



UNIVERSITY OF CRETE
DEPARTMENT OF PHYSICS
GUIDE TO UNDERGRADUATE STUDIES

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PREFACE

In the present document we describe the undergraduate program of the Department of Physics of the the University of Crete. The presentation is brief, but to the point, as a more extended discussion of the program is available in Greek. The new structure of the undergraduate program was a result of several months of analysis by the Undergraduate Program Committee, and it was validated during the General Assembly of the Department of Physics, which took place on November 3rd 2008. This new program is in effect since January 1st 2009. We believe that it is a clear improvement of the previous program, as it addresses the modern challenges facing our undergraduates, and continues the tradition of excellence in education offered by our Department over its 30 year long history.

Heraklion, 1 December 2018

Vassilis Charmandaris, Professor of Physics
Chair of the Undergraduate Program Committee

Iossif Papadakis, Professor of Physics
Chairman of the Department of Physics

SUMMARY

In this document we present the requirements for obtaining a Bachelors Degree (BSc) in Physics from the Department of Physics of the University of Crete, along with a description of the major characteristics of the undergraduate program. In brief to obtain a BSc in Physics:

- ❑ An individual must have been registered as a full time student for a period minimum of 8 semesters. During this period the student must have successfully completed (i.e. «passed») courses corresponding to a total load of at least 240 ECTS (=European Credit Transfer System).
- ❑ From the 240 ECTS necessary for graduation, 144 must be from the 22 compulsory courses of the Department (Category A), at least 40 from courses of Category B, and the remaining – if it is necessary – from courses of Category C.

1. CATEGORIES OF COURSES

The Department offers a number of courses, which are distributed to the following categories:

- ❑ Courses of Category A - «Compulsory Courses»
The Compulsory courses are 22, they represent the most important courses offered by the Department at least once a year and they are presented in Table A. All undergraduate physics students are required to successfully complete those courses, and consequently accumulate their 144 ECTS.
- ❑ Courses of Category B – «Main Physics Directions»
The courses of Category B are presented in Table B. These are either undergraduate or graduate level courses of the Department covering major areas in modern physics. Every effort is made that these courses are offered every year. All undergraduate students are required to successfully complete a number of Category B courses they choose, which correspond to at least 40 ECTS.
- ❑ Courses of Category C – «Special Topics in Physics»
The courses of category C comprise the rest of the courses offered by the Department in more focused areas physics and related disciplines. This category also included all other courses offered by various departments of the University of Crete that a physics undergraduate may follow. At the beginning of each semester, the Department, based on the resources available, announces which courses of Category C will be offered.

The Department of Physics reserves the right not to offer a Category B or C course if the number of students registered to it is less than five (5).

2. MAIN RULES OF THE PHYSICS CURRICULUM

The following five basic rules determine the way a physics undergraduate student may select his/her courses in order to complete the curriculum and eventually obtain a BSc degree in Physics.

- ❑ The maximum number of courses to which a student may register per semester is eight (8)
- ❑ At a given semester a student must register to a maximum of eight (8) courses in the following order:
 1. All past semesters courses of Category A offered that the student has not "passed" in the order they appear in Table A.
 2. All Category A courses offered, which belong to the current semester the student is registered, in the order they appear in Table A.
 3. Any course of Category B or C the student wishes to follow.
- ❑ It is considered that a student has successfully completed (i.e. "passed") a course only if a) the course was among the 8 possible courses the student had registered b) the student has obtained a passing grade, that is five (5) out ten (10), during the finals of the same semester or during the make up examinations (typically in September) of the same academic year. The minimum grade for a course is zero (0), the maximum is ten (10), and the minimum possible increment is one half (0.5).
- ❑ If a student has not "passed" a course he/she was registered for during the Fall or Spring semester, he/she may take the make up examination (typically in September) during the same academic year. If the student fails again, he/she has to include the course in his/her registration in a following semester in order to be able to be examined on the course.
- ❑ If a student has passed a course during the examination period of the Fall or Spring semester, he/she may opt to be examined again during the make up examination period of the same academic year in order to improve his/her grade. To do so, the student must request this in writing from the Undergraduate Secretariat at least 15 days in advance of the make up examination period. If the new grade is lower from the one she/he already had, the previous, higher, grade remains in the student record.

