Aristotle University of Thessaloniki
Faculty of Sciences
School of Physics

Study Guide

Academic Year 2020-2021

Website: www.physics.auth.gr

Thessaloniki

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1. Welcome message from the Head of School

We welcome you to the School of Physics of the Aristotle University of Thessaloniki and we congratulate you on your success, acknowledging your great effort. We know that most of you have consciously chosen to study Physics, a beautiful, fascinating and at the same time, demanding science. We believe that studying at our Schoolwill live up to your expectations, providing you with skills and opportunities for a successful career in various fields such as research, education, technology and industry.

The Study Guide is a very useful tool for informing the Physicsstudents about the courses and the structure of the Curriculum. It includes basic information about the administrative and academic composition of the School, faculty, other staff, the main points of the regulations of the educational process (courses, workshops, exams), as well as the possibilities of attending courses at cooperating European universities through the Erasmus program. Through timely and continuous information, students can organize their studies in the Schoolof Physics in a way that is efficient, creative and focused on their scientific interests (such as through elective courses).

The new students that are enrolled in the Department at the academic year 2020-21 will follow the "new curriculum" of the Schoolof Physics, which, after its renewal about eight years ago, is the only undergraduate program in force. In addition to the Study Guide, further clarifications and additional information on relevant issues about your education are provided at the School's website. At the same time, several electronic access services offered centrally by AUTh, are useful tools for handling educational issues (course enrolment declarations, selection of textbooks, access to libraries and electronic sources of information, electronic assessment of the teaching ability of faculty members and courses, etc.).

The teaching, technical and administrative staff of the Schoolsupport the Curriculum and are devoting significant efforts to attract the interest of the students and to willingly support their efforts. However, the effort made by the students themselves will lead to the successful completion of the educational process and the acquisition of knowledge and skills that will be useful for their future. Moreover, the maintenance and enhancement of the high-quality education and research offered by the Schoolof Physics is the result of the common efforts of all of us.

The unprecedented health crisis that we are experiencing requires significant adjustments in the educational process as well. The experience of the previous academic year is an important resource, so that we can successfully meet any challenges and achieve the academic goals of the new academic year. This is possible only with the cooperation and responsibility of the staff and students of our School.

On behalf of the Department, I would like to warmly thank the colleagues who edited this publication.

I wish you all a successful and constructive academic year, as well as health to you and your families.

Head of the School

Dimitris Melas

Professor

2. Academic Calendar

1. The academic year begins on September 1st of each year and ends on August 31th of the following year.
2. The educational activities of each academic year are structured in two Semesters. Each Semester includes at least 13 full weeks of teaching.
3. The first Semester begins at the end of September and the examinations take place during the period January-February. The second Semester starts in February and the exams are held in June. The number of weeks for conducting the examinations is defined in the Organization of the University. The re-examinations are performed in early September of each year.
4. The courses, except for the two examination periods, are interrupted from the Christmas eve until the day after the Epiphany, from the Thursday of Tyrophagous to the day after Shrove Monday and from Holy Monday to the Sunday of St. Thomas. The summer holidays take place from the beginning of July until the end of August.
5. Classes and exams are not held on weekends and on the following holidays - anniversaries:
   a. Saint Dimitrios (October 26)
   b. The national holiday of October 28
   c. The anniversary of the Athens Polytechnic uprising (November 17)
   d. Celebration of the three Hierarchs (January 30)
   e. The Annunciation (March 25)
   f. The 1st of May
   g. The day of the Holy Spirit

3. Important Points

All students, and especially new students, should carefully study the SchoolStudy Guide and especially the parts mentioned in the Curriculum and the Regulations of the School. However, some parts of the program and the Regulation need special attention, because in case these are overlooked they can potentially result to the cancelation of the student registration to the Department, loss of Semester, or rejection of participation in the examination procedures. These points are the following:

- All students of the Schoolmust pay attention to the regulations regarding the procedures of attending the courses, registering and executing the laboratory courses and participating in the examinations. The course statements in the winter and spring Semesters are submitted by the students electronically every October and February, respectively, through the AUTh electronic services, using their personal passwords. The login to the electronic services can be done through the School website (www.physics.auth.gr/home/student_support). After the statement is submitted, it is advisable to check after 1-2 days that the statement has been electronically registered, and to print a hard copy.
- Based on the course statements, students select through the online service Eudoxus (www.eudoxus.gr/) the books they wish to obtain for each course. Each student has the right to choose from the list of suggested books only one (1) book for each compulsory and selected course. The books are provided from the distribution points, as determined by the respective publishing house after the relevant list of beneficiaries is sent to him after the end of the declarations.
- Although each student canplan their own schedule for attending the courses during the Semesters, it is strongly recommended for the students to follow the School's course program and attend the courses included in each Semester.
- The students are strongly advised to be careful with theirselection of extra courses as well as for the elective courses they choose. It is extremely useful for the student to complete the courses of the previous Semester(s), then the courses of the current Semesterthe he/she attends and, if there is available time, for other extra courses.
- All students of the Schoolof Physics must regularly check the news and announcements posted on the officialwebsite (www.physics.auth.gr) or in the announcement boards in the east wing of the ground floor of the building of the School of Exact Sciences (S.Th.E.) as well as in the information boards of the Laboratories and classrooms. In this way they will have access to the up-to-date information about their obligations, as well as to the answer to many questions of daily life and the study process in the School. The students are also encouraged to contact faculty members about relevant courses either via email (physics.auth.gr, or auth.gr is recommended), or to visit them at their office during the pre-defined "student hours" that each faculty member hasdefined.
- The Schoolhas established the Study Advisor, which aims on the one hand to help the quick and smooth adaptation of new students to the Schoolof Physics and on the other hand to inform the Schoolabout the problems faced by students entering this new environment.
- Every Semester, all students, before the start of the examination period, have the right and duty to evaluate their courses and teachers, in order to improve the quality of their studies. The evaluation is confidential and is done through the website of the Quality Assurance Unit (MODIP-AUTh http://qa.auth.gr).

4. Curriculum of the School of Physics

The Curriculum includes 43 courses which are divided into compulsory courses and elective courses (those that the student chooses at his discretion). The compulsory courses are 31 (23 courses + 8 compulsory laboratories) and the elective courses 12, or 10 plus the dissertation. The total number of ECTS credits is 240.

Compulsory courses: The teaching hours of the compulsory courses are divided in **Theory hours (T)**: ie hours of theoretical lectures (lectures), and **Experimental hours (E)**: ie hours of explanations, questions, and solving exercises. The weekly curriculum clearly states the type of teaching of each lesson (T or E).

Elective courses: The elective courses that each student is required to attend are 12 in total, which are taught in the 7thand 8th Semester. These courses aim at the gradual enhancement of students' knowledge in one or more subject areas of their choice, without specialization, which is offered at postgraduate level. There are three groups of courses with specific characteristics each: 1) **Basic Elective** Courses, 2) **Special Elective** Courses and 3) **General Elective** Courses. The student must choose 4 courses from the Basic Choices course group and at least 3 from the other two groups. The other two courses are selected from the groups of special and general elective courses. The student can choose up to one course offered by other schools, which corresponds to a general options course. This will be done only after the approval of the Student Affairs Committee to which the student should apply in time stating the main characteristics of the course he / she has chosen (Title, Schoolthat offers it, teaching hours, course website or content).

