DOCTOR OF PHILOSOPHY (PHD) PROGRAMME IN *"Information Technologies for Engineering"*

Coordinator: Prof Massimiliano Di Penta (dipenta@unisannio.it)

Interested applicants are encouraged to contact the coordinator for information on the curricula and the disciplinary areas

FACULTY & ADMINISTRATION	Dipartimento di Ingegneria [Department of Engineering]
DURATION	3 years (36 Months)
CURRICULA	**a) Information Technology** **b) Energy and Environment**
Scientific/Academic Disciplinary Fields (SSD)	01/A - MATHS 09/E - ELECTRICAL ENGINEERING, ELECTRONICS AND MEASURES 09/F –TELECOMMUNICATIONS AND ELECTROMAGNETIC FIELDS ENGINEERING 09/G - SYSTEMS ENGINEERING AND BIOENGINEERING 09/H - COMPUTER SCIENCE AND ENGINEERING 08/A – INFRASTRUCTURE AND TERRITORIAL ENGINEERING 08/B - STRUCTURAL AND GEOTECHNICAL ENGINEERING 08/F - PLANNING AND URBAN AND TERRITORIAL DESIGN 09/B - MANUFACTURING, PLANT AND MANAGEMENT ENGINEERING 09/C - ENERGY, THERMO-MECHANICAL AND NUCLEAR ENGINEERING 09/D - CHEMICAL AND MATERIALS ENGINEERING

AVAILABLE POSITIONS: 15 (fifteen)

Positions without Scholarship (3)	Topic relevant to the curriculum chosen by the candidate	3 Positions without Scholarship	
Reserved Positions for holders of scholarship from foreign countries (2)	Topic relevant to the curriculum chosen by the candidate	**2 positions**	*To apply to these positions, the applicant must declare to possess the documentation concerning the achieved scholarship.*
Position with scholarship funded by Ingeo Progetti S.r.l. *(if the institution does not provide financing, the scholarship position will not be activated)*	**Topic:** Seismic and Hydrogeological Risk **Abstract:** The research doctorate will have as its theme "Environmental geotechnics: seismic risk and hydrogeological risk". Environmental geotechnics is a vast and absolutely current topic; the research we intend to carry out will focus in particular on the two main types of environmental hazards, seismic and hydrogeological, with the aim of evaluating the effects induced on civil works, from constructions to infrastructure, to quantify the risks. As regards seismic hazard, the role of vertical accelerations will be explored in depth; vertical accelerations are especially significant in near-fault areas, i.e. in the areas surrounding active faults, a typical situation in the entire Italian Apennine region. We hope to be able to carry out, in this context, a specific high-level experimental activity. As regards hydrogeological hazard, the topic of landslides in clayey soils, typical of the Apennine areas, and their interference especially with infrastructure works will be explored in depth. **Funding organization:** Ingeo Progetti S.r.l.	**1 position**	Curriculum: Energy and Environment
Position with scholarship funded by Duplomatic MS S.p.A. *(if the institution does not provide financing, the scholarship position will not be activated)*	**Topic:** Development of innovative numerical modeling techniques for the design and optimization of pumps **Abstract:** Pumps, both centrifugal and volumetric, are widely used in many applications. In this Ph.D. program, numerical techniques will be developed to study pumps used in many applications. In particular, the research will address to the design and optimization of pumps for fluid power (volumetric pumps) and aeronautical applications with hydrogen (both volumetric and centrifugal). The numerical modelling techniques will be mainly focused on the fluid dynamic shape optimization; therefore, both 3D CFD and lumped parameters will be introduced to optimize the design, improving the	**1 position**	Curriculum: Energy and Environment