The final Grade Point Average (GPA) is calculated as the average of all grades in courses weighted by the ECTS of each course. The GPA is given with an accuracy of two decimals. If a student has accumulated more than 240 ECTS, the extra courses of Category B and C with the lowest grade are removed from the GPA calculation, always ensuring that the total is load is equal or more than 240 ECTS.

3. RECOMMENDED PHYSICS CURRICULUM

The Department of Physics recommends the following curriculum of courses that can be followed by an undergraduate who wishes to obtain a BSc in Physics. The nominal length of studies is 8 semesters. The following Table includes an abbreviated name of each course along with the corresponding code in a parenthesis. Table A provides the full name of the course. Courses in Category B and C are indicated with the general term "Elective Course".

Semester			
1 st	2 nd	3 rd	4 th
Physics I (Φ101)	Physics II (Φ102)	Modern Physics I (Φ201)	Modern Physics II (Φ202)
Mathematics I (Φ111)	Mathematics II (Φ112)	Diff. Eqs. I (Φ211)	Diff. Eqs II (Φ212)
Math for Physics I (Φ113)	Physics Lab I (Φ108)	Physics Lab II (Φ207)	Classical Mechanics I (Φ204)
English I (Φ011)	English II (Φ012)	<i>Elective Course</i>	Physics Lab III (Φ208)
Intro to Computing (Φ150)	Comp. Program (Φ151)	<i>Elective Course</i>	<i>Elective Course</i>

Semester			
5 th	6 th	7 th	8 th
Quantum Mech. I (Φ303)	Electromagnetism I (Φ301)	From Quarks to Universe (Φ403)	<i>Elective Course</i>
Thermo-Stat (Φ405)	<i>Elective Course</i>	<i>Elective Course</i>	<i>Elective Course</i>
Advanced Lab (Φ307)	<i>Elective Course</i>	<i>Elective Course</i>	<i>Elective Course</i>
<i>Elective Course</i>	<i>Elective Course</i>	<i>Elective Course</i>	<i>Elective Course</i>

Even though the above curriculum is not compulsory and each student may organize the courses he/she wishes to follow, the Department of Physics considers that it is not wise to deviate substantially from it. The material covered by each course offered during an advanced semester assumes a solid knowledge of the material covered in all previous courses.

With the exception of the four compulsory Physics Labs there are no strict prerequisites for any course. However, if a student who has not passed basic courses of the first years wishes to register to an advanced course it is highly recommended to discuss this with the instructor of the course or the Physics faculty who acts as his/her undergraduate advisor.

4. COMPULSORY PHYSICS LABORATORIES

Due to their unique nature, the rules governing the attendance and evaluation of the four undergraduate compulsory physics laboratories (Φ-108, Φ207, Φ208, Φ307) are different. These are described in detail in Appendix B of the Greek version of this Guide. In brief they are the following:

- ❑ Each semester a student may register to no more than one of the previously mentioned laboratories.
- ❑ The course "Physics Lab I (Mechanics & Thermodynamics)" (Φ-108) has as prerequisite the course "General Physics I" (Φ-101) or the course "Physics Concept Grinders" (Φ-107).
- ❑ The course "Physics Lab II (Electricity & Magnetism)" (Φ-207) has as prerequisite the courses "General Physics II" (Φ-102) and "Physics Lab I (Mechanics & Thermodynamics)" (Φ-108).
- ❑ The course "Physics Lab III (Optics)" (Φ-208) has as prerequisite the course "Physics Lab II (Electricity & Magnetism)" (Φ-207).

- ❑ The course "Advanced Physics Lab" (Φ -307) has as prerequisite the courses "Introduction to Modern Physics I" (Φ -201) and "Physics Lab III (Optics)" (Φ -208).

5. FOREIGN LANGUAGES

All Physics undergraduates who have been admitted after the academic year 2008-2009 they have among the 22 compulsory courses of their curriculum two courses in English: " Φ -011: English I" and " Φ -012: English II".

Students who have a degree of "Proficiency" in English may, if they wish, be exempt of the final examination in the course " Φ -011: English I" with a grade of seven (7). The students must have registered for the course and must make a request in writing to the Secretariat of the Department providing the necessary documentation that he/she holds the "Proficiency". A student who wishes to improve this automatic grade in " Φ -011: English I", may be examined in this course during the exam periods of the year he/she was registered for the course.

