UNIVERSITY OF L'AQUILA

Department of Physical and Chemical Sciences

Degree profile of

1st Cycle Degree in PHYSICS

Laurea in FISICA

DEGREE PROFILE OF **Laurea in FISICA** ***Bachelor in PHYSICS***

TYPE OF DEGREE & LENGTH	Single degree (180 ECTS credits, 3 years)
INSTITUTION(S)	Università degli Studi dell'Aquila, Italy – University of L'Aquila
ACCREDITATION ORGANISATION(S)	Ministry of Education (Italy)
PERIOD OF REFERENCE	MIUR, validated for 3 years, for cohorts starting on October 2012
CYCLE /LEVEL	QF for EHEA: 1st cycle; EQF level: 6; Italian NQF: Laurea

A	PURPOSE
	The main objective of the course is to form graduates who have the necessary basic skills and knowledge in Physics, both theoretical and experimental, envisaging various employment capabilities and careers and to prepare students with particular interest in specialised areas of Physics for further studies.

B	CHARACTERISTICS	
1	DISCIPLINE(S) / SUBJECT AREA(S)	Physics; Mathematics; Informatics; Chemistry; Others (65: 20: 5: 5: 5)
2	GENERAL / SPECIALIST FOCUS	General education in basic experimental and theoretical Physics.
3	ORIENTATION	The degree program is primarily oriented in research, with a strong component of applicative skills in the several contexts. Education is provided envisaging specific employment/career opportunities: General Physics (topics in Theoretical, Applied and Experimental Physics), Numerical applications in Physics with significant computer science, fundamentals of condensed matter physics, nuclear physics, quantum mechanics, fluids dynamics, electronics.
4	DISTINCTIVE FEATURES	The program is organized in a stimulating environment where basic sciences are linked to learning and research activities. Courses are taught also in English if there are foreign students attending.

C	EMPLOYABILITY & FURTHER EDUCATION	
1	EMPLOYABILITY	The main employment opportunities are as following: positions in companies and small enterprises as well as in public and private institutions (research, quality assurance, commerce) active in the technological and informatics sector, bio-medical and pharmaceutical sector, environmental sector, electronic sector. Positions in financial institutions. Teaching positions.
2	FURTHER STUDIES	Master programs in Physics (theoretical, applied and experimental), interdisciplinary programs related to Physics (Physical Engineering, Biophysics, Medical Physics, Geophysics, Mathematical Engineering), Master programs in engineering/technological

		physics and Informatics.
D	EDUCATION STYLE	
1	LEARNING & TEACHING APPROACHES	Lectures, laboratory classes, seminars, small group work, individual study based on text books and lecture notes, individual consultations with academic staff, preparing Diploma dissertation.
2	ASSESSMENT METHODS	Written exams, oral exams, laboratory reports, oral presentations, continuing assessments, final comprehensive exam, assessment of Diploma dissertation.
E	PROGRAMME COMPETENCES	
1	GENERIC	
	— Capacity for Analysis and synthesis: Capacity for analysis and synthesis using logical arguments and proven facts. — Flexible mind: acquisition of a flexible mind, open to apply basic physical knowledge and competences in a wide range of job opportunities and in everyday life. — Team-work: capability to perform guided teamwork in a lab setting and related special skills demonstrating capacity for handling the rigor of the discipline and for time management (including meeting deadlines). — Communication skills: Ability to communicate effectively and to present complex information in a concise manner orally and in writing and using ICT and appropriate technical language. — Popularization skills: Ability to communicate with non-experts, including some teaching skills. — Physics culture: Ability to provide explanations of a wide range of processes and objects (both natural and technological) and ability to model them — Learning ability: ability, through independent study, to enter new fields by means of the acquired physics knowledge. — Problem solving: capacity to handle stress and to deal effectively with practical problems. — Knowledge of a second major European language. — Ability to work autonomously. — Decision-making. — Capacity to adapt to new situations. — Ethical commitment	
2	SUBJECT SPECIFIC	
	The programme meets all the specific competences as established and agreed in collaboration with the field stakeholders, clustered within the key overarching competences summarized below. At the end of the programme the graduates should be able to: Physics-related cognitive abilities and skills - Deep knowledge and understanding: Ability to analyse physical phenomena (both natural and technological) in terms of fundamental physics principles and by means of appropriate mathematical methods. - Estimation skills: Ability to understand and master the use of the mathematical and numerical methods most commonly used in physics - Mathematical skills: ability to understand and master the use of the mathematical and numerical methods most commonly used in physics. - Physics culture: Ability to provide explanations of a wide range of physical natural phenomena and processes (both natural and technological) at various scales (from the universe as whole to subatomic particles and processes), using knowledge and understanding from different physics topics and theories. - Learning ability: ability to enter new fields and problems using the acquired physics and mathematical knowledge by means of independent study. - Communication skills: ability to present scientific material and arguments in writing and orally to an informed audience. Physics-related practical skills - Experimental skills: Ability to perform experiments independently as well as to describe, analyse and critically evaluate experimental data. - Computational skills: Ability to use appropriate software such as programming languages and packages to solve physics problems and simulate physical and natural problems	