	performance and reducing the emitted noise. In some cases, structural optimization will also be included. **Funding organization:** Duplomatic MS S.p.A.		
Position with scholarship funded by Engineering Ingegneria Informatica S.p.A. *(if the institution does not provide financing, the scholarship position will not be activated)*	**Topic:** IT infrastructures for urban digital twins **Abstract:** An urban digital twin is the virtual representation of a (complex) system of the urban context in bi-causal connection with the physical system it represents. Its implementation, made possible by the spread of technologies such as the Internet of Things (IoT), the development of artificial intelligence (AI) techniques, such as Machine/Deep Learning, and the availability of hardware for high-performance, low-energy in-memory computing, enables new management models of urban services from a smart city perspective. The doctoral project aims to (a) develop AI and generative AI techniques to support the implementation of digital twins and digital twin systems that consider the need to adapt to the changing contextual conditions of the modeled physical environment and energy consumption constraints, and (b) study their impact on the design of hosting IT infrastructures. **Funding organization:** Engineering Ingegneria Informatica S.p.A.	**1 position**	Curriculum: Information Technology
Position with scholarship funded by Agenzia Spaziale Italiana *(if the institution does not provide financing, the scholarship position will not be activated)*	**Topic:** Lightweight on-board AI-based processing for near real-time response to cascade risks affecting anthropic areas. **Abstract:** The proposed research activity is aimed at disaster management in reference to cascading events in quick and effective terms, and in particular the extraction of exposure, vulnerability and damage maps for critical infrastructure (e.g., railway networks, bridges, roads, dams, etc.) within urban areas and adjacent areas of urban-rural transition, taking into account their interdependence, disposition with respect to urban construction and interaction and impact with respect to anthropic presence. **Funding organization:** Agenzia Spaziale Italiana. Scholarship funded according to CdA n. 67/2023, 20 March 2023."	**1 position**	Curriculum: Information Technology

Positions with scholarship funded under the PNRR DM 629/2024 (1 position)
(https://www.mur.gov.it/it/atti-e-normativa/decreto-ministeriale-n-629-del-24-04-2024)

Positions with scholarship funded under the PNRR DM 629/2024 *"Innovative PhD for Public Administration and Cultural Heritage"*	Scholarship n. 1 – **Topic (Public Administration):** Thermo-economic analysis of Public Administration actions to promote energy transition **Abstract:** Public Administrations have a specific role in the energy transition to achieve the ambitious goals of diffusion of renewable sources, improvement in energy efficiency and reduction in greenhouse gas emissions. PAs must connote themselves as "symbolic" places where good practices in the energy-environmental field are applied, sharing information on the most efficient technologies and removing constraints for introducing new plants. It is intended to systematically analyse the multiple potentials of PAs, also with reference to the promotion of innovative management scenarios of self-consumption and energy sharing of non-fossil energy carriers. Simulation and experimental activities will make it possible to identify strategies aimed at reducing energy consumption (primary and final), reducing the cost of energy carriers, containing greenhouse gas emissions, and thus enhancing social spillovers, such as direct and indirect employment. **Curriculum:** Energy and environment	**1 position with scholarship**	*For this type of position it is mandatory to carry out periods of study and research abroad and in companies/governmental organizations* *https://www.mur.gov.it/it/atti-e-normativa/decreto-ministeriale-n-629-del-24-04-2024*

