

DOCTOR OF PHILOSOPHY (PHD) PROGRAMME IN "<i>Information Technologies for Engineering</i>" 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	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	Curriculum A Information Technology Curriculum B Energy and Environment
Reserved Positions for holders of scholarship from foreign countries (2)	Topic relevant to the curriculum chosen by the candidate	2 positions	<i>To apply to these positions, the applicant must declare to possess the documentation concerning the achieved scholarship.</i> Curriculum A Information Technology Curriculum B Energy and Environment
Scholarship n. 1 Funded by: University Funds	Topic: Distributed Coordination Architectures for Agentic Systems in Adaptive Virtual Environments Abstract: Virtual environments provide an ideal setting both for large-scale, cost-effective data generation and for the development of immersive interactive systems. Agentic systems are emerging as a promising paradigm for applications characterized by adaptive behavior; however, current architectures still exhibit limitations in supporting coordination, state sharing, and distributed adaptation in highly dynamic environments. This project focuses on the study of architectural models and coordination mechanisms for agentic systems, enabling them to share local observations, synchronize state, and support distributed decision-making. The objective is to design modular, scalable systems that can be seamlessly integrated into modern production pipelines while ensuring efficiency, interpretability, behavioral consistency, user experience control, and reproducibility. The proposed solutions will be validated through representative case studies in virtual environments, including Procedural Content Generation and Dynamic Difficulty Adjustment.	1 position	Curriculum A Information Technology
Scholarship n. 2 Funded by: University and Engineering Department funds	Topic: Monitoring cryosphere dynamics using GNSS signals of opportunity Abstract: The rapid evolution of the cryosphere is one of the most sensitive indicators of ongoing climate change, with major implications for sea-level rise, the global energy balance, freshwater availability, and polar ecosystems. Reliable monitoring therefore requires observations that combine high temporal sampling, extensive spatial coverage, and sensitivity to surface properties under all-weather conditions. The PhD research will investigate innovative approaches for monitoring cryosphere dynamics, using spaceborne Global Navigation Satellite System Reflectometry (GNSS-R) polar-orbiting missions such as ESA's HydroGNSS and GNSS-R constellations operated by Spire-Global. The research will develop advanced processing and	1 position	Curriculum A Information Technology

	retrieval methodologies for characterizing sea-ice extent and type, snow conditions, ice-sheet surface properties, roughness, and freeze–thaw transitions. Coherent complex observables and multiband signals will be exploited to improve spatial resolution and sensitivity to temporal changes. The activity will also assess the capability of GNSS-R to complement conventional radar missions through more frequent L-band observations acquired by compact and low-power satellite instruments.		
Scholarship n. 3 Funded by: University and Engineering Department funds	Topic: High spatial resolution GNSS reflectometry using complex observables and wideband signals Abstract: Improving the spatial resolution of spaceborne GNSS reflectometry is crucial for resolving coastlines, inland waters and heterogeneous land surfaces, where standard incoherently integrated delay–Doppler maps may average returns from different surface types. The PhD research will investigate two complementary approaches: complex observables, preserving in-phase and quadrature components to support coherence assessment, high-rate along-track sampling, and coherent focusing when phase stability is sufficient; and wideband signals, improving delay discrimination. Attention will be devoted to GPS L5 and Galileo E5a, the signals acquired by HydroGNSS alongside L1/E1. Their 10.23-Mchip/s ranging codes provide approximately one order of magnitude finer intrinsic delay discrimination than GPS L1 C/A but require more advanced geolocation and signal processing in general. Newly available high-rate coherent channels and dual-frequency measurements will act as key technological drivers for the PhD activities, enabling the development and experimental assessment of advanced complex-waveform processing techniques, focusing algorithms, and resolution-enhancement methods over land, inland-water, and coastal environments.	1 position	Curriculum A Information Technology
Scholarship n. 4 Funded by: Engineering Department funds, and Italian Space Agency	Topic: Analysis techniques of multi-sensor data and their derived products for landslide detection in support of Disaster Risk Management Abstract: The PhD will focus on the development and testing of analysis techniques, including those based on Artificial Intelligence algorithms, applied to Earth observation data and their derived products, for landslide detection purposes. In addition to synthetic aperture radar and multispectral optical data, particular attention will be paid to hyperspectral data (e.g. from the PRISMA mission) and derived products (e.g. change detection maps, Persistent Scatterers multi-interferometric datasets). Trials will refer to application scenarios that will include, for example, identification at the early stage of landslides, predictive analyses, mapping in emergency and ordinary situations (slide inventories) and post-event monitoring. The activity will be carried out in collaboration with the Italian Space Agency (ASI) as part of the Landslide Pilot of the Working Group on Disasters (WGD) of the Committee on Earth Observation Satellites (CEOS) and its respective national initiative.	1 position	Curriculum A Information Technology

