UNIVERSITÀ DEGLI STUDI GUGLIELMO MARCONI



CALL FOR ADMISSION TO PHD PROGRAMME OF 38 CYCLE

A.Y. 2022-2023

ANNEX 1 TO R.D. 11 JULY 2022, n. 1

PHD PROGRAMME I		GINEERIN INABILIT	G SCIENCES FOR INNOVATION AND Y	
ADMINISTRATIVE HEADQUARTERS	Università degli Studi "Guglielmo Marconi"			
PROPOSING STRUCTURE	DEPARTMENT OF EN	NGINEERI	NG	
SCIENTIFIC AREAS	01 - Mathematical Sciences 02 - Physical Sciences 08 - Civil Engineering and Architecture 09 - Industrial and Information Engineering		SS.SS.DD:FIS / 01 - Experimental Physics;ICAR / 07 - Geotechnics;ICAR / 09 - Construction Technique;ICAR / 20 - Technique and Planning; UrbanplanningING-IND / 08 - Fluid Machines;ING-IND / 09 - Systems for energy and theenvironment;ING-IND / 11 - Environmental TechnicalPhysics;ING-IND / 12 - Mechanical and ThermalMeasurements;ING-IND / 14- Mechanical Design andMachine Construction;ING-INF / 03 - Telecommunications;ING-INF / 05- Information ProcessingSystems;MAT / 05 Mathematical AnalysisMAT / 07 Mathematical Physics	
SCIENTIFIC COORDINATOR	Prof. Fabio Orecchini , Full Professor of Energy and Environmental Systems at the "Guglielmo Marconi" University			
DURATION OF THE COURSE	3 Years			
	WITH SCHOLARSHIP	n. 4	Funded by the University	
POSITIONS		n. 4	Financed with PNRR funds pursuant to D.M. 9 April 2022, n. 351. It should be noted that in the event that the MUR does not pay the funding for the coverage of the scholarships, it will not proceed with the disbursement of the same, with consequent forfeiture of the positions assigned to the winning candidates. The winners will therefore be able to enroll only after this ministerial verification.	



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	WITHOUT SCHOLARSHIP	n. 2	The aforementioned places will be assigned, in compliance with the order of the ranking, to candidates aspiring to the scholarship, still eligible in the relative ranking, but with a lower score than the one with which the last scholarship was awarded
	TOTAL SEATS	n. 10	
	SUPERNUMERARY	Professors, ✓ the ✓ the students ✓ the students ✓ the	utcome of the competition, the Board of assessed the actual compatibility with: University structures; e ability of the Academic Board to follow PhD dents in carrying out training and research ivities; e possible performance of work by PhD dents,
		<u>can admit</u> number of	<u>in excess</u> , without a scholarship, an adequate Candidates who are eligible in the ranking, and to the following situations:
		a) recipient Law no. 24	ts of research grants pursuant to Article 22 of 0;
		b) foreign c of scholars	citizens who do not compete for the assignment hips;
		leave provi duration of extraordina the needs Law no. 47 grants and	es of Public Administrations, who can enjoy the ded for by collective bargaining for the normal f the course or, for employees under public law, ary leave for study purposes, compatibly with of the administration, pursuant to article 2 of 6 and subsequent amendments, with or without unless explicitly waived, only if they are enrolled t time in a PhD course, regardless of the subject
		· 1	ts of a personal gross annual income equal to or an that of the scholarship, currently set at \notin
		scholarship national ar research gr European o	s of non-European Union states holding os awarded by the Italian government or nd international institutions and holders of cants funded by the European Union or other or international scientific institution;
		,	of Apprenticeship contracts for the Research who do not fall within the positions ;
		of research internation submitted a within the	ho, having already been selected in the context n programs of the European Union or other al cooperation programs, even if they have not an application for admission to the competition terms established by the Announcement, apply nent in the PhD. Enrollment is in any case