Positions with scholarship funded under the PNRR co-financed by companies DM 630/2024 *"Introduction of innovative PhD that respond to the innovation needs of companies and promote the hiring of researchers from companies"*	**Scholarship n. 1 - Topic:** Development of Innovative Models for the Design and Management of Pressurized Water Systems **Abstract:** Pressurized water systems can be used for potable, irrigation, or industrial purposes. Proper design, both of new works and of upgrading interventions, and optimal management of existing works allow for the safeguarding of the most precious natural resource and the reduction of costs for infrastructure managers. To achieve this goal, it is necessary to develop mathematical models that enable efficient and sustainable management of water resources. These innovative models must allow for the schematic representation of water demand based on users' needs (potable purposes), soil moisture levels (irrigation purposes), and production demands (industrial purposes). Probabilistic based models can enable the integration of this schematic representation with a view to accurate forecasting and optimal management. **Co-Funding Organization:** Offtec S.r.l. **Curriculum:** Energy and Environment	**1 position with scholarship**	*For type of position it is mandatory to carry out periods of study and research abroad and in companies* https://www.mur.gov.it/it/atti-e-normativa/decreto-ministeriale-n-630-del-24-04-2024
	Scholarship n. 2 - Topic: Enabling technologies and methodologies for the massive integration of renewable power generators in electrical power systems **Abstract:** The strategic goal of modern environmental policies is to support the sustainable development of the energy sector by increasing energy efficiency, and promoting renewable energy sources. In this context, renewable power generators are considered as the most promising enabling technology for electrical power system decarbonization. To improve the integration of these generators into existing electrical grids, the research will analyze technological and methodological solutions aimed at increasing the efficiency and flexibility of renewable generation systems. This will be achieved through predictive detection of abnormal operating conditions, coordinated management of integrated storage systems, forecasting generated power profiles, and controlling interface systems with the electrical grid to provide ancillary grid services. **Co-Funding Organization:** New Solution Enterprise S.r.l. **Curriculum:** Energy and Environment	**1 position with scholarship**	
	Scholarship n. 3 - Topic: Infrastructure and environment monitoring with advanced data processing techniques. **Abstract:** The use of satellite data and their use in combination with "in situ" data and other remote sensing data has allowed the development of systems capable of monitoring	**1 position with scholarship**	

	critical structures and infrastructures and the environment in order to efficiently and effectively manage the territory, in support of Authorities and Decision makers. The research activities will focus on the study of structures and infrastructure (such as damps, railways, roads, etc.) and the environment (land use, coastlines, sea state, water pollution, air, etc.) and the analysis of Artificial Intelligence (AI) models for the realization of systems to support end users (public or private). Web prototypes are planned to facilitate monitoring and control of areas of interest. **Co-Funding Organization:** Intelligentia S.r.l. **Curriculum:** Information Technology	
	Scholarship n. 4 - Topic: Advanced data analysis techniques with Deep Learning for industrial applications **Abstract:** Data analysis techniques and related software tools have long found countless applications in the field of information and communication technology (ICT); to date, their application in the context of more traditional industrial scenarios is still limited. Industrial applications can benefit significantly from the use of data analysis techniques and, more recently, artificial intelligence models based on machine and deep learning. As demonstrated by the consolidated practices in the ICT area, the identification of trends, the characterization of the nominal operating state and the detection of anomalies can contribute to anticipating failures and intrusions of IT systems. The doctoral scholarship involves the study, definition and experimentation of innovative analysis and deep learning techniques of field data to improve the detection and management of computer anomalies and incidents in the industrial sector. **Co-Funding Organization:** Intelligentia S.r.l. **Curriculum:** Information Technology	**1 position with scholarship**
	Scholarship n. 5- Topic: Computer Vision for Mobile Robotics **Abstract:** The research project focuses on autonomous mobile robotic application, that is a four legged robot equipped with 6 degrees of freedom robotic arm and gripper; the PhD student will investigate on methods and techniques to detect a target object in the robot space using on board cameras and to plan on the fly the terminal robotic arm mission to complete the target object manipulation (pick, carry, place or touch in place). **Co-Funding Organization:** Mosaico Monitoraggio Integrato S.r.l. **Curriculum:** Information Technology	**1 position with scholarship**

