

## PhD in “SCIENCE AND ENGINEERING FOR THE ENVIRONMENT AND THE SUSTAINABILITY”

XXXVIII cycle

TEACHING COURSES OFFERED DURING THE ACADEMIC YEAR 2022/2023

COURSE	Hours	ETCS	DESCRIPTION	FINAL EXAM	SSD	REF PERSON
ADVANCED METHODS FOR THE ANALYSIS OF ENVIRONMENTAL MATRICES	16	4	<p>The purpose of the course is to provide an overview of advanced methodologies that can be used in the environmental field for the analysis of solid, gaseous or liquid matrices. Technical information will be provided on the principles of instrumental operation or the methodological approach, details on how to sample and prepare samples of the matrices, examples of analytical results and data processing, practical examples of the use of the methodology to answer specific questions in the field of environmental analysis. The following topics will be presented:</p> <ol style="list-style-type: none"> <li>1. Isotopic analysis for environmental and archeometric applications. Fundamentals of isotope physics. Isotope fractionation. Conventional and accelerator mass spectrometry. Environmental processes and isotope marking. Methods of sample preparation and measurement processes. Applications of isotopic methodologies to environmental, archaeometric processes and in the agri-food sector.</li> <li>2. Tree-ring stable isotopes analysis for environmental monitoring, from paleoclimatology to forest management and anthropogenic impacts on forest growth. The lesson will also discuss the combined use of isotope fractionation, xylogenesis and cross dating, as well as methodological topics like sampling, analysis and standardization. Study cases related to forest response to disturbances will be discussed.</li> <li>3. Introduction to water pollution and control. Wastewater treatment by adsorption and ion exchange. Advanced oxidation processes: Sono- and Electro-chemical treatment. Case studies on wastewater treatment with advanced electrochemical oxidation processes.</li> <li>4. Plant food and wastes therefrom: chemical characterization and innovative applications. Recovery of bioactive and functional ingredients from edible plants, advanced high-resolution tandem mass spectrometry tools for chemical identification and quantification purposes, and innovative perspectives for the exploitation of by-products and wastes therefrom.</li> <li>5. Estimate of gas fluxes in terrestrial and water ecosystems. Gas flux monitoring, principles, main techniques, techniques based on gas chromatographic analysis.</li> <li>6. Electron microscopy application for environmental studies. Electron microscopy principles, samples preparation techniques for conventional and field emission scanning electron microscopy, EDX and CPD techniques for environmental microscopy analysis, practical observation session on conventional SEM of different environmental matrices.</li> </ol>	NO	FIS/07 AGR/05 CHIM/10 CHIM/12 BIO/01 BIO/07	Lubritto Battipaglia Piccolella Iovino De Stefano Castaldi
DATA MANAGEMENT	16	4	<p>Data are now recognized as a major organizational resource to be attained and managed like other assets such as land, labour and capital. The ability to structure, access, manage and leverage this valuable resource is becoming more and more critical to all organizations, large or small, public or private. This course is designed to present the fundamental concepts and theories in data management, in order to promote their application to research activities and professional practice. An</p>	NO		Iacono

			<p>examination of Database Management Systems, database architectures, the role of data in decisional processes and the processes that guide the data lifecycle will be a focus of the course. Due to the importance of personal data in scientific research, it is mandatory to include in the course the main concepts about personal data protection regulation. Contents:</p> <ol style="list-style-type: none"> <li>1. Data Management basics: information need, sources and users, data attributes, data relationship, data life cycle.</li> <li>2. The conceptual database models utilizing entity-relationship model: design of data structures that will limit redundancy and enforce data integrity.</li> <li>3. The logical database model as the second step of database design: the relational data model in terms of data structure, data integrity, and data manipulation. Notes on data definition, manipulation and query languages (SQL).</li> <li>4. The role of data in Decision Support Systems: multidimensional data model; operational and informational systems; Data warehousing systems and OLAP analysis; Data Mining.</li> <li>5. Introduction to Big Data and large database and unstructured databases for scientific applications.</li> <li>6. Data management and personal data protection regulation: ethics of privacy; basics on GDPR regulation: general principles, right of users, accountability and policies; GDPR rules on personal data in the scientific research.</li> </ol>			
ENGLISH COURSE INTERMEDIATE	32	8	<p>The improvement of the English language is foreseen, divided in 3 modules (intermediate, advanced, academic-scientific) to which students access after an entrance test. The course is intended to fix knowledge of English with particular reference to writing articles and reports of nature technical-scientific. Furthermore, courses are available to encourage the language learning of doctoral students' free language courses with the Rosetta Stone platform, with the choice of 24 languages. Due to the importance of English language, it is mandatory to include one or more of the courses.</p>	NO		Sciarra (Vicinanze)
ENGLISH COURSE ADVANCED	32	8	<p>The improvement of the English language is foreseen, divided in 3 modules (intermediate, advanced, academic-scientific) to which students access after an entrance test. The course is intended to fix knowledge of English with particular reference to writing articles and reports of nature technical-scientific. Furthermore, courses are available to encourage the language learning of doctoral students' free language courses with the Rosetta Stone platform, with the choice of 24 languages. Due to the importance of English language, it is mandatory to include one or more of the courses.</p>	NO		Raffone (Vicinanze)
ENGLISH COURSE ACADEMIC AND SCIENTIFIC	24	6	<p>The improvement of the English language is foreseen, divided in 3 modules (intermediate, advanced, academic-scientific) to which students access after an entrance test. The course is intended to fix knowledge of English with particular reference to writing articles and reports of nature technical-scientific. Furthermore, courses are available to encourage the language learning of doctoral students' free language courses with the Rosetta Stone platform, with the choice of 24 languages. Due to the importance of English language, it is mandatory to include one or more of the courses.</p>	NO		Antinucci (Vicinanze)
ENVIRONMENTAL ASSESSMENT AND PERMITS	16	4	<p>Provide indications for the definition of the correct authorization procedures in the environmental field. Transfer the knowledge of tools, methodologies and procedures for the presentation and evaluation of authorization requests by defining the necessary procedures and specialist studies. Analysis of the environmental compatibility of works and production activities.</p>	NO	ING-IND/25; ICAR 03	Musmarra Panico
ENVIRONMENTAL IMPACT METRICS FOR GOODS AND SERVICES	16	4	<p>The aim of the course is to provide an essential but comprehensive introduction to the metrics of environmental performance of a production process for a good or service. The focus will be mainly on the approach of Life Cycle Thinking and the tools of Life Cycle Assessment (of environmental, economic and social aspects) and Material and Substance Flow Analyses.</p>	NO	ING-IND/25;	Ardolino Arena
HYDROLOGICAL HAZARDS AND	16	4	<p>The course aims at framing the problems of assessing the geo-hydrological hazard and geo-hydrological risk with an</p>	NO	ICAR/02	Santonastaso Di Nardo

