ATTACHMENT A

Form n. 1

PhD Programme in *"Economics and management for innovation and sustainability"*

Dipartimento di Economia e Giurisprudenza

Coordinator:	*Prof. Raffaele TrequattriniTel. 0776/2994649 e-mail: raffaele.trequattrini@unicas.it*

Total number of positions available:	3	
Positions with scholarships:	3	
Funds:	MOST Project - National Centre for Sustainable Mobility, Mission 4 "Education and Research" - Component 2 "From Research to Enterprise" of the National Recovery and Resilience Plan (PNRR)" - CUP H38H22000300001	
Length of the course:	*3 years*	

Scolarship n.1	on the topic *"Recycling and reuse of batteries: markets dynamics and service management perspectives"* - Tutor prof. Roberto BRUNI – SECS-P/08 (Economia e gestione delle imprese) - SPOKE 13;
	Short description of the research activity: International policy is focused on reducing carbon emissions, and the increasing use of the electric grid demands energy storage. In the following years, countries will ask for electricity management and storage in several sectors, and batteries will be a critical resource with relevant market growth. Raw materials for batteries are limited and mined in a limited number of countries worldwide, although their demand is growing. For these reasons, the recycling and reuse of batteries in their second and third life are viable solutions but need specific market analysis and emerging challenges in the extended supply chain. Looking at the technology evolution and the need for sustainable strategies, the project aims to study old and new markets concerning the phenomenon, opportunities and challenges for business relationships and service management perspectives. Semester to spend abroad at (tentative): University of Halmstad (Sweden), Masaryk University (Czech Republic)

Scolarship n.2	on the topic *"A management perspective of digital and sustainable devolepment of smart cities: involving urban stakeholders"* – Tutor prof. Andrea MORETTA TARTAGLIONE – SECS-P/08 (Economia e gestione delle imprese) - SPOKE 9
	Short description of the research activity: High Performance Computing (HPC) systems and the availability of big data, combined with models, methodologies, algorithms and distributed architectures and sensors, offer new opportunities to solve the key challenges of smart cities and support the urban digital transition. New technologies make it possible to design future solutions based on climate change and the protection of territories' traditions and identities, integrated with local communities in a virtuous relationship. This project aims at investigating models of active involvement of urban

	communities as engines of sustainable economic development, able to face the challenge of climate change and digital transformation through shared and innovative solutions in a management perspective. In particular, the research focuses on the role of new technologies in fostering information interoperability, accessibility and sharing to enable shared decision-making, stakeholder engagement and value co-creation in the design, evaluation and management of urban systems, services and infrastructures operating in the social, organisational and technological domains. Semester to spend abroad at (tentative): Autonomous University of Madrid (Spain), University of Zaragoza (Spain)

Curriculum	**Research Topics**
1) Economics	The curriculum focuses on theoretical and applied research on individual and collective decision-making, and especially on the functioning and performance of markets, on the performance of firms, and on public policy, as well as regulatory and institutional aspects. Research areas include, among others: Behavioral Economics; Firms and Markets; Global Value Chains; Innovation; Entrepreneurship; Human Capital and Organizational Change in Firms; Financial Markets; Big Data and Performance Evaluation; Artificial Intelligence; Economic Growth and its Social, Financial and Environmental Sustainability; Innovation and Transition in Rural Entrepreneurial Ecosystems
2) Management and finance	The curriculum focuses on corporate behavior, with special reference to the issues of innovation and the economic, financial, ethical, social and environmental sustainability of organizations. The activity is characterized by multidisciplinarity through the integration of economic-business, management, financial, and organizational perspectives, including with reference to production and technological processes. This curriculum enablesPhd students to acquire new skills in business management and offers a strong specialization for research-oriented professionals and/or professions requiring high scientific skills relevant to the behavior of public and private organizations.