and the second s					
		prior approv which, in t qualification the qualification h) those w universities University supervision. a) The	ho are enrolled in and who have sign for the issue of th e University Administr	ofessors of the I ates in possessi- cides on the suit PhD courses a ned agreements ne title of PhI ation will be respo	Doctorate ion of a cability of t foreign with the D in co- onsible
			communicating to the registration	se entitled to prod	ceed with
	Admission to the PhD a) ASSESSMEN The categories of qual subjects covered by the Tito	program include T OF THE SE ifications that we e PhD Program,	es: CURITIES (max. 1 rill be assessed, as lo	ng as they perta	in to the
	1 Thesis. If the cancer possession and ha	s indicated	Relating to the "Re and "Scientific Are		2
	 more degrees in the application, he must indicate the qualification to be taken into consideration. For undergraduates, relevance 		Course Partially relevant Not Relevant		1
EXAMINATIONS	will be assessed we the exams taken o date of this call (m	n the expiry			
	2 Graduation mark. candidate is in pos has indicated more application, he mu qualification to be	ssession and e degrees in the ast indicate the	105 (average exams27)	110 cum laude (average exams30)	2
	consideration. For undergraduates, th calculated on the average of the grad	r ne grade will be weighted des of all the	102 (average exams25)	104 (average exams 26.99)	1
	exams taken at the this call (max. 2 po	1 1	<102 (average exar	ns<25)	0
	3 Academic and stu- qualifications: 1st Masters, Postgrad	and 2nd level	Relating to the "Re and "Scientific Are Course		2



<u> </u>			
	Specialization diplomas, Awards, etc. If the candidate is in possession and has indicated several qualifications in the application, he must indicate the qualification to be taken into consideration (max. 2 punti).	Partially relevant Not relevant	1 0
	4 Documented work and research activity at possibly qualified	Relevant and Qualified Entity	5
	entities (universities, research	Relevant and unqualified entity.	4
	centers, qualified research and development centers of companies and institutions). If	Partially relevant and qualified entity	3
	the candidate is in possession and has indicated in the	Partially relevant and qualified entity	2
	application different work and research activities, he must indicate the qualification to be taken into consideration (max. 5 punti).	Not relevant and qualified entity	1
		Not relevant and unqualified body	0
	national and international conferences and congresses. If	Relating to the "Research Areas" and "Scientific Areas" of the PhD Course	2
	the candidate is in possession and has indicated in the	Partially relevant	1
	application several participations in conferences, he must indicate the qualification to be taken into consideration (max. 2 punti).	Not relevant	0
	5 Publications possibly in bibliometric journals (ISI	Relevant and bibliometric journal	7
possession and has indica more publications in the application, he must indic qualification to be taken i	SCOPUS). If the candidate is in possession and has indicated	Partially relevant and bibliometric journal	5
	more publications in the application, he must indicate the qualification to be taken into	Relevant and non-bibliometric journal	4
	consideration (max. 7 punti).	Partially relevant and non- bibliometric journal	2
		Not relevant and bibliometric journal	1



	Not relevant and non-bibliometric	0
	journal	

b) RESEARCH PROJECT (max 40 points) must:

- ✓ relate to the research areas listed in the "Research Areas" section and on the issues related to one or more of the SSDs listed in the "Scientific Areas" section of this sheet;
- ✓ be drawn up in Italian or English
- ✓ contain a maximum of 20,000 characters (including spaces)
- \checkmark be accompanied by bibliographical references
- ✓ divided into the following sections:
 1. Name of the PhD course and cycle, Name of the Candidate, Title of the Research

2. State of the art, Methodological framework and research impact accompanied by a bibliography with clear indications of the objectives in relation to progress compared to the state of the art

3. Summary of the three-year research program with indication of the theoretical / experimental methodologies, of the analysis programs / apparatuses, of the activities and of the relative timing.

4. Expected results in the 3 years with evidence of progress with respect to the state of the art and the impact on research and society.