	- Data Management skills: demonstrate skills in monitoring, by observation and measurement of physical properties, events or changes, and the systematic and reliable recording and documentation thereof. - Data Interpretation skills: ability to interpret data derived from laboratory observations and measurements in terms of their significance and relate them to appropriate theory.
F	COMPLETE LIST OF PROGRAMME LEARNING OUTCOMES
	Graduates of the 1st Cycle Degree in Physics have an integrated theoretical and practical knowledge allowing them to address their interest of specialization to several connected fields. These graduates will acquire: Knowledge and understanding — Ability to demonstrate knowledge and understanding of Physics fundamentals in: classical mechanics, vibrations and waves, optics and spectroscopy, thermodynamics, electromagnetism, quantum physics, basic nuclear, atomic and molecular physics. The level of this knowledge of general and modern physics is basic, i.e. the level needed to work in established areas of applications but not as high as needed for advanced research. — Ability to demonstrate knowledge and understanding of mathematics relevant for physics at a basic level, i.e. differential and integral calculus, algebra, analytic functions of real and complex variables, vectors and matrices, vector calculus, ordinary and partial differential equations, statistics, Fourier methods and furthermore capability of using such tools in physics applications. — Ability to demonstrate knowledge and understanding, at a basic level, of elements of fundamental theoretical physics issues (analytical mechanics, classical electromagnetism, relativity etc.; quantum physics, statistical mechanics) to appreciate the role of models and theories in the development of physics. — Ability to demonstrate knowledge and understanding, at a basic level, of modern physics (atomic and molecular, nuclear and sub-nuclear, solid state, astrophysics) with some exposure to advanced research. — Ability to apply knowledge and understanding, at an operative level, of elements of applied physics and related subjects (chemistry, electronics and related). — Basic knowledge and understanding of special fields chosen by the student: theoretical physics, condensed matter physics, medical physics, atmosphere physics, space physics, astroparticle physics, informatics, statistics in order to prepare for future specialization and/or interdisciplinary approaches. Ability to apply knowledge and to understand — Ability to apply experimental skills in physics (i.e. knowledge of experimental methods and how to perform physics experiments) under supervision, in order to test hypotheses and to investigate phenomena and their physical laws (i.e. familiarity with most common instrumentations, designing assembling and performing experiments: collecting and analyzing data, including error analysis and critical evaluations of experimental results). — Ability to apply knowledge and understanding in other areas as mathematics, astronomy, chemistry, biology, engineering, computer science, information and communication technology, economics, accountancy, actuarial science, finance and many others. — Ability to perform computer calculations related to physics problems developing and/or using appropriate software and at least one programming language, learning how to analyze and display results. — Ability to apply the acquired knowledge in practical situations, identifying problems and proposing solutions in practical situations involving physics and/or other scientific problems. — Acquisition of good working habits concerning both working alone (e.g. diploma thesis) and in teams (e.g. lab reports, including team-leading), achieving results within a specified time-frame, with an emphasis on awareness about professional integrity and on how to avoid plagiarism. Judgment skills — Ability to gather and interpret relevant scientific data and make judgments that include reflection on relevant scientific and ethical issues. — Ability to plan and conduct an experiment, planning times and methods, using independent judgment skills in evaluating and quantifying results. — Ability to formulate an analytical problem and propose ideas and solutions. — Ability to give opinions that include reflection on important scientific issues. — Ability to find and evaluate information sources, data, and physics literature. Communication skills — Demonstrated proficiency in using English language, including subject area terminology, for literature search and communication skills. — Ability to communicate the main fundamentals of classical mechanics and modern physics to non-experts. — Ability to communicate orally and in writing information, ideas, problems and solutions to informed audiences. — Ability to interact with other people and work in a team. — Ability to report and present experimental data also with the aid of multi-media systems. — Ability to describe and communicate on general subjects in simple and critical terms.

	Learning skills — Ability to search for data/information from available sources and to search pertinent literature, analyze information critically and come to conclusions supported by a personal motivated reasoning — Ability to learn and stay up-to-date looking for relevant literature and autonomously studying new issues in fundamental modern physics. — Learning skills necessary to adapt to different working environments and deal with a range of themes. — Learning skills necessary to pursue objectives, working both alone and in a group.

Comprehensive Scheme of the First Cycle Degree in PHYSICS				
YEAR	**CODE**	**COURSE**	**Credits (ECTS)**	**Semester**
I	F0001	Geometry	9	1
	F0002	Mathematical Analysis I	12	1
	F0003	An Introduction to Physics laboratory	6	1
		English	3	1
	F0004	Mechanics and Thermodynamics	12	2
	F0005	Laboratory of Mechanics and Thermodynamics	12	2
	F0006	Chemistry	6	2
II	F0007	Mathematical Analysis II	9	1
	F0008	Electromagnetism	12	1
	F0011	Laboratory of Computational Physics	9	1
	F0010	Classical Mechanics	6	2
	F0009	Laboratory of Electromagnetism and Optics	9	2
	F0012	An Introduction to Modern Physics	9	2
	DF0002	Mathematical Physics I	6	2
III	DF0003	Mathematical Physics II	6	1
	F0014	Introduction to Theoretical Physics	12	1
	F0016	Laboratory of Electronics	6	2
	DF0004	Fundamentals of Condensed Matter Physics	6	2
	DF0005	Fundamentals of Nuclear Physics	6	2
	F0017	Physics of Fluids	6	2
		Free choice Course/Courses	12	1,2
		Thesis	6	2