Programme Entry Requirements	Italian second level specialization degree ("laurea specialistica") or Italian second level (Master equivalent) graduate degree ("laurea magistrale") in the following classes LM-4 Architettura e ingegneria edile-architettura LM-6 Biologia LM-7 Biotecnologie agrarie LM-8 Biotecnologie industriali LM-9 Biotecnologie mediche, veterinarie e farmaceutiche LM-17 Fisica LM-18 Informatica LM-20 Ingegneria aerospaziale e astronautica LM-21 Ingegneria biomedica LM-22 Ingegneria chimica LM-23 Ingegneria civile LM-24 Ingegneria dei sistemi edilizi LM-25 Ingegneria dell'automazione LM-26 Ingegneria della sicurezza LM-27 Ingegneria delle telecomunicazioni LM-28 Ingegneria elettrica LM-29 Ingegneria elettronica LM-30 Ingegneria energetica e nucleare LM-31 Ingegneria gestionale LM-32 Ingegneria informatica LM-33 Ingegneria meccanica LM-34 Ingegneria navale LM-35 Ingegneria per l'ambiente e il territorio LM-40 Matematica LM-44 Modellistica matematico-fisica per l'ingegneria LM-53 Scienza e ingegneria dei materiali LM-54 Scienze chimiche LM-66 Sicurezza informatica LM-91 Tecniche e metodi per la società dell'informazione 4/S (specialistiche in architettura e ingegneria edile) 20/S (specialistiche in fisica) 23/S (specialistiche in informatica) 25/S (specialistiche in ingegneria aerospaziale e astronautica) 26/S (specialistiche in ingegneria biomedica) 27/S (specialistiche in ingegneria chimica) 28/S (specialistiche in ingegneria civile) 29/S (specialistiche in ingegneria dell'automazione) 30/S (specialistiche in ingegneria delle telecomunicazioni) 31/S (specialistiche in ingegneria elettrica) 32/S (specialistiche in ingegneria elettronica) 33/S (specialistiche in ingegneria energetica e nucleare) 34/S (specialistiche in ingegneria gestionale) 35/S (specialistiche in ingegneria informatica) 36/S (specialistiche in ingegneria meccanica) 37/S (specialistiche in ingegneria navale) 38/S (specialistiche in ingegneria per l'ambiente e il territorio) 45/S (specialistiche in matematica) 50/S (specialistiche in modellistica matematico-fisica per l'ingegneria) 61/S (specialistiche in scienza e ingegneria dei materiali) 62/S (specialistiche in scienze chimiche) 100/S (specialistiche in tecniche e metodi per la società dell'informazione) Italian graduate degree obtained under the system/laws prior to Min Decree 509/99 and equivalent to the classes specified above.

		For students graduated in foreign Universities, the following (or equivalent) degrees are considered: Master degree or equivalent degree in Computer Science, Biomedical Engineering, Electrical Engineering, Computer Engineering, Software Engineering, Mechanical Engineering, Civil Engineering, Chemical Engineering, Energy Engineering, Aerospace Engineering, Mathematics, Physics, Material Science	
Selection-Admissions: Policies & Procedures	Evaluation of Qualifications, Curriculum vitae and Oral Test		

	Evaluation of Qualifications	Up to 40 points	✓ Curriculum vitae with appropriate certification attesting exams taken and related marks/grades (up to 30 points);
			 ✓ Other (up to 10 points):
			    o project;
			    o motivation letter;
			    o publications;
			    o other training and/or research activities undertaken.

	Interview	Up to 60 points	The interview will last approximately 30 mins. Applicants are invited to prepare a presentation, of up to 15 mins, also including the use of audiovisual media, on a research topic that is consistent with the specific curriculum or disciplinary area chosen. Applicants should prepare one presentation for each curriculum/disciplinary area for which they have applied. Candidates would need to achieve a minimum grade of 30/60 in the interview in order to pass the oral test. Candidates' English language skills and proficiency will also be evaluated on this occasion. The interview may be conducted via "*teleconference*".
Selection-Admission Tests: Schedules	Oral Test Interview	Oral test dates and time will be announced by way of a notice published on the University website at: https://www.unisannio.it/en/ricerca/opportunità/dottorato-di-ricerca	
Selection-Admission Test Topic	Topic theme to be chosen by the candidate from among those covered by the PhD Programme disciplinary areas. For each specific curriculum/disciplinary area chosen, the candidate must identify and illustrate a specific research pathway.		