Admission requirements:

all *lauree specialistiche/magistrali* (in the case of International Degree, an equivalent qualification)

Mandatory documentation to be attached to the application

- curriculum *(to be complied in accordance with the guidelines attached to the call for candidatures andavailable on the University website: Attachment "B")*;
- certification or self-certification of a master's/specialist degrees with the mark obtained
- research project (*to be compiled in accordance with the requirements set out in the call for applications – "Attachment "C" available on the University website*)

Additional eligible qualifications

- Cover Letter (no more than 1)
- Publications with ISBN or ISSN
- Any other qualifications (e.g. Level II Master's degree, Higher Education Courses with final examination, Research contracts carried out for public and private organisations and companies)

Selection Procedures:

The admission examination consists of a pre-selection and an oral test.
The pre-selection admits candidates to the oral test and the judgement is made by the selection

board on the basis of the evaluation of the following elements
- curriculum vitae
- marks obtained in university studies
- any publications with ISBN or ISSN (no more than 1)
- any other qualifications (e.g. 2nd level Master's degree, advanced training courses with final examination, research contracts held for public and private bodies and companies)
- research project
- letter of recommendation from tenured university lecturers (no more than 1);
For admission to the oral test, the candidate must have passed the pre-selection test with a score of no less than 40/60. The oral test will be aimed at verifying the candidate's propensity and aptitude for scientific research in the chosen field, as well as his knowledge of the English language. The oral test may be conducted electronically, at the candidate's request, in the presence of adequate justification, including the candidate's residence in a foreign country. The chosen mode must be indicated in the application to take part in the competition. Candidates must indicate in their application an e-mail address to which they will be sent notification of the outcome of the assessment of their qualifications and, for those who have opted for the oral test by telematic means, information on how the test will be conducted. It is also possible to take the test in English, provided that this is explicitly requested when submitting the application form

Evaluation criteria:

The pre-selection test will be rated from 0 to 60 points, obtained by taking the following aspects into account:
1. Curriculum, marks obtained in university studies (0 to 20 points);
2. Publications (0 to 5 points);
3. Any other qualifications (0 to 7 points);
3. Research project (0 to 25 points);
4. Cover letter (0 to 3 points).
For admission to the oral test the candidate must have passed the pre-selection test with a score of no less than 40/60.
The oral test will be marked out of 60 points, obtained taking into consideration the following aspects:
1. the candidate's aptitude for carrying out research activities, also independently (0 to 20 points)
2. Propriety of language (0 to 20 points);
3. Ability to analyse and synthesise (0 to 20 points). Knowledge of the English language is required and will be subject to verification. The minimum mark for passing the oral test is 40/60. The merit ranking is determined by the sum of the marks obtained during the pre-selection and the oral test.

Exam topics

Curriculum Economics
The oral test will be focused on the following topics: microeconomics, macroeconomics, international economic policy.
In the oral test, the candidate will discuss the research project.
- Curriculum Management and Finance
The oral test will be focused on the following topics: accounting and finance, management and organization, technology of the productive processes.
In the oral test, the candidate will discuss the research project and the knowledge of English language.

Location for holding tests

Dipartimento di Economia e Giurisprudenza, Campus Folcara, località Sant'Angelo, 03043 Cassino (FR)

Examination Dates

Date of publication pre-select test judgement	**February 06, 2024**
Date of holding oral test	**February 09, 2024 at 11:00 am**
Place holding oral test	Dipartimento di Economia e Giurisprudenza, *Campus* "Folcara", 03043 Cassino (FR) either in presence or on the Google Meet platform at the link that will be communicated with the results of the pre-selection tests.
Publication of ranking	**by February 15, 2024**

The results and the final ranking list will be published at the following address:

https://www.unicas.it/ateneo/bandi-di-concorso/corsi-di-dottorato-di-ricerca-aa-20232024-xxxix-ciclo-bando-borse-aggiuntive/