6. DURATION OF STUDIES

The legislation regarding the maximum duration of undergraduate studies as determining by laws 3549/2007 and 4009/2011 is currently suspended and under revision. For more information on this issue you may contact the Secretary of the Department of Physics.

7. TRANSITIONAL RULES

The present undergraduate program of studies has been in effect since January 1st 2009. It applies to all students who were admitted to the Department of Physics since the 2006-2007 academic year (inclusive). Students who were admitted before that period are subject to a number of transitional rules described in detail in the Greek version of this Guide.

8. APPENDICES

8.1 APPENDIX A

In Appendix A we present the three Tables describing the distribution of courses in each one of the three Categories along with the ECTS of each course.

Table A – Course of Category A – «Compulsory Courses»			
A/A	Code	Course Title	ECTS
1	Φ-101	General Physics I	7
2	Φ-111	General Mathematics I	7
3	Φ-113	Mathematics for Physics I	7
4	Φ-150	Introduction to Computers	4
5	Φ-011	English I	4
6	Φ-102	General Physics II	7
7	Φ-112	General Mathematics II	7
8	Φ-108	Physics Lab I: mechanics and Thermodynamics	7
9	Φ-151	Introduction to Programming (FORTRAN or C)	6
10	Φ-012	English II	4
11	Φ-201	Introduction to Modern Physics I	7
12	Φ-211	Differential Equations I: Ordinary Differential Equations	7
13	Φ-207	Physics Lab II: Electricity	7
14	Φ-202	Introduction to Modern Physics II	7
15	Φ-212	Differential Equations II: Partial Differential Equations	7
16	Φ-204	Classical Mechanics I	7
17	Φ-208	Physics Lab III: Optics	7
18	Φ-303	Quantum Mechanics I	7
19	Φ-405	Thermodynamics and Statistics	7
20	Φ-307	Advanced Physics Lab	7
21	Φ-301	Electromagnetism I	7
22	Φ-403	From the Quarks to the Universe	7
<i>Total</i>			144

Notes on Table A: Each undergraduate student of the Department of Physics must successfully complete (i.e. “pass”) all courses of Table A. In case of failure in a course, the student must register again to it the following semester the course is offered. In case of failure in more than one of the courses in Table A, the order by which they should be included in future semesters is their corresponding index (A/A). Courses with a lower index number should always precede those of higher index in the course registration form.

Table B – Course of Category B – «Main Physics Directions»			
A/A	Code	Course Title	ECTS
1	Φ-311	Mathematics for Physics II	6
2	Φ-152	Numerical Analysis	6
3	Φ-406	Mechanics of Continuous Media	6
4	Φ-271	Introduction to Circuit Theory	6
5	Φ-374	Elements of Electronics	7
6	Φ-461	Laboratory of Lasers and Modern Optics	7
7	Φ-302	Electromagnetism II (Waves)	6
8	Φ-304	Quantum Structure of Matter	6
9	Φ-305	Quantum Mechanics II	6
10	Φ-230	Astrophysics I	6
11	Φ-331	Astrophysics II	6
12	Φ-333	Atmospheric Environment	6
13	Φ-361	Introduction to Optoelectronics	6
14	Φ-467	Atomic, Molecular and Optical Physics	6
15	Φ-273	Introduction to Semiconducting Devices	6
16	Φ-441	Introduction to Condensed Matter Physics	6
17	Φ-351	Computational Physics I	6
18	Φ-442	Condensed Matter Physics	6
19	Φ-324	Gravity and Cosmology	6
20	Φ-422	Elementary Particles and Forces	6
21	Φ-429	Special Topics in High Energy Physics	6
-		Graduate courses offered by the Department of Physics Masters programs: «Advanced Physics» and «Photonics and Nanoelectronics».	5 or 6

Notes on Table B: Each undergraduate student of the Department of Physics must successfully complete (i.e. “pass”) courses from the Category B which correspond to a total of at least 40 ECTS. Table B, includes all graduate courses of 5 or 6 ECTS offered by the Department of Physics in the Masters programs of «Advanced Physics» and «Photonics and Nanoelectronics».

