Title	Tipo	Modalità di copertura	Crediti Dottorali	Ore frontali	Modalità di verifica (voto /idoneità)	Periodo di erogazione	Anno di corso	Obiettivi formativi	Docente
MATLAB Course on Artificial Intelligence Algorithms and Machine Learning Techniques	Laboratori	Carico didattico ordinario	2.8	14	Idoneità	IN PRESENZA - GIUGNO 2025	1	The course is structured into 14 hours of lessons through 4 modules of 3.5 hours each. The lessons will take place in the Informatic laboratory with the use of the MATLAB software. The aim of the course is to introduce students to programming techniques that are useful for addressing four main topics: image processing, machine learning, deep learning, and Simulink. To participate in the face-to-face lessons, completing 3 preparatory courses on the MATLAB e-learning platform is mandatory. These modules are intended to provide an introduction to basic programming in the Matlab environment. A final test is planned in order to verify the candidate's proficiency.	Laghi-Rinaldini-Panarese (est)
The Craft of Scientific Research	Formazione disciplinare e multidisciplinare	Carico didattico ordinario	7.2	36	Idoneità	ONLINE - GENNAIO/FEBBRAIO 2025	1	The craft of Scientific Research focuses on a set of transferable skills that are deemed essential for the practice of scientific research. The first part of three lectures focuses on the fundamental concept of scientific truth and how humanity pursues it: Why do we need to know? What is a model? How do we know? Then we deliver a long list of "how to" lectures: How to choose a research topic, write and publish a scientific paper, write a grant application, give a scientific presentation, build and run a research group, teach science at the university level, review a paper or a grant. Grant writing and peer reviewing will also be the subject of two tutorials and two individual projects; their completion will be required to pass the exam.	Viceconti-Cristofolini
Uncertainty Analysis for Engineers	Formazione disciplinare e multidisciplinare	Carico didattico ordinario	2.4	12	Idoneità	IN PRESENZA e ONLINE - OTTOBRE/NOVEMBRE 2024	1 e 3	The course is structured into 12 hours of lectures plus practical exercises. In the introductory part, the basic concepts, fundamental definitions, and the different approaches commonly used for this purpose are presented. A second, mainly theoretical part, develops the basic equations and statistical tools necessary to characterize uncertainty. The theoretical part is then followed by an operational part in which the different operational methodologies for quantifying the error are described. Theoretical/practical exercises are proposed during the course. A Matlab program is also developed for the study of error propagation using Monte-Carlo methodologies. At the end of the course a small project is assigned which serves as a final assessment.	Talamelli-Orlu-Schlatter
Perturbation Methods in Mechanics	Formazione disciplinare e multidisciplinare	Contratto esterno	2.4	12	Idoneità	IN PRESENZA e ONLINE - OTTOBRE/NOVEMBRE 2025	2	The course is structured into 12 hours of lectures plus practical exercises. The aim of the course is to complement the mathematical knowledge of doctoral students by providing them with the fundamentals of perturbation methods applied to physics and engineering. Solutions of ordinary differential equations are analyzed and formulated as one-parameter problems. The course is structured in the following parts: 1)Basic concepts of perturbation techniques, such as order relationships, asymptotic sequences, asymptotic expansions, and convergence issues 2)solution method for regular perturbation problems 3)regular and a singular perturbation problem 4)balancing method and boundary-layer theory 5)inner and outer solutions for singular perturbation problems by means of boundary-layer theory and the composite form. 6)multiple-scale analysis on linear and non-linear problems. In addition, some excersizes/tests are proposed during the course; at the end, a small project is assigned which serves as a final assessment.	Antonio Segalini (est)

Python programming for scientific research	Formazione disciplinare e multidisciplinare	Carico didattico ordinario	2.4	12	Idoneità	IN PRESENZA e ONLINE - MAGGIO 2024 e APRILE-MAGGIO 2025	1,2,3	This course offered to PhD students covers some aspects of open-source programming tools within Python environment. In particular, this course will provide the essential skills to develop scripts and platform-independent applications for various engineering applications. The basis of Python programming will be introduced, such as variables declaration and initialization, construction of expressions with arithmetic, logical and relational operators. Then, plotting and image analysis tools will be explored. Finally, manipulation techniques of texts and files will be explored, with application to specific examples in engineering. In the end, open-source programming skills in Python will be achieved and practiced by the PhD students.	Pulvirenti