Information about didactic activities

https://www.unicas.it/dottorato/elenco-dottorati-di-ricerca-delluniversita-degli-studi-di-cassino-e-del-lazio-meridionale/corso-di-dottorato-in-economia-e-management-per-linnovazione-e-la-sostenibilita/

Form n. 2

Ph D Programme in "Methods, Models and Technologies for Engineering"

Dipartimento di Ingegneria Elettrica e dell'Informazione "Maurizio Scarano"

Coordinator:	*Prof. Fabrizio Marignetti* *Tel. 0776-2993716* *e-mail: marignetti@unicas.it*
Total number of positions available:	3
Positions with scholarships:	3
Funds:	MOST Project - National Centre for Sustainable Mobility, Mission 4 "Education and Research" - Component 2 "From Research to Enterprise" of the National Recovery and Resilience Plan (PNRR)" - CUP H38H22000300001
Length of the course:	*3 years*

Scolarship n. 1	on the topic *"Measurement methods for human exposure evaluation and electromagnetic compatibility in electrical traction vehicles"* - Tutor proff. Giovanni Betta, Domenico Capriglione – SPOKE 13;
Curriculum:	Information Engineering
	Short description of the research activity: The research activity is aimed at designing and validating measurement procedures to be adopted for evaluating human exposure to electromagnetic fields due to both low and high-frequency sources present within electric traction vehicles. As matter of fact, there are neither technical standards nor guides, specifically designed for making such kinds of measurements whenever the kinds of sources of electric, magnetic, and electromagnetic fields are due to the new electronic devices and systems typically present in modern electrical vehicles fully powered by batteries. The study will be based on models and experimental activities for designing and validating the proposed measurement procedures. Particular care will be addressed in identifying the main measurement errors and uncertainty causes, and in defining suitable processing methods for improving the reliability, repeatability, and accuracy of the achieved results. Similarly, EMC (Electromagnetic compatibility) in electrical vehicles gives rise to new issues especially from a testing point of view, where technical standards are generally thought for traditional powertrains. On one side, these results could cover a normative gap in human exposure and EMC evaluation, and on the other side, they could be useful for vehicle manufacturers, because they will allow the identification of passenger positions of the vehicle that could be most involved by high values of electric, magnetic, and/or electromagnetic fields, thus providing "hot spots" or "hot areas" to be suitably handled (as an example by using suitable shields) for containing human exposure and EMC problems. Semester to spend abroad at (tentative): University of East Sarajevo (Bosnia and Herzegovina)

Scolarship n. 2	on the topic "*Integrating Smart Sensor Networks and AI for Sustainable Mobility and Early Event War - ning Systems"* – Tutor proff. Luigi Ferrigno, Mario Molinara – SPOKE 9;

Curriculum	Information Engineering
	Short description of the research activity: This doctoral project aims to design and develop an innovative framework by integrating smart sensor networks and artificial intelligence (AI) to enhance sustainable mobility and provide early warnings for adverse weather events. The research will focus on developing distributed smart sensors capable of collecting and analyzing environmental data in real-time. By leveraging advanced AI algorithms, these sensors will predict and alert about potential weather-related disruptions, thus contributing to safer and more efficient transportation systems. The project will explore optimizing sensor network deployment for maximal coverage and data accuracy and developing AI models that can efficiently process vast amounts of sensor data to accurately predict weather events. The study will also examine the implications of this integrated system on promoting sustainable mobility practices, reducing environmental impact, and improving urban resilience to climate change. This interdisciplinary project bridges the gap between environmental science, AI, and urban planning, offering significant contributions to the fields of smart cities and disaster risk reduction. Semester to spend abroad at (tentative): I semester in the second year at "Stanford Energy Control Lab" https://onorilab.stanford.edu/

