ENVIRONMENT AND TRANSPORT***<br>*(current name of the course: **MODELS, MACHINES AND SYSTEMS ENGINEERING FOR ENERGY, THE ENVIRONMENT AND TRANSPORT**, the name has changed after approval of the grants by Regione Liguria, such changement does not involve the content of the approved projects) |

| **GENERAL INFORMATION**<br>**STRUCTURE OF THE TRAINING PROJECT** | |
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| **DURATION AND ORGANIZATION OF THE COURSE** | The course starts officially on 1 of November 2018 and lasts three years.<br>At the end of each year, doctoral students shall present the Teaching Body with a detailed written account of the activities carried out. The Teaching Body may ask for the account to be discussed according to procedures it has established.<br><br>**Coordinator of the course:** Prof. Roberto Cianci<br>**E-mail address:** cianci@dime.unige.it<br>**Department coordinating for research:** Department of Mechanical, Energetics, Management and Transport Engineering (Dipartimento di Ingegneria meccanica, energetica, gestionale e dei trasporti – DIME) |
| **TRAINING PROJECT** | The following 3 projects/scholarships are activated:<br><br>**Curriculum MACHINE AND SYSTEMS ENGINEERING FOR ENERGY, THE ENVIRONMENT AND PROPULSION (CODICE 7299):**<br><br>**Project/scholarship No. 1: Technologies for flexibility enhancement and energy harvesting in cogenerative combined cycles feeding district heating networks.**<br><br>*Months abroad:* 6<br><br>*In cooperation with:*<br>- IREN S.p.A.<br>- TICASS<br><br>*Project/scholarship details:*<br>For the efficiency and flexibility of existing electricity grids, which represent a critical energy infrastructure of the entire EU, new technologies are needed to increase the flexibility margins of production |

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| | plants, often constrained by the thermal demands of district heating networks. While on the side of thermal production, thermal storage can be a feasible solution, both technically and economically, from an electrical point of view storage by batteries is not yet competitive, as well as presenting environmental challenges, for sustainability of large scale electrochemical storages (raw materials availability, battery life, recyclability of exhausted systems, etc.). It is therefore necessary to look for alternative and complementary solutions that can be adopted both from existing plants and from new plants, so as to make electricity production more flexible, releasing it as much as possible from the thermal demands.<br>The proposal aims to tackle the problem of flexible electricity production from combined cycles, including cogeneration, studying innovative solutions at the bottoming cycle level, in order to release the still unexpressed potential of such plants to offer regulation services to the grid. The increase in flexibility is a key enabling technology to allow, from a wider point of view, a greater diffusion of non-programmable renewable energies such as wind power and photovoltaics.<br>Starting from real-life data of existing plants (in particular the combined cogeneration cycles in the availability of IREN operating in the cities of Genoa and Turin), the research work will focus on plant solutions that allow greater flexibility in electrical production, respecting the constraints imposed by thermal production.<br>In particular, the project aims to study the integration in combined cycles, at the bottoming cycle level, of closed organic fluid energy systems (ORC), operated either directly for the production of electricity, or in reverse, for the production of thermal energy: this will be done placing the emphasis not only on plant performance, but on the greater operational flexibility of the entire combined cycle. Furthermore, innovative solutions for energy harvesting will be studied in these reversible organic cycles, in order to increase their efficiency, especially in the case of reverse operation.<br>The objectives of the project will be pursued through a work divided into three distinct phases:<br>Phase 1 - State of the art of direct and reverse ORC cycles and validation of technical / economic feasibility (6 months)<br>Phase 2 - Analysis of available technologies and boundary conditions (12 months)<br>Phase 3 - Demonstration of a reverse ORC cycle prototype with energy harvester<br><br>**<u>Project/scholarship No. 2: Environmental friendly cogenerative systems for ship applications.</u>**<br><br>*Months abroad:* 6<br><br>*In cooperation with:*<br>- Fincantieri<br>- DLTM<br><br>*Project/scholarship details:*<br>The present project, which takes place in the frame of the reduction of environmental impact of the activities connected with the ship on board electrical and thermal energy production during navigation and during port and terminal operations, is aimed at defining an innovative mini cogenerative combined cycle with high global efficiency, to be adopted for the replacement of, or in combination with, the electric Diesel engines currently adopted. In particular, the activity will be focused on the optimization of the configuration of the combined cycle, which will adopt a mini gas turbine for the topping cycle and a compact steam turbine in the bottoming one, as well as of the single components.<br>The need for reduction of ship emissions arises from the necessity of |