Teaching courses in two Semesters: Some of the courses of the compulsory program can be taught in the next Semester in an audience (only those who have registered in the specific Semester have the right to take exams in these courses). These courses are selected by the Curriculum Committee based on criteria such as the number of students who owe them and are offered each year. The necessity of teaching them in both Semesters is re-evaluated every three years. The elective courses Internship, Thesis - Introduction to Research Methodology and Foreign Language are taught in both Semesters. The laboratory courses are also provided in two Semesters. The laboratory course that will be provided in the next Semester, will have the opportunity to be attended by those who did not attend the regular Semester or did not successfully complete it.

Diploma Thesis: The Diploma Thesis is not mandatory. If a Diploma Thesis will be realized by a student, it is equivalent to two special electives in addition to the three special electives that the student is required to choose. The Diploma Thesis is presented publicly and the presentation is announced electronically to all members of the School. The grading of the Diploma Thesis is performed by a three-member Committee of members of the Faculty Staff (Professors, Lecturers, EDIP) who are appointed by the supervisor in collaboration with the Director of the respective School. The Diploma Thesis can be written in English. In this case, before the English text, an extensive summary in Greek must be provided.

Prerequisite laboratories: a) The Laboratory of Applied Informatics is a prerequisite for all laboratory courses of the Department, b) The General Laboratory is a prerequisite for all subsequent laboratory courses of the Department, c) The Electrical Circuits laboratory is a prerequisite of the Laboratory of Electronics

Higher and lower number of students for elective courses:a) A lower number of students is defined per category of elective courses. This is determined by the number of students who took the course exams in February, June and September (each student counts once). If the required number is not completed in the specific course in two consecutive years, the Schoolhas the opportunity to suggest a) extension of teaching for another year with justification, or b) upgrading the course, or c) proposition to replace the course. Otherwise the course will be deleted from the curriculum. The lower limits of the number of students are: Basic Courses 10, Special and General choice 5. B) For each selected course, the maximum number of students is decided by the School Assembly. C) The elective laboratory courses can set specific limits in student attendance depending on their specific training capacity.

Course enrolment declarations: The number of courses that a student has the right to enrol per Semester is 2xN, where N is the number of courses in the Semester he/she is attending. The number of courses he/she can enrol from higher Semesters is 2 (two) per Semester.

Students who complete the minimum period of study ("graduate" students) are not restricted to enrol in courses provided that these have been taught in the previous Semester and the course continues to exist in the Curriculum. The examinations in June also include the elective courses of the winter Semester in which the "graduate" students who have enrolled and attended the course in the winter Semester of the current academic period can participate.

In addition to the 12 elective courses required to obtain the Physics Degree, a student can enrol and attend the examinations in two additional elective courses for grade correction. Additional courses are not counted in the degree grade but are listed in the detailed grade along with the additional ECTS. Enrolment in courses under the Erasmus program cannot be deducted. A student cannot enrol in an elective course from another School, who has recognized an unmatched selection under the Erasmus framework.

Students who are admitted with qualifying exams, upon their request, are included in a higher Semester, according to a decision of the School.

Attendance rules:

Students enrol at the beginning of each Semester on dates set by the Schooland register at the courses they choose to attend. A student can be expelled automatically upon request or as required by law.

Students who are proven to work at least 20 hours per week may enroll as part-time students, after submitting their application to be approved by the Faculty of Sciences. The Organization define the specific conditions and the procedure for the application of the previous paragraph, as well as the more specific conditions and the procedure for facilitating the study of students with special abilities.

The students can (after an application to the School Secretariat), to suspend their studies. The Organization of the Institution defines the validation procedure of the suspension of studies, the supporting documents that accompany the application and the maximum time of the suspension, as well as the possibility of exceptionally exceeding this time. The student status is temporarily suspended for the period of suspension of study, unless the suspension is due to proven health reasons or reasons of force majeure.

Each Semester includes at least thirteen (13) full weeks of courses. The extension of the duration of the Semester is allowed only in exceptional cases in order to complete the required minimum number of teaching weeks. This can not exceed two weeks, and is done after the decision of the Rector, following a proposal by the School Dean. If for any reason the number of teaching weeks held in a course is less than thirteen, the course is considered not taught and is not examined, any examination is invalid and the grade is not calculated for the award of the degree.

The exams are conducted exclusively after the end of the winter and spring Semesters for the courses taught in those Semesters, respectively. The student is entitled to be examined only in the courses included in the course enrolment declaration submitted at the beginning of the Semester. The student is entitled to be examined in the courses of both Semesters during the examination period of September and only in the courses included in the current course enrolment declaration of the current academic year.

Special care is taken for the oral examination of students with proven before their admission to the institution of dyslexia, according to a procedure defined in the Internal Rules of the Schoolof Physics

The grade in each course is determined by the faculty member, who can organize at his discretion written or oral exams or rely on assignments or laboratory exercises. If the student fails more than three times in a course, with the decision of the Dean, he is examined, at his request, by a three-member committee of teachers of the School, who have the same or related subject and are appointed by the Dean. The responsible for the course examination is excluded from this committee. In case of failure, the student continues his / her studies or not according to the terms and conditions set in the Organization of the Institution, which includes the maximum number of repetitions of the examination in a course.

The student completes his/her studies and is awarded a degree when he/she successfully passes the courses provided by the Curriculum and obtains the required number of credits (240 ECTS).

Tips for students:

For the best, consistent and successful course of their studies, the Schooland the teachers advise the students the following:

- To follow the indicative program from the Study Guide.
- After the basic courses of the Semester, to try as a priority to be successfully examined in the courses in which they have failed in previous Semesters, so as not to accumulate many courses at the end of their studies after eight (8) Semesters
- The attendance in courses and the participation to the course examinationshas to be done with planning and based on the capabilities that each student has. It is highly recommended that the students consult their teachers and not the rumors at the corridors.
- In any case of applying for a course from an higher Semester, make sure they have the necessary basic knowledge.
- To cover the positions of elective courses with courses that expand and enrich the knowledge they wish to have.

4.1. Compulsory Courses

1st Semester	Physics I (Mechanics)		2nd Semester	Physics II (Heat - Thermodynamics)	
	Mathematics I			Physics III (Electricity - Magnetism)	
	Applied Mathematics I			Mathematics II	
	Chemistry			Computer Programming & Computational Physics	
	Applied Informatics Laboratory*			Introductory Physics Laboratory*	
3rd Semester	Physics IV (Optics-Waves)		4th Semester	Mathematical Methods in Physics	
	Mathematics III			Electronics	
	Applied Mathematics II			Optics Laboratory*	
	Atmospheric and Environmental Physics			Physics V (Modern Physics)	
	Electric Circuits Laboratory*			Theoretical Mechanics	
5th Semester	Nuclear Physics and Elementary Particle Physics		6th Semester	Statistical Physics	
	Quantum Mechanics I			Electromagnetism	
	Astronomy - Astrophysics			Quantum Mechanics II	
	Atomic Physics Laboratory*			Nuclear Physics: Laboratory Course I*	
	Laboratory on Electronics			Structure of Materials: Laboratory Course*	
7th Semes-	Solid State Physics		8th Semes-		

** All Laboratory courses are also available in the next semester (winter or summer).*

4.2. Elective Courses

Students must succeed in examinations in all Compulsory and a total of 12 Elective courses, which should be distributed as follows:

- **4 Basic Elective courses**
- **3 Generic Elective courses**
- **3 Specialized Elective courses**
- **2 courses from Specialized and/or Generic groups Students may select from the corresponding tables of basic, generic, and specialized elective courses.**

