Educational Program
Guidelines to build up the learning plan

Generalities

The Educational Program indicates, year by year, the activities, both collective and individual, available for the realisation of the training process of the students of the PhD Course in Mathematics, Physics and Applications for Engineering at the University of Campania "Luigi Vanvitelli".

The Learning Plan is the document that details the training pathway of each student.

For each individual PhD cycle, the Educational Program and the Learning Plan are approved by the Board of Professors (henceforth referred to as the Board). The Board is also responsible for the training process of each student; in the implementation of these competences, for each student the Board is assisted by the Supervisor and at least one co-Supervisor, and by possible preliminary discussions.

The acquisition of the degree is based on the system of training credits (CFU). Credits are acquired by completing the activities set out in the Learning Plan. The credits that can be acquired 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 examination, the student must have acquired 60 CFUs per year, for a total of 180 CFUs.

The training process consists of:
- - Educational activities;
- - Scientific activities;
- - Subsidiary activities.

Educational activities

Teaching activities are divided into:
- Alignment teaching, of specific interest to first-year students. It is aimed at standardising the students' skills and knowledge. When necessary, it is prescribed and customised for each student, taking into account the training curriculum accrued before entering the Doctoral Course.
- Collective basic teaching, typically intended for all the students of the Course, organised in part within the Doctoral School in Mathematics, Physics and Applications for Engineering or by the University. It includes: interdisciplinary, multidisciplinary and transdisciplinary training; language training; computer training; research management and the exploitation and dissemination of results, intellectual property and open access to data and research products and the fundamental principles of ethics and integrity.
  See Table 2 for a list of mandatory basic courses.
- Advanced teaching, typically intended for specific groups of students of the course. Advanced teaching is typically delivered by means of higher education courses taught by internal or, exceptionally, external highly qualified lecturers. PhD students must choose at least 4 courses, for no less than 15 ECTS, from those proposed in the Educational Program, as detailed below. A further list of courses organised in partnership between our Doctorate and the Physics Doctorates of 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 to be chosen in the Educational Program may be replaced by 2 or more modules of courses provided by other Doctoral Courses (even SUPRA) or within national or international Schools of Higher Education or international Schools of Higher Education,

and the recognition of the relative CFUs takes place once and the attestation of attendance of the lessons is provided together with the certification of the final exam passing.

For the purposes of acquiring further CFUs, PhD students may also attend lectures provided by other PhD courses, subject to the approval of the Supervisors and the Coordinator. In this case the number of CFU corresponds to the number established in the Educational Program of the corresponding PhD course and the recognition of the relative CFUs takes place attendance of the classes is provided together with the certification of the final exam passing. The Training activities carried out within the framework of national or international Schools of Higher Education may be recognised, subject to the approval of the Supervisors and the Co-ordinator. Any teaching activities not included among those listed above will be assessed on a case-by-case basis by the Board of Professors.

Please refer to Table 3 for the list of advanced teaching activities.

Scientific Activities

Scientific activities are divided into
- experimental, theoretical or 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 to scientific conferences, congresses, symposia and seminars;
- preparation and production of documents (reports, procedures, etc.) of scientific importance;
- participation in the work of national or international research groups;
- participation in technology transfer activities;
- thesis writing;
- any other activity to be defined by the Board.

Recognition of credits for an activity requires, where applicable, a certificate of participation issued by the body that organised the activity.

Subsidiary activities

Other activities include
- Subsidiary or supplementary teaching activities within the limits specified in the Regulation of the PhD Course;
- proposing and organising scientific projects;
- third mission activities: relations with schools or local authorities; organisation of 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 useful, in the opinion of the Board, to the training of students.

Admission to the following year or to the final examination

Each PhD student is required to take at least 2 exams related to the specialized courses in the first year by November 30, 2024, for the purpose of admission to the second year.