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| | respecting the restrictive limits imposed by the International Maritime Organization (IMO) and from the growing presence of Emission Control Areas (ECAS), forbidden for the ships which do not respect the limitations.<br>Moreover, the studied solution may also find application in the field of minigeneration, for example for small power plants not reached by national grids.<br>The study will be divided into three phases. The first one is aimed at defining the plant architecture. During the second phase attention will be paid to the choice and optimization of the single components. Then, the steam turbine will be defined, with the intent of maximizing the machine efficiency and reducing dimension and weight, as well as guaranteeing the possibility of spilling steam for service. Generally speaking, the optimization of all of the components will be aimed at combining the fluid-dynamic requirements with a compact and light-weight design, as well as robustness and low-cost of the product.<br>The candidate should have a background in the field of Mechanical and/or Energy Engineering. The master thesis, or a previous working experience, in the frame of fluid machines and of energy systems for energy and propulsion represents a preferential title for the admission to the doctorate.<br><br>**Curriculum MATHEMATICAL ENGINEERING AND SIMULATION (CODICE 7300)**<br><br>**Project/scholarship No. 3: Study and development of the control platform for cooperative drone swarms MARS (Multiple Airdrones Response System).**<br><br>*Months abroad*: 4<br><br>*In cooperation with:*<br>- Inspire S.r.l.,<br>- FOS S.r.l.<br>- SOSIA<br><br>*Project/scholarship details:*<br><br>Drones represent technological progress in the field of automation and control. Within a few years, the unmanned aerial vehicle (UAV) joined our daily life thanks to the wide range of both military and civilian use. The use of drones in single configuration remains confined primarily within control, analysis, logistical support and supervision, while we do not have evidence of their direct use in collaborative environments designed to fulfill specific of highly complex tasks.<br>Despite the rapid evolution of this technology, there remain two major difficulties in their systematic use: the limited operating autonomy of 20-30 minutes and the difficulty of carrying out complex tasks with more devices simultaneously. The project concerns the study, development and testing of an innovative platform for the management and use of collaborative drone swarms called MARS (Multiple Airdrones Response System), which aims to overcome these limits and open new application areas in contexts where their use has not yet been hypothesized.<br>A central component in the study of the platform concerns both specific algorithms for the collaborative management of a variable number of drones, and the modeling and numerical simulation of possible application scenarios. Applications range from monitoring of fires, searching for missing, dislocation detection sensors in emergencies such as earthquakes, etc. The aim of the doctoral thesis is to achieve a prototype implementation and implementation tests. |

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| | The project is therefore by its nature strongly interdisciplinary. Although it is clear that a candidate can not possess skills in many different fields, we believe that important prerequisites are computer skills and/or knowledge in the field of industrial engineering, with a good propensity to experimentation in the laboratory and in the field. |
| **PhD FUNDING** | The annual gross amount of the grant, including social security expenses to be paid by the recipient, is € 16,500.00.<br>The amount of the doctoral grant shall be increased by 50% for an overall period of not more than 18 months, if the graduate student is authorized to by the teaching body to carry out research abroad.<br><br>Starting from the first year, each graduate student will have, besides the grant, a budget for research activities in Italy and abroad which will not be less than 10% of the grant. |
| **ADMISSION REQUIREMENTS** | |
| **COURSE ADMISSION** | Admission is subject to the passing of the selection tests and is conditioned by the positive outcome of the medical examinations, where required, that are carried out in health facilities and aimed at ascertaining the suitability for the specific task in accordance with D. Lgs. No. 81/08. |
| **REQUIRED QUALIFICATION** | Degree which has been conferred according to the rules and regulations in force prior to the reform of didactic freedom in universities, or a specialist/II level degree or an equivalent foreign academic qualification. |