7thSEMESTER	Elective Course – 1	**8thSEMESTER**	Elective Course – 6
	Elective Course – 2		Elective Course – 7
	Elective Course – 3		Elective Course – 8
	Elective Course – 4		Elective Course – 9
	Elective Course – 5		Elective Course – 10
			Elective Course – 11
			Elective Course – 12

** In each semester, students may attend one lesson normally offered in higher semester. Students are recommended to attend one generic elective course in the 5th and 6th semester.*

4.2.1. Basic elective courses

7th SEMESTER	8th SEMESTER
Astrophysics	Observational Astronomy
Particle Physics	Nuclear Physics
Renewable Energy Sources	Communications Systems
Electronic Circuits	Solid State Physics II
Structural Properties of Materials	Physics of Nanostructures and Surfaces
Atmospheric Enviroment	Hamiltonian mechanics
Non-Linear Dynamical Systems	Introduction to the Didactic of Physics
Computational Physics & Applications	
Introduction to the Didactic of Physics	

4.2.2. Specialized elective courses

7th SEMESTER	8th SEMESTER
Biophysics	Cosmology
Planetary Systems and Space Exploration	Introduction to ionized gas Physics (Plasma Physics)
Galactic and Extragalactic Astronomy	Radio astronomy - Astronomy in Non Optical wavelengths
Nuclear Physics: Laboratory Course II	Nuclear theory subjects
Physics and Technology of Semiconductor Devices	Experimental Foundations of Particle Physics
Theoretical Statistic Solid State Physics	Accelerators and Detectors in Nuclear and Particle Physics
Propagation of Electromagnetic Waves-Antennas-Microwaves and Applications	Radiation Physics and Applications of Radioi-sotopes
Non-Linear Circuits	Quantum Optics - Laser
Crystal Structure and Applications	Atmospheric Diffusion and Dispersion
Magnetic Materials and Applications	Atmospheric Technology
Microelectronics	Global Environmental Changes
Quantum Mechanics III	Laboratory on Electronic Circuits
Mathematical Methods in Physics II	Problems in Quantum Physics
Digital systems	Linear Circuits
Didactics of Physics Laboratory	General Theory of Relativity
Fluid Mechanics	Computer Architecture
Thesis for Barchelor-Intoduction to research methodology	Solid State Physics Laboratory
	Thesis for Barchelor-Intoduction to research methodology

4.2.3. Generic elective courses

WINTERSEMESTER	SUMMERSEMESTER
Bioelectromagnetics	Numerical Analysis
Physics of Liquids and Applications to Materials Science	Biology
Medical Physics-Dosimetry	Geometrical Optics - Applications
History and Evolution of Concepts in Physics	Geophysics - Seismology
Cosmic Radiation	Educational Technology Laboratory
Metrology - Quality Systems	Laboratory in Communications and Networks
Foreign Language (English)	Methodology, Presentation of Physics Subjects
Internship	Meteorology
Characterization Techniques and Materials in Preservation of Cultural Heritages	Foreign Language (English)
Physics of Metals	Energy Production from nuclear and Fossil Fuels
Physical Chemistry	Probability and Statistics
Chaotic Dynamics	Internship
	Enviromental radioactivity
	Technology-Materials and Social-Economic Environment
	Physics and Philosophy
	Physics of the Human Body
	Physics of Materials
	Photonic Technologies and Applications

4.3. Detailed Description of Courses

4.3.1. Compulsory Courses

1st Semester

NO	Code	Course	Hours	ECTS
1	ΓΘΥ201	**Physics I (Mechanics)**	**5 [3T, 2E]**	**8**
		F. Komninou, T. Kechagias, N. Vouroutzis, G. Dimitrakopoulos, E. Pavlidou, J. Kioseoglou 1. ΦΥΣΙΚΗ. ΕΙΣΑΓΩΓΗ ΣΤΗ ΜΗΧΑΝΙΚΗ, ΚΥΡΙΑΚΟΣ ΔΗΜΗΤΡΗΣ, ΚΑΡΑΚΩΣΤΑΣ ΘΕΟΔΩΡΟΣ, 2012, ΖΗΤΗ, ISBN: 978-960-456-334-0 2. ΦΥΣΙΚΗ ΤΟΜΟΣ 1, HALLIDAY,RESNICK,KRANE, 2009, Α.Γ.ΠΝΕΥΜΑΤΙΚΟΣ, ISBN: 978-960-7258-74-8 3. ΦΥΣΙΚΗ. ΕΙΣΑΓΩΓΗ ΣΤΗ ΜΗΧΑΝΙΚΗ, ΚΥΡΙΑΚΟΣ ΔΗΜΗΤΡΙΟΣ Σ., ΚΑΡΑΚΩΣΤΑΣ ΘΕΟΔΩΡΟΣ, 1998, ΖΗΤΗ, ISBN: 960-431-492-0		
2	ΜΑΥ201	**Mathematics I**	**4** [3T, 1E]	**6**
		M. Pleionis, P. Papadopoulos, V. Economou, C. Tsagkas 1. THOMAS ΑΠΕΙΡΟΣΤΙΚΟΣ ΛΟΓΙΣΜΟΣ, [GEORGE B. THOMAS], JR., JOEL HASS, CHRISTOPHER HEIL, MAURICE D. WEIR, 2018, ITE-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, ISBN: 978-960-524-515-3 2. ΑΝΩΤΕΡΑ ΜΑΘΗΜΑΤΙΚΑ, ΜΩΥΣΙΑΔΗΣ ΧΡΟΝΗΣ, 2016, ΑΦΟΙ ΚΥΡΙΑΚΙΔΗ ΕΚΔΟΣΕΙΣ ΑΕ, ISBN: 978-960-602-116-9		
3	ΜΑΥ202	**Applied Mathematics I**	**4** [3T, 1E]	**6**
		E. Meletlidou, T. Gaitanos, C. Meleti 1. ΜΙΑ ΕΙΣΑΓΩΓΗ ΣΤΗ ΓΡΑΜΜΙΚΗ ΑΛΓΕΒΡΑ ΚΑΙ ΑΝΑΛΥΤΙΚΗ ΓΕΩΜΕΤΡΙΑ, ΓΑΪΤΑΝΟΣ ΘΕΟΔΩΡΟΣ, ΜΕΛΕΤΛΙΔΟΥ ΕΥΘΥΜΙΑ, ΜΟΥΣΤΑΚΙΔΗΣ ΧΑΡΑΛΑΜΠΟΣ, ΠΑΠΑΔΟΠΟΥΛΟΣ ΔΗΜΗΤΡΗΣ, ΠΑΣΧΑΛΗΣ ΙΩΑΝΝΗΣ, 2018, ΕΚΔΟΣΕΙΣ ΣΟΦΙΑ, ISBN: 978-960-633-000-1 2. ΕΙΣΑΓΩΓΗ ΣΤΗ ΓΡΑΜΜΙΚΗ ΆΛΓΕΒΡΑ ΚΑΙ ΑΝΑΛΥΤΙΚΗ ΓΕΩΜΕΤΡΙΑ, 2Η ΈΚΔΟΣΗ, ΙΩΑΝΝΙΔΟΥ ΘΕΟΔΩΡΑ, 2018, ΤΖΙΟΛΑ, ISBN: 978-960-418-718-8		
4	ΧΜΥ201	**Chemistry**	**3** [2T, 1E]	**5**
		K. Dendrinou-Samara, F. Noli, T. Lazaridi 1. Γενική Χημεία, Darell Ebbing, Steven Gammon, 2002, ΤΡΑΥΛΟΣ & ΣΙΑ ΟΕ, ISBN: 960-7990-66-8 2. Γενική και Ανόργανη Χημεία, Μανουσάκης Γεώργιος, 2015, ΕΚΔΟΣΕΙΣ ΚΥΡΙΑΚΙΔΗ ΜΟΝΟΠΡΟΣΩΠΗ ΙΚΕ, ISBN: 978-960-599-009-1		
5	ΗΥΥ501	**Applied Informatics Laboratory**	**4**	**5**
		M. Aggelakeris, C. Lioutas, I. Samaras, A. Ioannidou, D. Tassis, C. Sarafidis, K. Virsokinos, C. Gravalidis, T. Kaifas, S. Kassavetis, A. Mantzari, I. Tsiaoussis, K. Garane, F. Zervaki, T. Chatziantoniou, N. Chastas, C. Meleti, A. Andreadou Η ΤΕΧΝΗ ΚΑΙ ΟΙ ΤΕΧΝΙΚΕΣ ΜΙΑΣ ΕΠΙΣΤΗΜΟΝΙΚΗΣ ΑΝΑΦΟΡΑΣ, ΑΓΓΕΛΑΚΕΡΗΣ ΜΑΥΡΟΕΙΔΗΣ, 2018, ΆΒΑΚΑΣ, ISBN: 978-960-6789-23-6		
		TOTAL	**20**	**30**