Table C – Courses of Category C – «Special Topics in Physics etc.»			
A/A	Code	Course Title	ECTS
1	Φ-491	Diploma Thesis	12
	Φ-103	Topics in Modern Physics I	3
	Φ-107	Physics Concept Grinders I	6
	Φ-232	Observational Astrophysics	6
	Φ-277	Electronic Microscopy	6
	Φ-334	Introduction to Atmospheric Physics	6
	Φ-407	Physics of the Interior of the Earth	6
	Φ-428	Introduction to Neural Networks	6
	Φ-457	Financial Mathematics I	6
	Φ-466	Techniques of Laser Spectroscopy	6
	Φ-473	Semiconductor Physics Laboratory	7
	Φ-547	Applied Geophysics	6

	Φ-015	Modern Physics with English I	5
			...
	...	Teaching Assistant – Physics Lab I, II, III	3

	...	Teaching Assistant in Computing I, II	3

	...	English III & IV, French / German / Spanish / Russian I, II, III, IV	4

-	-	Select Courses offered by other Departments of the University of Crete.	-
-	-	Courses of the Erasmus Program	-

Notes on Table C: The above Table C includes only a few representative courses of Category C since courses in this category are only offered when there is interest from the students and the availability of instructors. A list with all courses offered by the Department of Physics over the past few years is available at:

<http://www.physics.uoc.gr/en/courses/all>

This Category also includes select courses offered by other Departments of the University of Crete. The complete list of available courses in this Category is announced before the beginning of each semester. An undergraduate student who has completed the requirements of courses in Categories A and B, has to successfully complete (i.e. “pass”) as many courses in Category C necessary, in order to obtain the minimum of 240 ECTS, towards the BSc in Physics.

During the course “Diploma Thesis” a student may perform a research project under the guidance of a faculty member of the Department of Physics. In order to obtain the 12 ECTS for this course, the student must write a thesis and present his/her finding in a seminar, followed by an oral examination of a three-member committee selected by the Undergraduate Program Committee.

8.2 APPENDIX B

In this Appendix we present the list of courses that have been offered by the Department of Physics over the past several years. We provide the Code and Title of each course, its Category (A, B, or C) as well as the corresponding ECTS. Graduate level courses are shaded in grey. The complete syllabus of each course is available online at:

<http://www.physics.uoc.gr/en/courses/all>

Code	Course Title	Cat.	ECTS
Φ-011	English I	A	4
Φ-012	English II	A	4
Φ-015	Modern Physics with English I	C	5
Φ-101	General Physics I	A	7
Φ-102	General Physics II	A	7
Φ-103	Topics of Modern Physics I	C	3
Φ-107	Physics Concept Grinders I	C	6
Φ-108	Physics Lab I – Mechanics & Thermodynamics	A	7
Φ-111	General Mathematics I	A	7
Φ-112	General Mathematics II	A	7
Φ-113	Mathematics for Physicists I	A	7
Φ-150	Introduction to Computing	A	4
Φ-151	Introduction to Programming – C	A	6
Φ-152	Numerical Analysis	B	6
Φ-201	Introduction to Modern Physics I	A	7
Φ-202	Introduction to Modern Physics II	A	7
Φ-204	Classical Mechanics I	A	7
Φ-207	Physics Lab II – Electricity & Magnetism	A	7
Φ-208	Physics Lab III – Optics	A	7
Φ-211	Differential Equations I	A	7
Φ-212	Differential Equations II	A	7
Φ-230	Astrophysics I	B	6
Φ-232	Observational Astrophysics	C	6
Φ-234	Astronomical Data Analysis	C	6
Φ-252	Introduction to C++ Programming	C	6
Φ-262	Principles of Medical Physics	C	6
Φ-271	Introduction to Circuit Theory	B	6
Φ-273	Introduction to Semiconductor Devices	B	6
Φ-277	Electronic Microscopy	C	6
Φ-291	Introduction to Computing – Teaching Assistant	C	3
Φ-292	Programming with Fortran – Teaching Assistant	C	3
Φ-293	Physics Lab I – Teaching Assistant	C	3
Φ-294	Physics Lab II – Teaching Assistant	C	3
Φ-295	Physics Lab III – Teaching Assistant	C	3
Φ-301	Electromagnetism I	A	7
Φ-302	Electromagnetism II – Waves	B	7
Φ-303	Quantum Mechanics I	A	7
Φ-304	Quantum Structure of Matter	B	6
Φ-305	Quantum Mechanics II	B	6
Φ-307	Advanced Physics Lab	A	7
Φ-308	Project on Experimental or Theoretical Physics	C	4
Φ-311	Mathematics for Physicists II	B	6
Φ-324	Gravity and Cosmology	B	6