5. Bibliographic references

The research project consists in the development of a document that can evaluate the propensity for research and its ability to independently organize the different phases of the project. The evaluation criteria are:

	Criterion	Da	Α	
1	Relevance to the	0	10	
	"Research Areas"			
	and "Scientific			
	Areas" of the PhD			
	Course			
2	Knowledge of the	0	10	
	State of the Art /			
	Bibliography			
3	Clarity and	0	10	
	completeness of			
	the presentation of			
	the objectives,			
	methodologies and			
	potential results			
4	Progress with	0	10	
	respect to the state			
	of the art and the			
	impact of research			

c) ORAL EXAM

The oral exam will focus on the discussion of the qualifications and the research project and will be aimed at ascertaining:



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	 ✓ the ability to pr ✓ the attitude to re 	nglish or alternatively of an research project.	
	Criterion	Da	Α
	1 Knowledge "Research	e of the 0 Areas" and the Areas" of the	10
	2 Clarity and of the pres	d completeness 0 entation of your and research	10
	3 Attitude to advanceme	o research and 0 ent of the state and ability to work ntly and in	10
	4 Ability	to read / 0 / expose a text n language	10
SCORES ATTRIBUTABLE TO THE INDIVIDUAL TESTS	 The Commission has a total of 100 points, distributed as follows: ✓ Research project: 40/60 ✓ Titles and publications: 20/60; Oral exam: up to 40 points. Only candidates who achieved a score of not less than 40/60 in the evaluation of the research project and of publications, will be admitted to the oral exam; the oral exam is considered passed if the candidate has achieved a vote of not less than 25/40; at the end of the oral exam, the Commission prepares the general merit ranking by adding for each candidate the score reported in the individual tests; Candidates with a minimum overall score of 65/100 will be declared eligible for the Competition. 		
CALENDAR OF EXAMINATIONS	The date, time and methods of conducting the oral exam will be made known <u>at least</u> <u>7 days in advance</u> through the publication of a suitable notice in the "Calls and Competitions" and "Research Doctorates" Sections of the University website. By means of this notice, the fulfillment of the disclosure of the documents is deemed to be fulfilled, <u>therefore such publication will be valid in all respects as notification</u> <u>of the meeting</u> . Candidates for the admission competition are therefore required to show up on the day and at the time indicated without waiting for further personal communications on the matter, with a valid identity document. The absence of the candidate on the scheduled day and time will be considered as a formal renunciation of participation in the Competition.		



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COURSE ENROLLMENT FEE	Candidates declared suitable and admitted without a scholarship and candidates admitted to the Course as supernumeraries, are required, upon enrollment, to pay an annual contribution of € 5,000.00 (five thousand euros / 00) . The payment of the regional tax for the right to university study of the Lazio Region is added and the recipients of the scholarship are also required to pay the regional tax for the right to study. The contributions paid will not be returned for any reason.
TRAINING OBJECTIVES	The Doctorate intends to promote the preparation of researchers and professionals capable of being the fulcrum of innovation for industry and society, of contributing to the development of new knowledge, of managing original research and development projects, autonomously completing programs of strategic importance. To achieve this goal, the Course promotes and supports a strong integration between basic and applied research with a high degree of interdisciplinarity, with particular attention both towards the productive realities active in this sector (see the various collaborations in the various research projects of the members of the college such as the Maire Tecnimont group, coordinator of the AIRE project, the companies ICI Caldaie, Calida Technologies, Marion Technologies partner of the GICO project, the SNAM companies and Rampini partner of the LAZE project, the companies ICI Caldaie, Calida Technologies, Marion Technologies partner of the GICO project, the SNAM companies and Rampini partner of the LIAE project, etc.) and towards research by means of possible spin-offs that can be developed within the framework of the doctorate itself, thus creating new productive realities currently non-existent (using not only the Marconi laboratory, as the operational structure of this doctorate, but also the recent Marconi Innovation Hub center and the CERITED - Center for Ecological and Digital Transition and the structures of other bodies with which USGM or directly the Department of Engineering Skills with those of a physical and mathematical nature and those of civil engineering and architecture, in order to promote a path capable of training self-sufficient people, both in the use of tools and methods for research, and the ability to transfer these high skills in the field of business innovation. In particular, the doctorate intends to be the tool for the advanced training of professionals able to move within future technological scenarios in various contexts (Systems for energy and the environment; Environmenta



associated with this activity and the personal growth of the eventual winner of this doctorate.