2nd Semester

NO	Code	Course	Hours	ECTS
6	ΓΘΥ202	**Physics II (Heat - Thermodynamics)**	5 [3Τ, 2Ε]	8
		N. Fragkis, C. Lioutas, N. Vouroutzis, D. Tassis, G. Dimitrakopoulos 1. Θερμοδυναμική, Michael M. Abbott, Hendrick C. Van Ness, 1983, ΕΣΠΙ ΕΚΔΟΤΙΚΗ Ε.Π.Ε., ISBN: 978-960-7610-31-7 2. Θερμοδυναμική Συστημάτων σε Ισορροπία, C.J.Adkins, 2015, ΡΟΠΗ, ISBN: 978-618-82009-1-3 3. ΘΕΡΜΟΤΗΤΑ ΚΑΙ ΘΕΡΜΟΔΥΝΑΜΙΚΗ,MARK W. ZEMANSKY, RICHARD M.DITTMAN, 2014, ΕΠΙΣΤΗΜΟΝΙΚΕΣ ΚΑΙ ΤΕΧΝΟΛΟΓΙΚΕΣ ΕΚΔΟΣΕΙΣΑ.Γ.ΠΝΕΥΜΑΤΙΚΟΣ, ISBN: 978-960-7258-80-9 4. ΘΕΡΜΟΔΥΝΑΜΙΚΗ και ΠΡΟΧΩΡΗΜΕΝΗ ΘΕΡΜΟΔΥΝΑΜΙΚΗ, Απόστολος Πολυζάκης, 2017, Power Heat Cool, ISBN: 978-960-98311-9-2		
7	ΓΘΥ203	**Physics III (Electricity - Magnetism)**	5 [3Τ, 2Ε]	8
		C. Sarafidis, C. Volos, P. Patsalas 1. ΦΥΣΙΚΗ ΓΙΑ ΕΠΙΣΤΗΜΟΝΕΣ ΚΑΙ ΜΗΧΑΝΙΚΟΥΣ: ΗΛΕΚΤΡΙΣΜΟΣ ΚΑΙ ΜΑΓΝΗΤΙΣΜΟΣ, ΦΩΣ ΚΑΙ ΟΠΤΙΚΗ, ΣΥΓΧΡΟΝΗ ΦΥΣΙΚΗ,RAYMOND A. SERWAY, JOHN W. JEWETT, 2013, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ, ISBN: 978-960-461-509-4 2. Φυσική, Τόμος: 2ος τόμος, Halliday David, Resnick Robert, Walker Jearl, Παπανικόλας Κώστας (γενική επιμέλεια), Καραμπαρμπούνης Α., Κοέν Σ., Σπυράκης Π., Τζανετάκης Π., Στυλιάρης Ε. (Επιστημονική Επιμέλεια), Τζαμτζής Γ. (συντονισμός), 2013, Gutenberg, ISBN: 978-960-01-1594-9		
8	ΜΑΥ203	**Mathematics II**	4 [3Τ, 1Ε]	5
		C. Tsagkas, K. Kosmidis, V. Economou 1. ΛΟΓΙΣΜΟΣ ΣΥΝΑΡΤΗΣΕΩΝ ΠΟΛΛΩΝ ΜΕΤΑΒΛΗΤΩΝ ΚΑΙ ΔΙΑΝΥΣΜΑΤΙΚΗ ΑΝΑΛΥΣΗ, ΚΩΝΣΤΑΝΤΙΝΙΔΟΥ ΜΑΡΙΑ, ΣΕΡΑΦΕΙΜΙΔΗΣ ΚΑΡΟΛΟΣ, 2012, Εκδόσεις "Σοφία", ISBN: 978-960-6706-18-9 2. Εισαγωγή στο διαφορικό λογισμό συναρτήσεων πολλών μεταβλητών, Καρανικόλας Νικόλαος Δ., 2010, Ζήτη, ISBN: 978-960-456-263-3 3. Διαφορικός λογισμός πολλών μεταβλητών,Βλάχος Λουκάς, 2008, ΤΖΙΟΛΑ, ISBN: 978-960-418-157-5		
9	ΗΥΥ201	**Computer Programming&Computational Physics**	3 [2Τ, 1Ε]	4
		T. Samaras, F. Zervaki 1. Μαθαίνετε εύκολα C,Καρολίδης Δημήτριος Α., 2013, Άβακας, ISBN: 978-960-93-5034-1 2. C: Από τη Θεωρία στην Εφαρμογή,Γ. Σ. Τσελίκης - Ν. Δ. Τσελίκας, 2016, Γ.Σ.Τσελίκης - Ν.Δ.Τσελίκας, ISBN: 978-960-93-1961-4		
10	ΓΘΥ501	**Introductory Physics Laboratory**	4	5
		K. Chrysafis, M. Gioti, G. Dimitrakopoulos, E. Doni-Karanikola, M. Katsikini, T. Kechagias, F. Komninou, C. Polatoglou, E. Pavlidou, D. Tassis, I. Samaras, A. Molochidis, I. Tsiaoussis, N. Chastas, C. Metaxa, C. Topaloglou, A. Laskarakis, C. Gravalidis ΕΡΓΑΣΤΗΡΙΑΚΕΣ ΑΣΚΗΣΕΙΣ ΓΕΝΙΚΗΣ ΦΥΣΙΚΗΣ,ΜΕΛΗ ΔΕΠ ΤΟΥ ΤΟΜΕΑ ΦΥΣΙΚΗΣ ΣΤΕΡΑΙΑΣ ΚΑΤΑΣΤΑΣΗΣ ΤΟΥ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ ΑΠΘ, 2012, COPY CITY, ISBN: 978-960-9551-07-6		
		TOTAL	21	30

