

# Educational Program

## Guidelines to build up the learning plan

### Generalities

The "Manifesto degli Studi" (MS), or Educational Program, outlines, year by year, the educational activities, both collegial and individual, carried out to implement the training process for the students of the PhD program in Mathematics, Physics, and Applications for Engineering at the University of Campania "Luigi Vanvitelli."

The Training Plan is the document that details the training path of each student.

For each individual PhD cycle, the Educational Program and the Learning Plan are approved by the Academic Board (henceforth referred to as the Board). The Board is also responsible for the training process of each student; in the implementation of its competences, the Board is supported by the Supervisor and at least one co-Supervisor for each student, along with any necessary advisory discussions.

The awarding of the PhD title is based on the credit system (CFU). Credits are acquired by completing the activities outlined in the Training Plan. The credits that can be obtained are determined for each activity on the basis of the overall commitment required of the student in terms of study and learning.

In order to be admitted to the final exam, the student must have acquired 60 CFU per year, for a total of 180 CFU.

The training process is structured into:

- - Educational activities;
- - Scientific activities;
- - Auxiliary activities.

### Educational activities

Teaching activities are divided into:

- Alignment teaching, specifically for first-year students. Its goal is to standardize the students' skills and knowledge. When necessary, it is prescribed and personalized for each student, considering the educational background gained prior to entering the Ph.D Program.
- Basic collegial teaching, typically intended for all students of the Program, organised in part within the Graduate School in Mathematics, Physics and Applications for Engineering or by the University. It includes: interdisciplinary, multidisciplinary and transdisciplinary training; language training; IT training; teaching related to research management and the enhancement and dissemination of results, intellectual property and open access to data and research products, and the fundamental principles of ethics and integrity.

For the list of mandatory courses within the basic teaching activities, refer to Table 2.

- Advanced teaching, typically intended for specific groups of students of the course. Advanced teaching is usually delivered through higher-level courses taught by professors of the Board or, in exceptional cases, highly qualified external professors. PhD students must choose at least 4 courses, for no less than 15 CFU, from those offered in the Educational Program, as detailed below. A further list of courses organised in partnership between our Ph.D. Program and the Ph.D. Programs in Physics at the University of Bari "A. Moro", the University of Salento, Lecce, and the University of Naples "Federico II" will be added to the list of proposed courses. It is envisaged that 1 of the courses to be chosen in the Educational Program may be replaced by one or more course modules within the framework of the partnership. Similarly, 2 of the courses selected from the Educational Program can be replaced by 2 or more course modules offered by other Doctoral Courses (even SUPRA) or

through national or international Schools of Higher Education. The recognition of the corresponding CFU takes place following proof of attendance and the successful completion of a final exam.

For the purposes of acquiring further CFU, PhD students may also attend courses offered by other PhD Programs, subject to the approval of their Supervisors and the Coordinator. In this case, the number of CFU will correspond to what is established in the MS of the corresponding Ph.D. Program, and the recognition of the CFU will take place following proof of attendance and the successful completion of a final exam.

Training activities carried out as part of national or international higher education schools can also be recognized, subject to the approval of the Supervisors and the Coordinator. Any educational activities not included among those listed above will be evaluated on a case-by-case basis by the Board.

For the list of courses in advanced teaching activities, refer to Table 3.

### Scientific Activities

Scientific activities are divided into

- experimental, theoretical and numerical activities aimed at achieving scientific objectives;
- preparation of scientific papers to be presented at national or international conferences, or to be published in national or international journals;
- participation in scientific conferences, workshops, symposia and seminars;
- preparation and production of documents (reports, procedures, etc.) of scientific relevance;
- participation in the work of national or international research groups;
- participation in technology transfer activities;
- writing of the thesis;
- any other activity to be defined by the Board.

The recognition of credits for an activity requires, where applicable, a certificate of participation issued by the entity that organised the activity.

### Subsidiary activities

Other activities include

- Subsidiary or supplementary teaching activities within the limits specified by the PhD Course Regulations;
- proposal and organization of scientific projects;
- third mission activities: relations with schools or local authorities; organisation or participation in science dissemination events (e.g. Researchers' Night, Futuro Remoto);
- contribution to the organisation of scientific or higher education events;
- any other activity deemed useful, in the opinion of the Board, for the students training.