Scolarship n. 3	on the topic "*Design and comparison of Rare-Earth free motors for electric traction*" – Tutor prof. Fabrizio Marignetti – SPOKE 2;
Curriculum	Electrical Engineering
	Short description of the research activity: This doctoral project aims to design innovative high-power density motors for traction. The project investigates alternative solutions to permanent magnet motors that do not require the use of rare earth materials, with a significant reduction in the environmental impact. The characteristics required of traction motors are a high flux under overload conditions, which is necessary to accelerate the vehicle, and an extended operating range in the region at constant power that allows it to reach high speeds In particular, the following motors will be considered: - Electrically Excited Synchronous Motors (EESR) and Self Excited Electric Motors (SESM): synchronous wound rotor machines, possibly assisted by permanent magnets (hybrid excitation), with contactless excitation. - Medium Voltage Induction Motors. This solution is a promising alternative, especially to standard motors for railway traction, as it improves the power density of the machine, and reduces the size of the inverter. - Axially Laminated Anisotropic Rotor Reluctance Synchronous Machines (ALA-RSM). These machines have the highest ratio of direct axis to square axis inductance among synchronous machines. Electromechanical and thermal simulations will be conducted, to optimize the machine design. Semester to spend abroad at (tentative): One semester in the second year at "Technical University of Timisoara" https://iee.upt.ro/en

Curriculum	Research Topics
1) Civil and Environmental Engineering	The course trains highly qualified technical and scientific experts in the topics of basic and applied research for Civil and Environmental Engineering, supplemented by the knowledge of environmental and territorial protection. The course enables the doctoral student to enter the working world by performing highly professional activities in various fields and competing in activities such as planning, design, redevelopment, construction and rehabilitation, maintenance and management, assistance to technical facilities, risk analysis and safety management in the prevention and emergency phases.
2) Information Engineering:	The curriculum in Information Engineering provides highly specialized training in the field of Information and Communication Technology to enable PhDs to work in its application areas and to manage and promote its scientific and technological innovation. In particular, the curriculum provides specific skills in the different areas of information engineering aimed, for example, at the development of artificial intelligence, machine learning and IoT techniques, the design and development of telecommunications networks and radar systems, the control of industrial automation systems, industrial and service robots, the analysis of electromagnetic fields for antenna design, electromagnetic protection and characterization, the design of sensor networks and the development of embedded systems.
3) Electrical Engineering	The curriculum in Electrical Engineering is aimed at the acquisition of specificand advanced skills in analytical and numerical modeling, experimental characterization, supervision, control, and design of power electronic systems, electrical machines and drives, and electrical energy systems and devices. The skills acquired are aimed at achieving research objectives in applicationssuch as smart grids, renewable energy systems and energy harvesting, electrical energy storage, fast charging for electric vehicles, and vehicular traction systems.
4) Mechanical and Management Engineering	The curriculum in Mechanical and Management Engineering enables the Ph.D. student to acquire technical and scientific skills in one of the following fields of research for the study, modeling, and/or experimentation of complex mechanical and thermofluid-dynamic systems, as well as for the study of economic and management systems. These three fields concern, respectively, robotic and mechatronic systems, mechanisms, mechanical structures and components of machines, materials and mechanical technology, as well as thermo-technical and air treatment systems, machines and energy systems, and finally, innovative methodological tools for production and industrial plant management.
5) Environments and technologies for motor activity and health	The curriculum in Environments and Technologies for Motor Activity and Health develops high research skills in the area of methods and devices for motor activity and health, with a focus on the topics of exercise and sport activity for people with different degrees of ability and health conditions. The curriculum provides an in-depth understanding of the anatomical and biochemical knowledge underlying the functioning of the human body in movement, as well as the social context and psychological

	and pedagogical aspects that can motivate attention to the body and the practice of sports and motor activity at different ages of life. Special attention is given to the training and functional and nutritional assessment of the athlete, the evaluation of the effectiveness of health promotion and motor activity interventions through the use of epidemiological and statistical techniques, the environmental quality and safety of sports facilities, and the orthopedics and traumatology of sport and movement.