3rd Semester

NO	Code	Course	Hours	ECTS
11	ΓΘΥ204	**Physics IV (Optics - Waves)**	5 [3T, 2E]	8
		I. Arvanitidis, M. Aggelakeris, M. Katsikini, N. Vouroutzis, K. Virsokinos, M. Gioti 1. Οπτική,Hecht Eugene (επιστ. επιμ. Βές Σωτήρης), 2018, GUTENBERG, ISBN: 978-960-01-1955-8 2. Οπτική,Eugene Hecht, 1979, ΕΣΠΙ ΕΚΔΟΤΙΚΗ Ε.Π.Ε., ISBN: 978-960-7610-30-0 3. Πανεπιστημιακή φυσική με σύγχρονη φυσική, Τόμος: Β ΤΟΜΟΣ, Young H., Freedman R., 2019, ΕΚΔΟΣΕΙΣ ΠΑΠΑΖΗΣΗ, ISBN: 978-960-02-3536-4		
12	ΜΑΥ206	**Mathematics III**	4 [3T, 1E]	6
		C. Moustakidis, A. Petkou, K. Kosmidis 1. ΔΙΑΝΥΣΜΑΤΙΚΗ ΑΝΑΛΥΣΗ, ΜΟΥΣΤΑΚΙΔΗΣ ΧΑΡΑΛΑΠΜΟΣ, 2011, Εκδόσεις "σοφία", ISBN: 978-960-6706-58-5 2. Διανυσματικός Λογισμός, Γεωργιος Κ. Λεοντάρης, 2015, Θεοδωρίδη, ISBN: 978-960-8026-09-4 3. Εφαρμοσμένη Ανάλυση και Θεωρία fourier, Φιλιππάκης Μ., 2017, τσότρας, ISBN: 978-618-5066-83-3 4. Απειροστικός λογισμός, Briggs William, Cochran Lyle, Gillett Bernard, 2018, Κριτική, ISBN: 978-960-586-234-3		
13	ΜΑΥ204	**Applied Mathematics II**	4 [2T, 2E]	6
		G. Vougiatzis, K. Tsiganis 1. ΔΙΑΦΟΡΙΚΕΣ ΕΞΙΣΩΣΕΙΣ ΚΑΙ ΕΦΑΡΜΟΓΕΣ, ΓΕΩΡΓΙΟΣ Β. ΒΟΥΓΙΑΤΖΗΣ, ΓΕΩΡΓΙΟΣ Δ. ΜΠΟΖΗΣ, ΔΗΜΗΤΡΙΟΣ Β. ΠΑΠΑΔΟΠΟΥΛΟΣ, 2012, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ, ISBN: 978-960-461-510-0 2. ΣΥΝΗΘΕΙΣ ΔΙΑΦΟΡΙΚΕΣ ΕΞΙΣΩΣΕΙΣ, ΤΡΑΧΑΝΑΣ ΣΤΕΦΑΝΟΣ, 2008, ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, ISBN: 978-960-524-089-9		
14	ΑΠΥ201	**Atmospheric and Environmental Physics**	3 [2T, 1E]	5
		A. Bais, D. Melas, D. Balis 1. Ατμοσφαιρική ρύπανση με στοιχεία μετεωρολογίας, Λαζαρίδης Μιχάλης, 2010, ΤΖΙΟΛΑ, ISBN: 978-960-418-246-6 2. Εισαγωγικά Μαθήματα στη Φυσική της Ατμόσφαιρας, Ζερεφός Χρήστος, 2009, Παπασωτηρίου, ISBN: 978-960-7182-40-1.		
15	ΕΦΥ501	**Electric Circuits Laboratory**	3 [2T, 1E]	5
		I. Stouboulos, S. Goudos, K. Efthymiadis, K. Siakavara, C. Volos, C. Sarafidis, A. Laskarakis, K. Baltzis, T. Kaifas, K. Kyritsi 1. ΑΡΧΕΣ ΗΛΕΚΤΡΙΚΩΝ ΚΥΚΛΩΜΑΤΩΝ, ΑΠΟ ΤΗ ΘΕΩΡΙΑ ΣΤΟ ΠΕΙΡΑΜΑ,Κ. ΕΥΘΥΜΙΑΔΗΣ, Ο. ΚΑΛΟΓΗΡΟΥ, Ι. ΚΥΠΡΙΑΝΙΔΗΣ, Κ. ΜΕΛΙΔΗΣ, Α. ΣΙΑΚΑΒΑΡΑ..., 2002, ΣΥΓΧΡΟΝΗ ΠΑΙΔΕΙΑ, ISBN: 978-960-357-053-2 2. Ηλεκτρικά Κυκλώματα, Joseph A. Edminister, 1980, ΕΣΠΙ ΕΚΔΟΤΙΚΗ Ε.Π.Ε., ISBN: 978-960-7610-09-6		
		TOTAL	19	30

4th Semester

NO	Code	Course	Hours	ECTS
16	ΜΑΥ205	**Mathematical Methods in Physics**	4 [3Τ, 1Ε]	5
		G. Lalazisis, C. Moustakidis, A. Petkou 1. ΜΑΘΗΜΑΤΙΚΕΣ ΜΕΘΟΔΟΙ ΦΥΣΙΚΗΣ ΤΟΜΟΣ Α' ΜΙΓΑΔΙΚΕΣ ΣΥΝΑΡΤΗΣΕΙΣ ΑΝΑΛΥΣΗ FOURIER,ΜΑΣΕΝ ΣΤΥΛΙΑΝΟΣ, ΓΡΥΠΑΙΟΣ ΜΙΧΑΗΛ, 2009, ΧΑΡΑΛΑΜΠΟΣ ΝΙΚ. ΑΪΒΑΖΗΣ, ISBN: 978-960-98630-3-2 2. ΜΑΘΗΜΑΤΙΚΕΣ ΜΕΘΟΔΟΙ ΦΥΣΙΚΗΣ ΤΟΜΟΣ Ι,ΒΕΡΓΑΔΟΣ ΙΩΑΝΝΗΣ, 2009, ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, ISBN: 978-960-524-180-3 3. ΜΑΘΗΜΑΤΙΚΕΣ ΜΕΘΟΔΟΙ ΓΙΑ ΦΥΣΙΚΟΥΣ: ΜΙΑ ΠΕΡΙΕΚΤΙΚΗ ΕΙΣΑΓΩΓΗ,TAI L. CHOW, 2018, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ, ISBN: 978-960-461-817-0		
17	ΓΘΥ205	**Physics V (Modern Physics)**	5 [3Τ, 2Ε]	8
		G. Kitis, S. Stoulos, A. Ioannidou, S. Tzamarias, G. Vourlias, P. Patsalas, A. Liolios 1. ΣύγχρονηΦυσική,Krane Kenneth, 2019, Broken Hill Publishers Ltd, ISBN: 9789925575312. 2. ΣΥΓΧΡΟΝΗΦΥΣΙΚΗ, SERWAY R., MOSES C., MOYER C., 2009, ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣΕΚΔΟΣΕΙΣΚΡΗΤΗΣ, ISBN: 978-960-524-059-2		
18	ΓΘΥ206	**Theoretical Mechanics**	5 [3Τ, 2Ε]	8
		K. Tsiganis, G. Vougiatzis, K. Kosmidis 1. ΚΛΑΣΙΚΗ ΜΗΧΑΝΙΚΗ, KIBBLE, T.W.B. & BERKSHIRE, F.H., 2012, ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, ISBN: 978-960-524-378-4 2. ΘΕΩΡΗΤΙΚΗ ΜΗΧΑΝΙΚΗ,ΧΑΤΖΗΔΗΜΗΤΡΙΟΥ ΙΩΑΝΝΗΣ, 2013, ΓΙΑΧΟΥΔΗ, ISBN: 978-960-6700-99-6 3. Θεωρητική Μηχανική,Καραχάλιος ΓεώργιοςΛουκόπουλος Βασίλειος, 2014, Liberal Books, ISBN: 9786188008472		
19	ΗΤΥ201	**Electronics**	3 [2Τ, 1Ε]	5
		S. Siskos, T. Laopoulos 1. ΗΛΕΚΤΡΟΝΙΚΕΣ ΔΙΑΤΑΞΕΙΣ & ΘΕΩΡΙΑ ΚΥΚΛΩΜΑΤΩΝ, 10Η ΈΚΔΟΣΗ,BOYLESTAD R.NASHELSKY L., 2012, ΤΖΙΟΛΑ, ISBN: 978-960-418-339-5 2. Μικροηλεκτρονικά Κυκλώματα, Τόμος Α, 7η Έκδοση,Τόμος: Α, Sedra Adel, Smith Kenneth, 2017, Παπασωτηρίου, ISBN: 978-960-491-107-3 3. ΒΑΣΙΚΕΣ ΑΡΧΕΣ ΜΙΚΡΟΗΛΕΚΤΡΟΝΙΚΗΣ,ΒΕΗΖΑD RAZAVI, 2018, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ, ISBN: 978-960-461-850-7. 4. ΗΛΕΚΤΡΟΝΙΚΑ ΚΥΚΛΩΜΑΤΑ, ΘΕΩΡΙΑ ΚΑΙ ΑΣΚΗΣΕΙΣ,Κ. ΚΑΡΥΜΠΑΚΑΣ, 2014, ΣΥΓΧΡΟΝΗ ΠΑΙΔΕΙΑ, ISBN: 978-960-357-117-9		
20	ΓΘΥ502	**Optics Laboratory**	2	4
		I. Arvanitidis, E. Vigka, N. Vouroutzis, M. Gioti, M. Katsikini, M. Aggelakeris, K. Virsokinos, C. Metaxa, N. Fragkis, K. Papagelis, A. Laskarakis 1. ΕΡΓΑΣΤΗΡΙΑΚΑ ΘΕΜΑΤΑ ΟΠΤΙΚΗΣ, Μ. ΑΓΓΕΛΑΚΕΡΗΣ, Ι. ΑΡΒΑΝΙΤΙΔΗΣ, Ε. ΒΑΝΙΔΗΣ, Σ. ΒΕΣ, Ε. ΒΙΓΚΑ, Ν. ΒΟΥΡΟΥΤΖΗΣ, Μ. ΓΙΩΤΗ, Μ. ΚΑΤΣΙΚΙΝΗ, 2012, ΖΗΤΗ, ISBN: 978-960-456-339-5		
		TOTAL	19	30