Scholarship n. 5 Funded by: Italian Space Agency	Topic: Novel methods of Artificial Intelligence for landslide detection in application use-cases of Disaster Risk Management Abstract: The PhD will focus on the development of innovative Artificial Intelligence methods applied to satellite remote sensing of landslide phenomena with respect to the different phases of the disaster risk management cycle (prevention, preparedness, emergency, recovery and reconstruction). In particular, Earth observation data will be used, primarily synthetic aperture radar and optical. Experiments will be conducted to test applicability, performance, and benefits against real-world application use scenarios focused on the use of Earth Observation (EO) data for disaster risk management. The activity will be carried out in collaboration with the Italian Space Agency (ASI) as part of the Landslide Pilot of the Working Group on Disasters (WGD) of the Committee on Earth Observation Satellites (CEOS) and its respective national initiative.	1 position	Curriculum A Information Technology
Scholarship n. 6 Funded by: University and Engineering Department Funds	Topic: Multi-Scale Study of Heat Transfer in Data Centers: Numerical Modeling and Experimental Characterization for Energy Optimization Abstract: The project will address the energy efficiency challenge in IT infrastructures, combining heat transfer in electronic devices with consumption containment in asservated HVAC systems. Focusing on data centers, the research will implement multi-objective optimization criteria for thermal management through a multi-scale approach operating across two interconnected levels. At the micro-scale, the thermofluid-dynamic behavior of chips, packages, and servers will be analyzed, investigating dissipation paradigms based on phase-change systems (heat pipes). At the macro-scale, the investigation will define building efficiency interventions, advanced HVAC configurations, and renewable source integration. The methodology will synergistically integrate numerical and experimental approaches: on the computational plane, CFD models, system-level simulations, and digital twins will be developed, validated by laboratory thermal tests and in-situ monitoring. The research will pursue a substantial contraction of required thermal and electrical power, formulating scalable thermodynamic solutions.	1 position	Curriculum B Energy and Environment
Scholarship n. 7 Funded by: University Funds and co-funding by the RFX Consortium	Topic: Modeling and Design of Microbubble Implosion Systems for Proton-Boron Fusion Energy Abstract: The research proposes the modelling, numerical study and development of the innovative “Microbubble Implosion” (MBI) technique for p-B11 nuclear fusion. The method involves irradiating nanostructured hydrogen-boron targets arranged around hollow spheres with laser pulses lasting tens of femtoseconds and intensities of 10^{18}-10^{22} W/m². Rapid ionization generates intense electric fields, caused by the accumulation of electrons within the cavity, capable of inducing an implosion up to theoretical densities equal to 10^5 times that of solid-state matter and fields up to 10^{16} V/m. p-B11 fusion, which is essentially aneutronic, reduces the issues associated with fast neutrons and, owing to the femtosecond timescale, limits Bremsstrahlung	1 position	Curriculum B Energy and Environment

	losses. The project includes target development, tests at ENEA–ABC and ELI Beamlines, and possible applications to Proton Boron Capture Therapy.		
Scholarship n. 8 Funded by: University and Engineering Department Funds, and co-funding by Matter Economy Srl	Topic: Seismic performance assessment of innovative and sustainable structural systems considering the entire life cycle Abstract: The research activities will focus on the study of innovative structural systems conjugating the advantage of seismic damage containment with the low environmental impact. In particular, solutions relying on the use of recycled materials and with low environmental impact will be considered. The methodology consists of experimental tests on structural subassemblies and FEM numerical modelling. Such an approach will allow to collect experimental data that can be used to calibrated refined numerical models that can be extended to more complex structural systems. The performances will be assessed over the entire life cycle considering all the phases from construction, use, maintenance and end-of-life.	1 position	Curriculum B Energy and Environment
Scholarship n. 9 Funded by: Engineering Department Funds, and co-funding by IMEVA S.p.A.	Topic: An Integrated Approach to the Modeling and Monitoring of Soil–Barrier Interaction for Road Restraint Systems Abstract: The performance of road safety barriers is strongly influenced by the interaction between the structure and the supporting soil, particularly under unfavorable geotechnical conditions. However, current design and certification approaches do not provide a comprehensive representation of the dynamic behavior of the soil–barrier system, nor do they enable continuous monitoring of its in-service performance. This research proposes an integrated framework based on the Digital Twin paradigm for the analysis, monitoring, and optimization of road restraint systems. The proposed methodology involves the development of an advanced numerical model of soil–structure interaction, calibrated through experimental testing and validated by dedicated in situ test campaigns. The Digital Twin is subsequently integrated with intelligent monitoring systems employing advanced sensing technologies, enabling continuous model updating and the implementation of a data-driven framework for real-time assessment of barrier performance. The research study also investigates innovative materials and geotechnical ground improvement techniques aimed at enhancing the effectiveness of restraint systems installed under critical ground conditions. The expected outcomes, in addition to publications in high-impact international peer-reviewed journals, include reduced testing and certification costs, improved reliability of design methodologies, and the development of innovative tools for predictive maintenance and the intelligent management of road infrastructure.	1 position	Curriculum B Energy and Environment

Scholarship n. 10 Funded by: University Funds, and joint co-funding by Di e Di FORUM s.r.l. and Aediltech s.r.l.	Topic: Computational modelling and shape and stereotomic optimisation of block-based structures fabricated through additive and subtractive digital fabrication Abstract: Unilateral block-based structures achieve their load-bearing capacity through an optimal geometry of the blocks, whether convex or non-convex, of the interfaces and of the material's mechanical properties, transmitting loads along internal compression-only paths. Digital fabrication makes it possible to revisit this paradigm with new materials and processes, towards reversible, low-carbon construction solutions. The research will develop a computational framework for the mechanical and geometric modelling, analysis and optimisation of block-based structures, combining limit analysis and energy-based methods, discrete element methods and geometric optimisation algorithms with constraints on shape and stereotomy. Global geometry and subdivision will be optimised under equilibrium, friction and fabrication constraints. Scale models will be used to assess the predictive accuracy of the numerical methods through two complementary processes: computer numerical control subtractive machining of stone elements and robotic additive fabrication of fluid dense materials, including the use of printed formwork.	1 position	Curriculum B Energy and Environment
It should be noted that the activation of funded positions for which financial support is provided, in whole or in part, by external organizations or companies is subject to the actual transfer of the corresponding funds. Therefore, should such organizations or companies fail to transfer the funding, the scholarships will not be activated.			

Programme Entry Requirements

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. Candidates would need to achieve a minimum grade of 24/40 to be admitted to the interview
	Interview	Up to 60 points	The interview will last approximately 20 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 36/60 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 will 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.		