Qualification requisites for admission:

The following master's/specialist degrees, or equivalent titles, in case of qualification obtained abroad:

LM-3 Landscape Architecture
LM-4 Architecture and Construction and Architectural Engineering
LM-4 c.u. Architecture and Construction and Architectural Engineering (5 years)
LM-6 Biology
LM-7 Agricultural biotechnology
LM-8 Industrial biotechnology
LM-9 Medical, veterinary and pharmaceutical biotechnology
LM-10 Conservation of architectural and environmental heritage
LM-11 Science for the conservation of cultural heritage
LM-12 Design
LM-13 Pharmacy and industrial pharmacy
LM-16 Finance
LM-17 Physics
LM-18 Computer Science
LM-20 Aerospace Engineering and Astronautics
LM-21 Biomedical Engineering
LM-22 Chemical Engineering
LM-23 Civil Engineering
LM-24 Engineering Building Systems
LM-25 Automation Engineering
LM-26 Safety Engineering
LM-27 Telecommunications Engineering
LM-28 Electrical Engineering
LM-29 Electronic Engineering
LM-30 Energy and Nuclear Engineering
LM-31 Management Engineering
LM-32 Computer Engineering
LM-33 Mechanical Engineering
LM-34 Marine Engineering
LM-35 Environmental and Territorial Engineering
LM-40 Mathematics
LM-41 Medicine and Surgery
LM-42 Veterinary medicine
LM-43 Information technology methodologies for the humanities
LM-44 Mathematical and physical modeling for engineering.
LM-46 Dentistry and dental prosthetics
LM-47 Organization and management of services for sports and motor activities
LM-48 Urban and environmental spatial planning
LM-51 Psychology
LM-53 Science and Material Science Engineering
LM-54 Chemical Sciences

LM-55 Cognitive Sciences LM-56 Science of economics
LM-57 Adult and continuing education sciences
LM-58 Sciences of the universe
LM-61 Human nutrition sciences
LM-63 Sciences of public administration
LM-66 Computer security
LM-67 Sciences and Techniques of Preventative and Adapted Physical Activities
LM-68 Science and Sport Techniques
LM-69 Agricultural science and technology
LM-70 Food science and technology
LM-71 Industrial chemistry science and technology
LM-72 Navigation science and technology
LM-73 Forestry and environmental sciences and technologies
LM-74 Geological Sciences and Technologies
LM-75 Science and technology for the environment and territory
LM-76 Economic sciences for the environment and culture
LM-77 Economic and business sciences
LM-79 Geological Sciences
LM-80 Geographical sciences
LM-81 Development cooperation sciences
LM-82 Statistical sciences
LM-83 Actuarial and financial statistical sciences
LM-91 Techniques and methods for the information society
LM-93 Theories and methodologies of e-learning and the
20/S (specialist in Physics)
23/S (specialist in Computer Science)
25/S (specialist in Aerospace Engineering and Astronautics)
26/S (specialist in Biochemical Engineering)
27/S (specialist in Chemical Engineering)
28/S (specialist in Civil Engineering)
29/S (specialist in Automation Engineering)
30/S (specialist in Telecommunications Engineering)
31/S (specialist in Electrical Engineering)
32/S (specialist in Electronic Engineering)
33/S (specialist in Energy and Nuclear Engineering)
34/S (specialist in Management Engineering)
35/S (specialist in Computer Engineering)
36/S (specialist in Mechanical Engineering)
37/S (specialist in Marine Engineering)
38/S (specialist in Environmental and Territorial Engineering)
45/S (specialist in Mathematics)
76/S (specialist in Sciences and Techniques of Preventative and Adaptive Physical Activities)

The following degrees are admissible only for access to curriculum 5) Environments and technologies for motor activity and health:
LM-51-Psychology
LM-55-Cognitive Sciences
LM-67-Sciences and Techniques of Physical and Adapted Activities
LM-68-Science and Sport Techniques
76/S (specialist in Sciences and Techniques of Physical and Adaptive Activities)