5th Semester

NO	Code	Course	Hours	ECTS
21	ΠΣΥ201	**Nuclear Physics and Elementary Particle Physics**	4 [3Τ, 1Ε]	7
		E. Savvidis, D. Sampsonidis, C. Eleftheriadis, K. Kordas 1. Σύγχρονη Σωματιδιακή Φυσική, Mark Thomson, 2020, Ροπή, ISBN: 978-618-5289-46-1 2. Εισαγωγή στην πυρηνική φυσική,Cottingham W. N., Greenwood D. A., 2002, Τυπωθήτω, ISBN: 978-960-7643-18-6 3. ΠΥΡΗΝΙΚΗ ΦΥΣΙΚΗ,ΧΡΗΣΤΟΣ ΕΛΕΥΘΕΡΙΑΔΗΣ, 2014, COPY CITY, ISBN: 978-960-9551-14-4		
22	ΓΘΥ207	**Quantum Mechanics I**	5 [3Τ, 2Ε]	8
		G. Lalazisis, C. Moustakidis, T. Gaitanos, K. Kosmidis 1. ΚΒΑΝΤΙΚΗ ΦΥΣΙΚΗ,STEPHEN GASIOROWICZ, 2015, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ, ISBN: 978-960-461-650-3 2. ΚΒΑΝΤΟΜΗΧΑΝΙΚΗ ΤΟΜΟΣ Ι,Τόμος: Ι, ΤΡΑΧΑΝΑΣ ΣΤΕΦΑΝΟΣ, 2009, ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, ISBN: 978-960-524-206-0		
23	ΑΑΥ201	**Astronomy – Astrophysics**	4 [3Τ, 1Ε]	7
		P. Papadopoulos,N. Stergioulas 1. ΑΣΤΡΟΦΥΣΙΚΗ ΤΟΜΟΣ Ι,Τόμος: Ι, SHU FRANK, 2009, ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, ISBN: 978-960-7309-16-7, 2. Εισαγωγή στη σύγχρονη αστρονομία,Χ.Βάρβογλης, Ι.Σειραδάκης, 2010, ΑΓΙΣ-ΣΑΒΒΑΣ ΓΑΡΤΑΓΑΝΗΣ, ISBN: 960-7013-21-2 3. Εισαγωγή στην αστροφυσική,Αλυσσανδράκης Κ., 2014, ΕΚΔΟΣΕΙΣ ΠΑΠΑΖΗΣΗ, ISBN: 978-960-02-3058-1		
24	ΓΘΥ503	**Atomic Physics Laboratory**	2	4
		G. Kitis, S. Stoulos, E. Savvidis, A. Ioannidou, S. Tzamarias, A. Liolios, D. Sampsonidis, C. Eleftheriadis, K. Kordas, K. Kyritsi, C. Topaloglou 1. ΕΡΓΑΣΤΗΡΙΑΚΕΣ ΑΣΚΗΣΕΙΣ ΑΤΟΜΙΚΗΣ ΦΥΣΙΚΗΣ,Σ. ΔΕΔΟΥΣΗΣ, Χ. ΕΛΕΥΘΕΡΙΑΔΗΣ, Μ. ΖΑΜΑΝΗ, Α. ΙΩΑΝΝΙΔΟΥ..., 2009, ΣΥΓΧΡΟΝΗ ΠΑΙΔΕΙΑ, ISBN: 978-960-357-091-2		
25	ΗΤΥ502	**Laboratory on Electronics**	2	4
		S. Siskos, S. Goudos, E. Nikolaidis, S. Nikolaidis, K. Siozios, D. Babas, K. Baltzis, E. Pappas, N. Chastas 1. ΕΡΓΑΣΤΗΡΙΑΚΕΣ ΑΣΚΗΣΕΙΣ ΗΛΕΚΤΡΟΝΙΚΗΣ,Γ. ΘΕΟΔΩΡΙΔΗΣ, Κ. ΚΟΣΜΑΤΟΠΟΥΛΟΣ, Θ. ΛΑΟΠΟΥΛΟΣ, Σ. ΝΙΚΟΛΑΪΔΗΣ, Κ. ΠΑΠΑΘΑΝΑΣΙΟΥ, Σ. ΣΙΣΚΟΣ, 2009, ΣΥΓΧΡΟΝΗ ΠΑΙΔΕΙΑ, ISBN: 978-960-357-086-8,		
		TOTAL	17	30