### **Admission to the following year or to the final examination**

Each PhD student is required to pass at least 2 exams related to the specialized courses during the first year by November 30, 2024, in order to be admitted to the second year.

At the end of each year, the Board, during the evaluation process, for each student

- recognises the credits acquired for the activity carried out during the year on the basis of a descriptive report of the activity performed, possibly supported by a presentation, and the opinion of the supervisor
- authorises admission to the final examination or advancement to the next year if the requirements are met, and possibly defines the activities to be carried out for the recovery of unacquired credits.

## Temporal Distribution of Activities in the Educational Process

As a rule, the activities in each student's educational process follow the time distribution summarised in Table 1. Specific needs may suggest, for individual students, different arrangements, e.g. students who have been awarded scholarships funded by an institution or a company may agree with the them on a personalized educational plan in line with their scientific interests and consistent with the educational goals of the PhD Course.

*Table 1. Time distribution of CFU's to be acquired during the Ph.D. program*

	<b>First Year</b>	<b>Second Year</b>	<b>Third Year</b>	<b>CFU</b>
Educational activity	16-40	4-20	0-10	<b>26-52</b>
Scientific activity	20-44	35-56	35-60	<b>120-154</b>
Subsidiary activity	0-15	0-15	0-15	<b>0-24</b>
<b>Total</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>180</b>

## Course Evaluation System

The evaluation system of the training pathway, framed within the broader evaluation system of the PhD Course, includes the following specific activities:

- evaluation of the Course by the graduate students (organisation, articulation, educational programme, facilities, tutoring, availability of funds, etc.);
- evaluation of the Course by the members of the Board (organisation, prerequisites, facilities).

The organisation and management of the Evaluation System are the responsibility of the Board, which also defines its practical implementation (operational tools, timelines, responsibilities, etc.).

## List of the courses for the academic year 2024/2025

**Table 2: Basic courses and seminars (compulsory)**

Activity	Description
English course	Advanced English language courses are offered, organized at the Doctoral School and/or Athenaeum level. In addition, the University offers free language courses on the Rosetta Stone platform, with the option of 24 languages.
<u>Course: Introduction to modern computing infrastructures (Prof. M. Iacono)</u> <u>4 CFU 16 hours</u>	The course aims to provide doctoral students with the basic knowledge of modern computing infrastructures, presenting the main small- and large-scale computing infrastructures, in order to enable them to use them appropriately for the requirements of using and developing specialised computer applications for research problems. After an introduction to the characteristics of modern computing nodes and computer networks, the course presents the main topics related to the architecture, organisation and software support offered by today's large-scale computing systems, with particular reference to massively distributed architectures and cloud applications. The course also includes an introduction to the performance evaluation of these systems and the related modelling.
Valorization and dissemination of results, intellectual property and open access to research data and products  <u>Course: Data Management (Prof. L. Campanile)</u> <u>2 CFU 8 hours</u>	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 presents fundamental concepts in data management, emphasizing data as a critical resource and the importance of its proper handling, particularly regarding personal data protection and its role in decisional processes. The course focuses on foundational aspects of data management and regulations related to data protection, especially the GDPR, which is crucial for scientific research.
Management of research and knowledge of European and international research systems	Mandatory courses for PhD students are organized at the University level and are taught by experts from APRE, European Research Promotion Agency: 1) Open access & science 1 module; 2) Dissemination, Communication & Exploitation: how to maximise results, 1 module; 3) Possible post-PhD training paths.
Valorization and dissemination of results, intellectual property and open access to research data and products	Common seminars to all doctoral programs are provided on Spin-Offs and Start-Ups in research; introductory concepts and prerequisites for starting a business; business model and regulations; and the innovation ecosystem supporting start-ups.
Fundamental principles of ethics, gender equality, and integrity.	The University, in cooperation with the Agency for the Promotion of European Research (APRE), organises session on introduction to the Horizon Europe calls. Topics on Ethics in Horizon and Gender in Horizon Europe will be presented. PhD students will be stimulated to reflect on the (gender) orientation of research and its role in European funding programmes.