Documentation to be attached mandatorily to application

The applicant is required to apply and submit on-line the following documentation:

- curriculum *(to be produced following the guidelines attached to the call for candidatures and available on the University website: Attachment "B")*;
- an appropriate certification that includes an official academic transcript of the entire university course study, with a list of university exams and grades, the final grade of graduation of both the first and second level degrees or the equivalent university degrees for foreign students;
- research project *(to be prepared as requested in the form available on the University website: Attachment "E")*;
- letters of presentation *(not less than 2 and no more than 4)*.

Additional assessable qualifications

- publications (maximum 5*)*.

Procedure for the selection process of candidates:

The admission exam consists of two exams: an entry test and an oral examination. The entry test consists of the evaluation of the following:

- curriculum;
- publications (maximum 5);
- other scientific qualifications (qualifications on the curriculum that might be useful for the assessment of the curriculum, among which must mandatorily include suitable certification regarding the grades received in the examinations in the whole university studies, including the final grade of graduation of both the first and second level degrees, or the Vecchio Ordinamento degree, or the equivalent university degrees for foreign students);
- research project;
- presentation letters (not less than 2 and no more than 4).

The oral examination evaluates the candidate's predisposition for carrying out research in one of reference disciplinary sectors of the PhD programme and the candidate's knowledge of the English
language.
On request of the candidate and in the presence of adequate reasons, including the candidate's residence in a foreign country, the oral examination can also be done online. The procedure chosen must be specified by the candidate in the application form.
The oral examinations can also be in English upon explicit request of the candidate in the application form. In the application form, candidates must necessarily provide an e-mail address which will be used by the University to inform the candidate about his/her evaluation of qualification, and for those who have chosen the online oral examination, to receive instructions for the oral examination

Evaluation criteria:

The entry test will be evaluated from 0 to 60 points, taking into consideration the following aspects:
- Curriculum vitae, grades obtained in the university course and any other scientific qualifications (from 0to 25 points);
- Publications, max 5 (from 0 to 5 points);
- Research project (from 0 to 25 points);
- Letters of presentation (from 0 to 5 points).

In order to be admitted to the oral exam the candidate has to pass the entry test with a minimum scoreof 40/60.
The oral exam will be evaluated from 0 to 60 points, taking into consideration the following aspects:
- The candidate's aptitude for carrying out research activities, even in an autonomous form (from 0 to 20points);
- Ability to speak properly (from 0 to 20 points);
- Ability to analyze and summarize (from 0 to 20 points).

Knowledge of English language is required and will be subject to verification. The minimum score to passthe oral exam is 40/60.
The merit ranking is determined by the sum of the scores obtained in the entry test and the oral test.

Exam Topics

Exam topics cover the degree courses listed previously in **"Qualification requisites for admission"**

Location of the Admission Test

Area didattica di Ingegneria - Sala del Consiglio – Via G. Di Biasio, 43 - Cassino

Examination Dates

Date and result of the entry test	**February 6, 2024**
Date of the oral examination	**February 9, 2024 at 10:00 am**
Location of oral examination	Area didattica di Ingegneria - Sala del Consiglio – Via G. Di Biasio,43 - Cassino
Publication of final merit ranking lists	**by February 15, 2024**

The results and the final ranking list will be published at the following address:
https://www.unicas.it/ateneo/bandi-di-concorso/corsi-di-dottorato-di-ricerca-aa-20232024-xxxix-ciclo-bando-borse-aggiuntive/

Information on teaching activities

https://www.unicas.it/dottorato/elenco-dottorati-di-ricerca-delluniversita-degli-studi-di-cassino-e del-lazio-meridionale/corso-di-dottorato-in-metodi-modelli-e-tecnologie-per-l-ingegneria/