PhD in PHYSICAL SCIENCES The AND ENGINEERING FOR INNOVATION AND SUSTAINABILITY carries out advanced training and scientific research activities related to 3 areas: INDUSTRIAL AND INFORMATION ENGINEERING, CIVIL AND ARCHITECTURE ENGINEERING and PHYSICAL AND MATHEMATICAL SCIENCES covered by the scientific sectors of the members of the college: energy, thermomechanical and nuclear engineering, mechanical, aerospace and naval engineering, electrical, electronic and measurement engineering, telecommunications and electromagnetic fields engineering, physics and mathematics, urban and territorial planning and design, structural and geotechnical engineering. In fact, research in industrial and information engineering requires more and more advanced skills in physical and mathematical sciences and, as regards the application in the territory, in Civil Engineering and Architecture. Examples are research on the development and integration of renewable sources, hydrogen and fuel cell systems, measurement, control, automation and management systems, advanced geotechnical and structural analysis, urban and landscape analysis and planning in general. / design / management of innovative and sustainable systems, which can be found in the publications, projects, patents and awards of the members of the doctoral college and in the related activities carried out by the Department of Engineering Sciences (DSI, department of this doctorate) and by the University degli Studi Guglielmo Marconi, both experimentally, through the laboratory with the test rig of electrochemical processes (e.g. batteries / supercapacitors / fuel cells / electrolysers) and thermochemical processes (e.g. conditioning, pyrolysis, gasification), and simulatively, through the server of the DSI to which teachers, researchers and students have access equipped with various pros grams (e.g. ASPEN, SIMAPRO). **RESEARCH AREAS** Therefore, the PhD Program has training and research contents in strategic topics for high-level innovation such as: o Evaluation, design, measurement, control, implementation, optimization, management and decommissioning (through simulation of steady-state and transient behavior and performance and experimental tests) of materials, processes, components, machines, plants and innovative systems for production, conversion / transformation, storage, transport, distribution and use of energy in the civil and industrial sectors, with particular reference to production from local and renewable resources, distributed generation, innovative energy carriers, buildings and industrial and agricultural production and environmental protection such as renewable energy plants with the use of fuel cells (for example see the European projects UNIFHY, BLAZE, GICO, SO-FREE, LIFE3H focused on production from waste or from renewables, storage and distribution of hydrogen and its use in stationary systems and for mobility with fuel cells) especially through the development of fashions lli (black box, one, two and three dimensional) theoretical (matter and energy balances, thermodynamic, kinetic, fluid dynamic models and their mix) and / or experimental (and theoreticalexperimental mix) through software (e.g. MATLAB, ASPEN, SIMAPRO, FLUENT) and test benches / test rigs and pilot plants (e.g. batteries / supercapacitors / fuel cells / electrolysers, sorbents / catalysts, combustion / pyrolysis / gasification through programmable resistive power supplies and banks, EIS, GC, MS, TGA / DSC, ovens, etc. present in the Marconi laboratory and other laboratory instruments and pilot plants present in the bodies with which Marconi has collaboration agreements) and the study of the physical,

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chemical and thermal properties of materials including techniques of additive manufacturing; eco-design and green design and biomaterials and nanomaterials;