The Board, at the end of each year, in the final phase, for each of the students
- recognises the credits acquired for the activity carried out during the year on the basis of a descriptive report of the carried-out activity, a public presentation, if any, and the opinion of the supervisors
- authorises admission to the final examination or passage to the following year if the requirements are met, and possibly defines the activities to be carried out to recover credits not acquired.

Temporal Distribution of Activities in the Training Process

As a rule, the activities of each student's training process respond to the time distribution summarised in Table 1. Specific needs may suggest, for individual students, different arrangements, e.g. students who have won grants funded by an institution or a company may agree with the latter on a customised training plan in line with their scientific interests and consistent with the training objectives of the PhD Course.

Table 1. Time distribution of CFU's to be acquired in the doctoral program

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

Course Evaluation System

The evaluation system of the training pathway, within the more general evaluation system of the PhD Course, requires for the following specific activities:
- evaluation of the Course by the students (organisation, articulation, training programme, facilities, tutoring, availability of funds, etc.);
- evaluation of the Course by the lecturers (organisation, prerequisites, facilities);

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

List of the courses a.a. 2023/2024

Table 2: Basic courses and seminars (compulsory)

Activity	Description
English course	English language improvement courses are planned, organized at the Doctoral School and/or Athenaeum level. In addition, free language courses are available to doctoral students on the Rosetta Stone platform, with a choice of 24 languages.
Introduction to modern computing infrastructures (Prof. M. Iacono) 4 ECTS	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 Seminar on Data Management (Prof. M. Mastroianni) 2 ECTS	A series of seminars in data management is planned as part of the teaching activities organised at the level of the School of Engineering and Basic Sciences. The aim is to present the fundamental concepts and theories in data management in order to promote their application to research activities and professional practice. Fundamental concepts on data management in research and professional practice are presented: database management systems, database architectures, the role of data in decision-making processes, data life cycle, data protection regulations, drafting a data management plan.
Management of research and knowledge of European and international research systems	Courses, compulsory for PhD students, are organised at the Athenaeum level, held by experts from the European Research Promotion Agency (APRE) by the Athenaeum: 1) Open access & science 1 module; 2) Dissemination, Communication & Exploitation: how to maximise results, 1 module; 3) Possible post-PhD training paths 1 module.
Valorization and dissemination of results, intellectual property and open access to research data and products	There are three modules of 4 hours each, common to all PhDs, on Spin Off and Research Start-ups; introductory concepts and prerequisites for starting a company; the business model and regulations; the innovation ecosystem supporting start-ups.
Principi fondamentali di etica, uguaglianza di genere e integrità	The University, in cooperation with the Agency for the Promotion of European Research (APRE), organises information paths on the Horizon Europe calls. There are modules on Ethics in Horizon and Gender in Horizon Europe. PhD students will be stimulated to reflect on the (gender) orientation of research and the role in European funding programmes. Two modules are common to all PhDs.

Table 3. Advanced courses

Name	Lecturer	SSD	ECTS	HOURS	YEAR	Period
Patent as an inventive research activity	A. Capece	ICAR/13	6	24	1	
Algebraic and geometric methods in combinatorics and coding theory	O. Polverino/F. Zullo	MAT/03	4	16	1	Mar/May
Spline models for regression analysis	R. Campagna	MAT/08	4	16	1	Feb/Mar
Theory of nuclear forces	L. Coraggio	FIS/02	4	16	1	Feb
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/Jul
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	Apr/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	Oct/Nov
Petri Nets and their applications in science and engineering	S. Marrone	INF/01	5	20	1	Feb/Apr
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	Apr/June
Stochastic Processes and Analysis of Correlations	E. Lippiello/A. Sarracino	FIS/02	4	16	2	Feb/Mar
Astrophysics with ultra-high-energy neutrinos and Neutrino Telescope	P. Migliozzi	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
Model theoretic analysis of algebraic structures	P. D'Aquino	MAT/01	4	16	1	Mar/July
Introduction to Set Theory	P. D'Aquino	MAT/01	4	16	2	Mar/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

For the course contents, refer to the List of Specialistic 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.