| **SELECTION PROCESS** | |
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| **SELECTION COMMITTEE** | The committees are made up of at least 3 university professors for each course; they may be integrated by not more than 2 experts, who may also be foreign nationals, from public and private research institutions and structures. |
| **ADMISSION TEST VENUE** | Università degli studi di Genova, Department of Mechanical, Energetics, Management and Transport Engineering (Dipartimento di Ingegneria meccanica, energetica, gestionale e dei trasporti – DIME), sezione MASET, via Montallegro 1, Genova. |
| **TYPE OF ADMISSION TEST** | • Comparative assessment of the qualifications/publications.<br>• Written test (research project).<br>• The interview consists in the discussion of the written test (research project) and the description of the candidate's research area of interest, also on the basis of previous activities stated in his/her scientific-professional curriculum<br><br>The tests are focused on confirming the candidates' aptitude for scientific research. |
| **METHODS FOR INVITING THE CANDIDATES AND COMMUNICATING THE OUTCOMES OF THE TESTS** | The **examination schedule** is as follows:<br><br>• Evaluation of qualifications, curriculum and written test (research project): **23.7.2018, 10.00 am**<br><br>• Interview: **23.7.2018, 3.00 pm,** at Dipartimento di Ingegneria meccanica, energetica, gestionale e dei trasporti (DIME), Meeting room, MASET section.<br><br>**Candidates can use video conference mode; and, for identification purposes, the candidate must show the original document of which he has deposited a certified copy at the time of application.**<br><br>The **list of those admitted to the interview** will be affixed at the Dipartimento di Ingegneria meccanica, energetica, gestionale e dei trasporti (DIME) |

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| | The **final lists** shall be announced on **10th August 2018**, and will appear solely on:<br>• the noticeboard of the relevant research Departments/facilities for the research courses;<br>• the noticeboard of the University;<br>• on the Internet address https://unige.it/usg/it/dottorati-di-ricerca<br><br>No information whatsoever shall be posted to candidates' domicile. |
| **WRITTEN TEST** | The research project (10 pages maximum) has to be attached to the online application form, and it must concern one or more research Projects/grants highlighted in the section 'TRAINING PROJECT'.<br>The research project will be evaluated as practical test for the selection, together with the evaluation of the qualifications and the scientific-professional curriculum, in order to identify the candidate's aptitude for scientific research in terms of originality, feasibility, clarity in the definition of objectives, methods and expected results. |
| **INTERVIEW** | The interview consists in the discussion of the written test (research project) and the description of the candidate's research area of interest, also on the basis of previous activities stated in his/her scientific-professional curriculum<br>During the interview, the candidate shall also prove his/her proficiency in the following foreign language: English.<br>Non-Italian candidates will also have to prove knowledge of the Italian language. |
| **PERCENTAGE VALUES OF TO EACH TEST** | To each candidate can be assigned a maximum of 150 points, divided as follows:<br>- comparative assessment of the qualifications/publications: max score 30/30, pass mark 20/30.<br>- Written test (research project):max score 60/60, pass mark 40/60.<br>- Interview: max score 60/60, pass mark 40/60.<br><br>The final ranking will be drawn up by adding the scores assigned in comparative assessment, written test and interview.<br>Candidates will be selected in compliance with the principles of equal opportunities. |
| **ADDITIONAL CRITERIA FOR ADMISSION TO THE COURSE** | In the case of equal grades, the evaluation of candidates' incomes prevails for the assignation of grants, as per D.P.C.M. 9 April 2001 |


## PROJECT CO-FINANCED BY THE EUROPEAN UNION

**Regional Operational Program for Liguria - European Social Fund 2014-2020**