- Energy systems for mobility: innovative power trains, HEV (Hybrid Electric Vehicle), BEV (Battery Electric Vehicle), FCEV (Fuel Cell Electric Vehicle); Driving cycles and energy-emission analysis of the use in real conditions (on the road) of vehicles; Research and development of technologies (including power electronic systems) and innovative solutions (including those relating to the management of the electricity grid) for motor vehicles and for industrial mobility, communication and energy systems; Self-driving cars, V2I (Vehicle to Infrastructure) and V2V (Vehicle to Vehicle); smart mobility;
 - Energy and environmental certification of innovative materials, processes, components, machines, plants and systems including buildings; Study of the lighting and acoustic problems of confined and non-confined environments; Research and development of new methodologies for the thermohygrometric well-being of confined environments;
 - Energy and environmental planning, efficient use of energy in the industrial, tertiary and residential sectors and analysis of needs, local production from renewable sources, energy import / export and related emissions in different atmospheres with particular reference to the application of technologies and systems described in the previous points and the environmental impact of energy systems including LCA (Life Cycle Assessment), LCC (Life Cycle Cost), S-LCA (Social Life Cycle Analysis);
 - Reverse engineering, rapid prototyping, integrated design techniques (Desing for X, DESS), Lean Six Sigma, accelerated tests for decay prediction; predictive maintenance; industrial automation and home automation; quality and safety;
 - Evaluation, design, measurement, control, implementation, optimization, management and decommissioning of IT systems and networks; Next generation IT architectures; Cloud and distributed systems; Software engineering; Reliability and safety; Databases and knowledge bases; Innovative architectures for the web; Natural language processing; Machine learning; Distributed databases; Artificial intelligence; Wireless telecommunication systems and new generation networks; Satellite systems; advanced land, air and satellite traffic control systems;
 - o Smart Grids, Smart Cities and Social Innovation;
 - Government of the territory, urban planning and land use; Seismic risk mitigation of the territory and the built, Basic concepts and approaches related to the identification of the seismic risk for the territory and the built, Consolidation and support of the land, Survey techniques for monitoring the territory, Seismic vulnerability of buildings and techniques of intervention, instruments of legislation on the evaluation and planning of interventions for the mitigation of the seismic risk of the territory and the built.
 - Theoretical and applicative aspects of physics and mathematics such as High Energy Physics and related experimental equipment; Mathematical Physics and applications of energy and engineering interest; Theoretical physics of fundamental interactions and applications to the development of new technologies.
 - Innovative and sustainable technologies for frontal and distance education systems.

The research areas listed above find direct, transversal and / or indirect confirmation in almost all the strategic policies of the PNRR. In particular, the research area of the



doctorate for projects carried out with a scholarship pursuant to Ministerial Decree n. 351 of 9 April 2022 is mainly related to mission 2 green revolution and ecological transition (covering all the components of this measure: M2C1: sustainable agriculture and circular economy; M2C2: renewable energy, hydrogen, grid and sustainable mobility; M2C3: efficiency energy and building requalification; M2C4: protection of the territory and of the water resource); but also in mission 1 digitization, innovation, competitiveness, culture and tourism (main focus is on the M1C2 component: digitization, innovation and competitiveness in the production system), in mission 3 infrastructures for sustainable mobility (covering all the components of this measure M3C1: investments in the railway network M3C2: intermodality and integrated logistics), in mission 4 Education and Research (covering M4C1 for example with the development of the Marconi laboratory remotely and for long term test, see European project RE-OPEN and M4C2 for example with the development of patents and spinoffs). Furthermore, some strong points of connection are found in the general themes of "Smart growth. Sustainable and inclusive "of" Social and Territorial Cohesion ", of" Health and economic, social and institutional resilience ", of the" Green Transaction ". Particular attention in the doctorate will be given (in full coherence with the objectives of the NRP which dedicates numerous investments to the sector) to the theme of "urban regeneration", understood as a tool aimed at "reducing situations of marginalization and social degradation as well as improving quality urban decorum as well as the social and environmental context ", and to the definition of tools (such as Integrated Urban Plans) that can provide for" a participatory urban planning, with the aim of transforming vulnerable territories into smart and sustainable cities, limiting the consumption of building land "(cit. PNRR). In general, the doctorate is perfectly in line with the Italian, European and international objectives for 2030 and 2050 for a progressive and complete decarbonisation. These objectives require the development of innovative and sustainable materials, processes, components, machines, plants and systems in particular in the energy sector both in terms of environmental compatibility, energy security and competitiveness. Hence the need, and the enormous potential, to invest in the development of the entire value chain of new technologies and new vectors such as hydrogen; processes that start from research, innovation, technology transfer and higher education, and embrace the whole field of production (e.g. green hydrogen, electrolysers, fuel cells), infrastructures (e.g. multi-platform stations, hydrogen pipelines, purification sites and pressurization and storage) and uses (e.g. sustainable mobility, hard to abate sectors and power plants, grid stabilization, civil and industrial uses). The doctorate is divided into training processes characterized by the use of a combination of disciplinary and interdisciplinary methodological approaches aimed at guaranteeing the development of research in the areas described in the previous point, bearing in mind the state of the art and innovations at national, European and