6th Semester

NO	Code	Course	Hours	ECTS
26	ΓΘΥ209	**Statistical Physics**	4 [3T, 1E]	7
		N. Fragkis, E. Vigka 1. ΣΤΑΤΙΣΤΙΚΗ ΦΥΣΙΚΗ,F.MANDL, 2013, Α.Γ.ΠΝΕΥΜΑΤΙΚΟΣ, ISBN: 978-960-7258-568		
27	ΓΘΥ210	**Electromagnetism**	5 [3T, 2E]	9
		K. Efthymiadis, K. Siakavara 1. ΘΕΩΡΙΑ ΗΛΕΚΤΡΟΜΑΓΝΗΤΙΚΟΥ ΠΕΔΙΟΥ,Κ. ΕΥΘΥΜΙΑΔΗΣ, ΑΙΚ. ΣΙΑΚΑΒΑΡΑ, Ε. ΠΑΠΑΔΗΜΗΤΡΑΚΗ-ΧΛΙΑΧΛΙΑ, Ι. ΤΣΟΥΚΑΛΑΣ, 2015, Copy City ΕΠΕ, ISBN: 978-960-9551-21-2 2. ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΗΛΕΚΤΡΟΔΥΝΑΜΙΚΗ (ΣΕ ΕΝΑΝ ΤΟΜΟ),GRIFFITHS J. DAVID, 2012, ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, ISBN: 978-960-524-381-4		
28	ΓΘΥ208	**Quantum Mechanics II**	3 [2T, 1E]	6
		T. Gaitanos, A. Petkou 1. ΚΒΑΝΤΙΚΗ ΦΥΣΙΚΗ,STEPHEN GASIOROWICZ, 2015, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ, ISBN: 978-960-461-650-3 2. Εισαγωγή στην Κβαντομηχανική,Ταμβάκης Κυριάκος, 2003, Leader Books, ISBN: 9607901398		
29	ΣΣΥ501	**Structure of Materials: Laboratory Course**	2	4
		G. Vourlias, P. Patsalas, E. Pavlidou, T. Zorba, C. Gravalidis, S. Kassavetis, A. Mantzari Course Material for study are provided by the lecturers		
30	ΠΣΥ501	**Nuclear Physics: Laboratory CourseI ***	2	4
		K. Kordas, A. Liolios, G. Kitis, S. Stoulos, E. Savvidis, A. Ioannidou, C. Eleftheriadis, D. Sampsonidis, K. Kyritsi, C. Topaloglou 1. Η ΠΥΡΗΝΙΚΗ ΦΥΣΙΚΗ ΣΤΟ ΕΡΓΑΣΤΗΡΙΟ,Χ. ΕΛΕΥΘΕΡΙΑΔΗΣ, Μ. ΖΑΜΑΝΗ-ΒΑΛΑΣΙΑΔΟΥ, Α. ΛΙΟΛΙΟΣ, Μ. ΜΑΝΩΛΟΠΟΥΛΟΥ, Η. ΣΑΒΒΙΔΗΣ, 2012, COPY CITY, ISBN: 978-960-9551-05-2		
		TOTAL	16	30

7th Semester

NO	Code	Course	Hours	ECTS
31	ΣΥΥ201	**Solid State Physics**	4 [3T, 1E]	8
		E. Paloura, K. Virsokinos, I. Arvanitidis, S. Logothetidis, K. Papagelis 1. Φυσική στερεάς κατάστασης,Ibach Harald, Luth Hans, Επιμέλεια - μετάφραση: Βες Σωτήριος, Μετάφραση: Παλούρα Ελένη, Αναγνωστόπουλος Αντώνης, Πολάτογλου Χαρίτων, 2011, Ζήτη, ISBN: 978-960-456-313-5 2. ΦΥΣΙΚΗ ΤΗΣ ΣΤΕΡΕΑΣ ΚΑΤΑΣΤΑΣΗΣ,ΒΕΣ Σ., ΚΑΝΕΛΛΗΣ Γ., 1993, ΓΙΑΧΟΥΔΗ, ISBN: 978-618-5092-28-3		
32		**Elective Course 1**	3	5
33		**Elective Course 2**	3	5
34		**Elective Course 3**	3	4
35		**Elective Course 4**	3	4
36		**Elective Course 5**	3	4
		TOTAL	19	30

8th Semester

NO	Code	Course	Hours	ECTS
37		Elective Course 6	3	5
38		Elective Course 7	3	5
39		Elective Course 8	3	4
40		Elective Course 9	3	4
41		Elective Course 10	3	4
42		Elective Course 11	3	4
43		Elective Course 12	3	4
		TOTAL	21	30

4.3.2. Basic Elective Courses

7th Semester

NO	Code	Course	Hours	ECTS
1	ΑΑΕ201	**Astrophysics**	3	5
		N. Stergioulas, G. Pappas 1. ΑΡΧΕΣ ΑΣΤΡΙΚΗΣ ΕΞΕΛΙΞΗΣ, Ν. ΣΠΥΡΟΥ, ΓΑΡΤΑΓΑΝΗΣ 2. ΑΣΤΡΟΦΥΣΙΚΗ,ΤΟΜΟΣ ΙΙ, ΓΑΛΑΞΙΕΣ- ΗΛΙΑΚΟ ΣΥΣΤΗΜΑ, F.H. SHU, ΙΤΕ/ΠΑΝ. ΕΚΔ. ΚΡΗΤΗΣ 3. ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΑΣΤΡΟΦΥΣΙΚΗ, ΑΛΥΣΣΑΝΔΡΑΚΗΣ Κ., 2014, ΕΚΔΟΣΕΙΣ ΠΑΠΑΖΗΣΗ, ISBN: 978-960-02-3058-1		
2	ΠΣΕ204	**Particle Physics**	3	5
		S. Tzamarias 1. ΣΤΟΙΧΕΙΩΔΗ ΣΩΜΑΤΙΔΙΑ, Α. ΝΙΚΟΛΑΪΔΗΣ, ΑΪΒΑΖΗΣ 2. ΕΙΣΑΓΩΓΗ ΣΤΗ ΦΥΣΙΚΗ ΣΤΟΙΧΕΙΩΔΩΝ ΣΩΜΑΤΙΔΙΩΝ, ALESSANDRO BETTINI, 2017, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ, ISBN: 978-960-461-782-1		
3	ΕΠΕ201	**Renewable Energy Sources**	3	5
		A. Bais COURSE MATERIAL FOR STUDY ARE PROVIDED BY THE LECTURERS		
4	ΗΤΕ203	**Electronic Circuits**	3	5
		T. Laopoulos 1. ΗΛΕΚΤΡΟΝΙΚΕΣ ΔΙΑΤΑΞΕΙΣ & ΘΕΩΡΙΑ ΚΥΚΛΩΜΑΤΩΝ, 10Η ΈΚΔΟΣΗ, BOYLESTAD R.NASHELSKY L. 2. Μικροηλεκτρονικά Κυκλώματα, Τόμος Β, 7η Έκδοση,Τόμος: Β, Sedra Adel, Smith Kenneth, 2017, Παπασωτηρίου, ISBN: 978-960-491-108-0 3. ΒΑΣΙΚΕΣ ΑΡΧΕΣ ΜΙΚΡΟΗΛΕΚΤΡΟΝΙΚΗΣ,ΒΕΗΖΑD RAZAVI, 2018, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ, ISBN: 978-960-461-850-7		
5	ΣΥΕ203	**Structural Properties of Materials**	3	5
		C. Lioutas, G. Dimitrakopoulos Μαθήματα για τη δομή των κρυσταλλικών στερεών, Χρήστος Β. Λιούτας, 2020, Ροπή, ISBN: 978-618-5289-45-4		
6	ΑΠΕ202	**Atmospheric Environment**	3	5
		D. Melas, K. Tourpali 1. ΑΤΜΟΣΦΑΙΡΙΚΗ ΡΥΠΑΝΣΗ, Σ. ΚΑΡΑΘΑΝΑΣΗΣ,ΤΖΙΟΛΑ 2. ΑΤΜΟΣΦΑΙΡΙΚΗ ΡΥΠΑΝΣΗ ΜΕ ΣΤΟΙΧΕΙΑ ΜΕΤΕΩΡΟΛΟΓΙΑΣ, Μ. ΛΑΖΑΡΙΔΗΣ, ΤΖΙΟΛΑ 3. ΑΤΜΟΣΦΑΙΡΙΚΗ ΡΥΠΑΝΣΗ: ΕΠΙΠΤΩΣΕΙΣ, ΕΛΕΓΧΟΣ ΚΑΙ ΕΝΑΛΛΑΚΤΙΚΕΣ ΤΕΧΝΟΛΟΓΙΕΣ, Ι. ΓΕΝΤΕΚΑΚΗΣ, ΚΛΕΙΔΑΡΙΘΜΟΣ		
7	ΜΑΕ204	**Non-Linear Dynamical Systems**	3	5
		G. Vougiatzis, F. Zervaki ΜΗ ΓΡΑΜΜΙΚΕΣ ΣΥΝΗΘΕΙΣ ΔΙΑΦΟΡΙΚΕΣ ΕΞΙΣΩΣΕΙΣ,Α.ΜΠΟΥΝΤΗΣ, 1997, Α.Γ.ΠΝΕΥΜΑΤΙΚΟΣ, ISBN: 960-7258-25-8 Πρόσθετο Διδακτικό Υλικό : ΕΙΣΑΓΩΓΗ ΣΤΑ ΜΗ ΓΡΑΜΜΙΚΑ ΔΥΝΑΜΙΚΑ ΣΥΣΤΗΜΑΤΑ, Τύπος: Ηλεκτρονικό Βιβλίο, ΓΕΩΡΓΙΟΣ ΒΟΥΓΙΑΤΖΗΣ, ΕΥΘΥΜΙΑ ΜΕΛΕΤΛΙΔΟΥ, 2016,ISBN: 978-960-603-103-8		
8	ΗΥΕ401	**Computational Physics and Applications**	3	5
		D. Melas, J. Kioseoglou		