Design of Experiments: theory and applications	Formazione disciplinare e multidisciplinare	Carico didattico ordinario	2.4	12	Voto	IN PRESENZA e ONLINE - GIUGNO 2024 e GIUGNO 2025	1,2	This course on Design of Experiment (DOE) consists of lessons for a total of 12 hours. The first part deals with some fundamentals on DOE and the application of the related techniques to different fields (not just technological). The importance of initial brainstorming is also discussed, aimed at choosing the input and output variables and the most suitable technique with reference to the specific field. The second part of the course is focused on the applications of the above-mentioned techniques in the engineering field. Students will also have the opportunity to see some nods to DOE's multidisciplinary applications. At the end of the course, a couple of hours will be dedicated to the interactive development of an experiment, the evaluation of which will constitute the final test for the assignment of credits.	Olmi
Data-driven methods in engineering	Formazione disciplinare e multidisciplinare	Carico didattico ordinario	2.4	12	Idoneità	ONLINE - LUGLIO 2024 e LUGLIO 2025	1,2	The course consists of 12 hours of lectures and aims to provide the fundamentals of machine learning techniques for modeling complex dynamic systems. The course is divided into the following main phases 1) Introduction. The singular-value decomposition (SVD) 2) Compressed sensing, optimal sensor placement 3) Robust principal component analysis and dynamic-mode decomposition (DMD) 4) Implementation of modal decompositions 5) Deep-learning applications and developments Theoretical/practical exercises are proposed during the course. Applications are also developed for the application of "machine learning" techniques to simplified models. At the end of the course, a project is assigned which serves as a final assessment.	Tarchi
Open source codes for the solution of differential equations in engineering applications	Formazione disciplinare e multidisciplinare	Carico didattico ordinario	2.4	12	Idoneità	IN PRESENZA e ONLINE - apr-mag-24 e apr-mag-25	1,2,3	This course offered to PhD students covers some aspects of the solution of differential equations by the finite volume method in open environments such as OpenFOAM. The main applications are in the field of heat transfer and fluid dynamics, and other interdisciplinary fields. Introduction to the finite volume approach for the solution of differential equations. In particular, the course will deal with: Open Source world for the solution of differential equations – Introduction to OpenFOAM; Construction of computational domain and computational grid–Convergency check and validation; Numerical solution by means of Open FOAM – Application to simple examples.	Pulvirenti
Mathematica™ Course for DIN PhD Students	Formazione disciplinare e multidisciplinare	Carico didattico ordinario	2.4	12	Idoneità	IN PRESENZA e ONLINE - GENNAIO 2025	1,2,3	The course is structured into 12 hours of frontal lessons in laboratory mode. The lessons take place directly on the MathematicaTM software. The introductory part presents basic concepts of numerical analysis and how they manifest themselves in the software. In the second part, the syntax of the program for symbolic calculation and data manipulation is explored in depth. Afterwards, some concepts useful for programming are introduced, and data visualization and the construction of figures and graphs are covered. Finally, differential and integral calculus and numerical calculation are explored in depth. During the course, practical exercises on the program are offered. At the end of the course, a small project is assigned which serves as a final assessment.	Brandao

An elementary introduction to quantum mechanics	Formazione disciplinare e multidisciplinare	Carico didattico ordinario	2.4	12	Idoneità	IN PRESENZA e ONLINE - APRILE 2025	1,2,3	The course is structured into 12 hours of frontal lessons. In the introductory part, quantum mechanics is framed in its historical evolution based on experimental results relating to black body radiation and atomic physics. Basic concepts are presented, including wave-particle dualism, the uncertainty principle, fundamental definitions, and different representations based on the position and momentum of a particle. A second part, mainly theoretical, develops the Schrödinger equation and the mathematical tools necessary to describe the states and observables of a quantum system. The final part of the course shows the determination of stationary states for a particle in a one-	Barletta
Aerospace and Climate Change	Formazione disciplinare e multidisciplinare	Carico didattico ordinario	1.6	8	Idoneità	IN PRESENZA e ONLINE 2025	1,2,3	The course will provide students with an in-depth understanding of the interactions between the aerospace sector and climate change, preparing them to make significant contributions to reducing the environmental impact of the sector. Through a series of 4 lessons (2 hours each) the following objectives will be pursued: 1.Understand interactions between aerospace sector and climate change. 2.Analyze the environmental impact of aerospace activities. 3.Explore technologies and strategies to reduce the environmental impact of the aerospace industry.	Mirco Cantelli (est)
Seminari "Ciclo primo semestre"	Seminari	Coordinamento	1	25		IN PRESENZA e ONLINE - Nov-24/Apr-25	1,2,3	Non-programmable disciplinary, multidisciplinary and transdisciplinary seminars/ Seminari disciplinari, multidisciplinari, transdisciplinari non programmabili	
Seminari "Ciclo secondo semestre"	Seminari	Coordinamento	1	25		IN PRESENZA e ONLINE - Mag-25/Set-25	1,2,3	Non-programmable disciplinary, multidisciplinary and transdisciplinary seminars/ Seminari disciplinari, multidisciplinari, transdisciplinari non programmabili	