**Table 3. Advanced courses**

Name	Lecturer	SSD	ECTS	HOURS	YEAR	Period
Patent as an inventive research activity	A. Capece	ICAR/13	6	24	1	September
Algebraic and geometric methods in combinatorics and coding theory	O. Polverino/F. Zullo	MAT/03	4	16	1	March/July
Spline models for regression analysis	R. Campagna	MAT/08	4	16	1	January/February
Theory of nuclear forces	L. Coraggio	FIS/02	4	16	1	February
Physics for Space Application	M. De Cesare	FIS/07	4	16	1	Oct/Nov
Research in mathematics Education	U. Dello Iacono	MAT/04	4	16	1	June/July
Stability analysis of open-channel flows with Newtonian and non-Newtonian fluids	M. Iervolino	ICAR/01	5	20	1	Oct/Nov
Biophotonics for clinics and environment	M. Lepore/ I. Delfino	FIS/07	4	16	1	April/June
An Introduction to Linear Dynamics	E. D'Aniello	MAT/05	4	16	1	May
Biophysical mechanisms and therapeutic implications of human exposure to ionizing radiation	L. Manti	FIS/07	5	20	1	October/November
Petri Nets and their applications in science and engineering	S. Marrone	INF/01	5	20	1	February/April
New Concepts and Materials for Applications in Photovoltaics, Energy Storage and Electronics	G. Landi	FIS/01 ING- INF/01	5	20	1	Apr/Jul
Computational solid and structure mechanics: Finite elements and Boundary elements	V. Minutolo	ICAR/08	5	20	1	Mar/Apr
Principle of non-Newtonian Fluid Mechanics	C. Carotenuto/M. Minale	ING- IND/24	5	20	1	September
Numerical Applications for Physics and Engineering	B. Morrone	ING- IND/10	5	20	1	June/July
Navier-Stokes equations: an introduction to the well(ill)-posed initial boundary value problem.	P. Maremonti	MAT/07	5	20	1	Mar/Apr
Digital Signal Processing	L. Verde	INF/01	5	20	2	April/June
Stochastic Processes and Analysis of Correlations	E. Lippiello/A. Sarracino	FIS/02	4	16	2	February/March

Astrophysics with ultra-high-energy neutrinos and Neutrino Telescope	P. Migliozi	FIS/04	2	8	1	
Semilinear elliptic problems: A variational Approach	B. Pellacci	MAT/05	5	20	1	Apr/May
An introduction to Reaction-Diffusion Equations.	B. Pellacci	MAT/05	5	20	2	Apr/May
Isotope Physics and Methodologies	F. Marzaioli	FIS/07	5	20	1	June
Numerical methods for smooth and non-smooth optimization	S. Crisci	MAT/08	4	16	1	Mar/Apr
Optics and Photonics for advanced multimodal metrology	P. Ferraro	FIS/07	4	16	1	Oct/Nov
Label free phase contrast microscopy: principles and applications	L. Miccio/V. Bianco	FIS/07	4	16	1	Oct/Nov
Pyro-electrohydrodynamics and advanced technologies for soft-matter manipulation	S. Coppola/S.Grilli	FIS/07	4	16	1	Oct/Nov
Statistical Methods in Experimental Sciences	F. Terrasi	FIS/07	5	20	1	Apr/May
Pseudofinite structures	P. D'Aquino	MAT/01	4	16	1	Jan/July
Some aspects of Brace Theory	A. Russo	MAT/02	5	20	1	
Introduction to homogenization of elliptic equations	F. Murat	MAT/05	4	16	1	Mar/Apr
Low-energy nuclear physics techniques and their applications	R. Buompane	FIS/04	4	16	1	Mar/June
Natural Language Processing: State-of-Art, Tools and Open Challenges	F. Marulli	INF/01	5	20	1	June/Sept
Cavity-enhanced spectroscopy	L. Gianfrani/ P. Maddaloni	FIS/03	4	16	1	March/April

For the course contents, refer to the List of Specialized Courses.

For the list of the courses within the partnership with Physics Doctorates of the University of Bari "A. Moro", the University of Salento, Lecce, and the University of Naples "Federico II", refer to the PhD webpage, link to Supra Courses.