EARLY WARNING SYSTEMS			approach based not only on cartographic and historical information (susceptibility estimation, i.e. static probability), but through the development of mathematical models (i.e., temporal dynamic probability).			Greco
OPTIMIZATION METHODS FOR THE MANAGEMENT OF WATER RESOURCES	16	4	The course aims at providing the students with notions relating to management and operational issues, with the related economic aspects, as part of the optimal management of water resources facing them with modern optimization techniques	NO	ICAR/02	Santonastaso Di Nardo Greco
PATENT AS AN INVENTIVE RESEARCH ACTIVITY	24	6	The course focuses on patenting principles, practices and strategies in the processes of intellectual property management and enhancement and technology transfer at national and international level. The lessons aim to promote the exploitation of research results through the protection of Intellectual Property (IP), providing tools and methods on procedural forms and steps to structure patent applications. Specifically, they will concern the principles of IP protection, patent submission and evaluation procedures, information on how to retrieve data on existing patents (anteriority search) and the necessary bibliographical tools.	SI	ICAR/13	Capece
PILE FOUNDATIONS UNDER MECHANICAL AND THERMAL LOADS: ANALYSIS AND INNOVATIVE DESIGN	12	3	Piles are deep foundations having the role of transferring the loads from the structure to the deep, and thereby stronger, soil layers. If they are equipped with closed loop pipes attached to the steel rebars, in which a heat carrier fluid is circulated thanks to a heat pump, piles also gain the role of heat exchangers with the soil allowing the heating and cooling of buildings in a sustainable manner by exploiting the renewable geothermal energy. In this framework, the course is intended to cover the main features concerning the behaviour of pile foundations under different loading conditions, including temperature variations. The starting point will be the performance of the single pile which is analysed in terms of load-displacement response due to mechanical as well as to thermal loads via analytical and numerically-based approaches. Design issues are then discussed for pile groups subjected to generalised loading conditions.	NO	ICAR/07	Iodice
RESEARCH AND INNOVATION THROUGH NATIONAL AND INTERNATIONAL STANDARD REFERENCES	24	6	The course will focus on the analysis and study of standard references as "tools" for innovation and support to research activities, starting from the categorisation of the standards issued by the different national, European and international standardization organisations. The main standard references related to environmental management and protection systems will be analysed. The main requirements useful for obtaining certifications of products and processes in compliance with EU safety, health and environmental protection requirements will also be introduced. Examples of standards in different areas of research with particular reference to production processes aimed at ensuring the safety and well-being of user-operators in industrial settings will also be given. The PhD students will be involved in research activities with respect to the specific objectives of the PhD course through practical exercises aimed at the framework of the standard references applicable to the different subject areas through the use of the main UNI, CEN and ISO platforms.	NO	ICAR/13	Laudante
STATISTICS FOR THE ENVIRONMENT	24	6	The goal is to provide basic knowledge of descriptive and inferential statistics, data analysis and data mining. The program intends to describe the most appropriate methodologies to acquire critical capacity towards each instrument in terms of advantages and limitations. An essential role will be played by the introduction to the concepts of descriptive statistics, such as measures of central tendency, variability, dependence, probability and statistical inference.	NO	BIO/03	Strumia