Code	Course Title	Cat.	ECTS
Φ-331	Astrophysics II	B	6
Φ-333	Atmospheric Environment	B	6
Φ-334	Introduction to Atmospheric Physics	C	6
Φ-336	Observational Cosmology	C	6
Φ-338	Principles and Applications of Remote Sensing	C	6
Φ-351	Computational Physics I	B	6
Φ-361	Introduction to Optoelectronic - Photonics	B	6
Φ-374	Elements of Electronics	B	7
Φ-392	Teaching of Physics I	C	6
Φ-403	From Quarks to the Universe	A	7
Φ-405	Thermodynamics and Statistical Physics	A	7
Φ-406	Introduction to Mechanics of Continuous Media	B	6
Φ-407	Physics of the Interior of the Earth	C	6
Φ-408	Dynamical Systems	C	6
Φ-422	Elementary Particles and Forces	B	6
Φ-428	Introduction to Artificial Neural Networks	C	6
Φ-429	Special Topics in High Energy Physics	B	6
Φ-441	Introduction to Condensed Matter Physics	B	6
Φ-442	Condensed Matter Physics	B	6
Φ-447	Global Climate Changes	C	6
Φ-457	Mathematics of Finance I	C	6
Φ-461	Laboratory of Laser and Modern Optics I	B	7
Φ-466	Techniques of Laser Spectroscopy	C	6
Φ-467	Atomic, Molecular, and Optical Physics	B	6
Φ-473	Semiconductor Physics Laboratory	C	7
Φ-478	Elements of Material Science	C	6
Φ-491	Diploma Thesis	C	12
Φ-4093	Practical Training	C	3+17
Φ-501	Classical Mechanics II	B	6
Φ-503	Advanced Quantum Mechanics	B	6
Φ-505	Statistical Physics	B	6
Φ-509	Classical Electrodynamics	B	6
Φ-511	Mathematical Methods for Physics	B	6
Φ-523	Quantum Many-Particle Systems	B	5
Φ-528	Artificial Neural Networks	B	5
Φ-532	Production and Transfer of Radiation	B	5
Φ-533	Theory of Gravity	B	5
Φ-534	High Energy Astrophysics	B	5
Φ-561	Quantum Optics I	B	5
Φ-563	High Power Narrow Pulse Laser	B	5
Φ-570	Structural and Chemical Analysis of Materials	B	5
Φ-571	Analog Electronics	B	5
Φ-572	Physics of Semiconductor Devices	B	6
Φ-573	Laboratory of Semiconductor Physics	B	5
Φ-574	Physics of Semiconductors	B	5
Φ-575	Physics of 2D Semiconductor Devices	B	5
Φ-604	Quantum Field Theory	B	5
Φ-606	Advanced Quantum Field Theory	B	5
Φ-631	Astrophysics III	B	5
Φ-660	Symmetries and Group Theory	B	5
Φ-661	Laboratory of Laser and Modern Optics II	B	5
Φ-664	Techniques of Laser Spectroscopy	B	5

Code	Course Title	Cat.	ECTS
Φ-665	Quantum Electronics I – Theory and Technology of Laser	B	6
Φ-666	Quantum Electronics II – Non linear Optics	B	5
Φ-669	Advanced Methods of Computational Physics	B	5
Φ-675	Semiconducting Optoelectronic Devices	B	5
Φ-676	Advanced Electronics Laboratory	B	5
Φ-677	Electronic Thin Film and Nanostructure Science	B	5
Φ-696	Modern Research Topics	B	16
Φ-703	Applied Quantum Physics	B	6
Φ-733	Physics of Galaxies	B	5
Φ-772	Magnetic Materials and Nanoelectronics	B	5
Φ-800	Quantum Optics and Quantum Information	B	5
Φ-841	Special Topics in Condensed Matter Physics I	B	5
Φ-881	Advanced Topics in Modern Physics II	B	5
Φ-963	Special Topics of Photonics	B	5
Φ-964	Special Topics of Micro and Nano Electronics	B	5
Φ-965	Teaching Experimental Physics I	B	3
Φ-966	Teaching Experimental Physics II	B	3

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