EDUCATIONAL AND RESEARCH METHODOLOGY

international level. . The working methodology is characterized by a strong interaction between teachers and students / doctoral students and also involves the involvement of figures, laboratories and plants belonging to the entities with which Marconi has joint research projects or collaboration agreements.

To increase the skills of doctoral students, the course includes an offer of training programs which, based on the specific scientific skills of the components of the college, aims to define an engineering profile characterized by a high degree of specialization and a critical understanding of current and innovative technologies both in the national context and in the European and international one.



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	The related didactic offer, divided into common activities and activities of a specialized nature, therefore provides for 1) specific training activities of interdisciplinary content and in particular various ad hoc teaching modules structured in cycles of frontal and interactive lessons progressively open to direct participation of PhD students with final assessment (e.g. Linguistic and IT specialization, Management, enhancement and ethics of research, Laboratory of Physics, Chemistry and Mathematics) and 2) specialization courses on topics related to the objectives. training courses of the individual PhD student (e.g. Laboratory of Innovative Technologies for Sustainable Energy Systems, Urban Planning, Industry 4.0, Modern Physics Meetings, Use of test rigs and equipment present in Marconi such as the test rig of batteries / supercapacitors / fuel cells / electrolysers , sorbents / catalysts, combustion / pyrolysis / gasification, use of programmable resistive power supplies and banks, EIS, GC, MS, TGA / DSC, ovens, etc.). These activities are complemented by participation in the main seminars, conventions, conferences and study days in the sector.
EMPLOYMENT OPPORTUNITIES	The objective of the PhD is to train experts who, thanks to the skills acquired, are able to guide the development of process and product innovation in the various industrial, civil and research fields, such as the development of efficient energy systems and sustainable from renewable sources and fuel cells. In this sense, future PhDs, in possession of both specialized technical skills and operational skills for managing the development of innovation, can be included, for example, as Innovation Manager, Energy Manager, Fleet Manager, Product Manager or at internal departments of Research and Development, Design, Production, Application and Management, of public and / or private entities, for, for example, the design or management of energy production, distribution, storage and use plants; control of the safety of the plants and analysis and monitoring of the environmental impact of the same; rationalization and optimization of the use of resources, assessment of the seismic risk of the territory and buildings and the design of specific interventions. Furthermore, thanks to the disciplines inherent to the governance of the territory, future doctors will have skills capable of guaranteeing the possession of the cognitive and cognitive foundations of a decision-maker in the public sector and, in general, in the management of urban transformations. They will be able to design and implement, in compliance with the existing regulatory framework, the administrative and management systems that best meet the needs of its positive functionality. In order to provide a multidisciplinary preparation, and thanks to the combination industries, companies and bodies for the production and conversion of energy and for the mobility of people and goods, businesses plant engineering, automation industries, industries, manufacturing companies in general and in the context of services, in the Public Administration and in local authorities. Furthermore, in the field of technological innovation in Industrial and Information Engineering



	the creation of patents, new companies and academic spin-offs, especially through the Innovation hub. of Marconi
RESPONSIBLE OFFICE	PHD OFFICE UNIVERSITA' DEGLI STUDI "GUGLIELMO MARCONI" Via Plinio, 44 00193 – ROME Tel. 06/37725205 PEC: dottoratidiricerca@pecunimarconi.it e-mail: dottoratidiricerca@unimarconi.it web. www.unimarconi.it
DEADLINE FOR SUBMISSION OF APPLICATIONS	Applications must be received, under penalty of forfeiture, within the peremptory term of 30 days starting from the day following the publication of the relevant notice in the Gazzetta Ufficiale - IV Special Series -, according to the procedure indicated in Article 4 of the call.