🕮 1. ΥΠΟΛΟΓΙΣΤΙΚΗ ΦΥΣΙΚΗ, ΑΝΔΡΙΩΤΗΣ Ν. ΑΝΤΩΝΗΣ, 2016, ΑΝΔΡΙΩΤΗΣ Ν. ΑΝΤΩΝΗΣ, ISBN: 9789609378895

9	ΔΨΕ401	**Introduction to the Didactic of Physics**	3	5

A. Molochidis, E. Hatzikraniotis

🕮
1. ΕΙΣΑΓΩΓΗ ΣΤΗ ΔΙΔΑΚΤΙΚΗ ΤΩΝ ΦΥΣΙΚΩΝ ΕΠΙΣΤΗΜΩΝ, Κ. ΡΑΒΑΝΗΣ, ΕΚΔΟΣΕΙΣ ΝΕΩΝ ΤΕΧΝΟΛΟΓΙΩΝ
2. ΔΙΔΑΣΚΟΝΤΑΣ ΦΥΣΙΚΕΣ ΕΠΙΣΤΗΜΕΣ, ΧΑΛΚΙΑ ΚΡΥΣΤΑΛΛΙΑ

8th Semester

NO	Code	Course	Hours	ECTS
1	ΑΑΕ601	**Observational Astronomy**	3	5
		P. Papadopoulos, M. Pleionis, K. Tsiganis 1. ΠΑΡΑΤΗΡΗΣΙΑΚΗ ΑΣΤΡΟΝΟΜΙΑ, ΣΤ. ΑΥΓΟΛΟΥΠΗΣ, Ι. ΣΕΙΡΑΔΑΚΗΣ, ΠΛΑΝΗΤΑΡΙΟ		
2	ΠΣΕ201	**Nuclear Physics**	3	5
		C. Eleftheriadis 1. ΠΥΡΗΝΙΚΗ ΦΥΣΙΚΗ-ΒΑΣΙΚΕΣ ΑΡΧΕΣ ΚΑΙ ΠΥΡΗΝΟΣΥΝΘΕΣΗ, ΧΡΗΣΤΟΣ ΕΛΕΥΘΕΡΙΑΔΗΣ, COPY CITY		
3	ΗΤΕ202	**Communications Systems**	3	5
		S. Goudos 1. ΑΡΧΕΣ ΤΗΛΕΠΙΚΟΙΝΩΝΙΑΚΩΝ ΣΥΣΤΗΜΑΤΩΝ, H.TAUB D.SCHILLING, ΤΖΙΟΛΑ 2. ΑΝΑΛΟΓΙΚΕΣ & ΨΗΦΙΑΚΕΣ ΕΠΙΚΟΙΝΩΝΙΕΣ, HSU HWEI P, ΤΖΙΟΛΑ		
4	ΣΥΕ207	**Solid State PhysicsII**	3	5
		M. Aggelakeris, M. Gioti 1. ΦΥΣΙΚΗ ΣΤΕΡΕΑΣ ΚΑΤΑΣΤΑΣΗΣ, IBACH HARALD, LUTH HANS, ΕΠΙΜΕΛΕΙΑ - ΜΕΤΑΦΡΑΣΗ: ΒΕΣ ΣΩΤΗΡΙΟΣ, ΜΕΤΑΦΡΑΣΗ: ΠΑΛΟΥΡΑ ΕΛΕΝΗ, ΑΝΑΓΝΩΣΤΟΠΟΥΛΟΣ ΑΝΤΩΝΗΣ, ΠΟΛΑΤΟΓΛΟΥ ΧΑΡΙΤΩΝ, 2011, ΖΗΤΗ, ISBN: 978-960-456-313-5 2. ΕΙΣΑΓΩΓΗ ΣΤΗ ΦΥΣΙΚΗ ΣΤΕΡΕΑΣ ΚΑΤΑΣΤΑΣΕΩΣ,C.KITTEL, 1979, Α.Γ.ΠΝΕΥΜΑΤΙΚΟΣ, ISBN: 960-7258-51-7 3. ΜΑΓΝΗΤΙΣΜΟΣ ΚΑΙ ΜΑΓΝΗΤΙΚΑ ΥΛΙΚΑ,ΑΓΓΕΛΑΚΕΡΗΣ Μ., ΕΥΘΥΜΙΑΔΗΣ Κ.Γ., ΚΑΛΟΓΗΡΟΥ Ο., 2013, CCITY PUBLISH, ISBN: 978-960-9551-10-6		
5	ΕΦΕ207	**Physics of Nanostructures and Surfaces**	3	5
		E. Paloura COURSE MATERIAL FOR STUDY ARE PROVIDED BY THE LECTURERS		
6	ΓΘΕ202	**Hamiltonian Mechanics**	3	5
		E. Meletlidou,G. Vougiatzis 1. ΚΛΑΣΙΚΗ ΜΗΧΑΝΙΚΗ, Σ.Ν. ΠΝΕΥΜΑΤΙΚΟΣ, ΠΝΕΥΜΑΤΙΚΟΣ 2. ΕΙΣΑΓΩΓΗ ΣΤΗ ΜΗΧΑΝΙΚΗ HAMILTON, ΣΙΜΟΣ ΙΧΤΙΑΡΟΓΛΟΥ		

4.3.3. Specialized elective courses

7th Semester

NO	Code	Course	Hours	ECTS
1	ΒΙΕ103	**Biophysics**	3	4
		T. Samaras,N. Fragkis 1. ΒΙΟΦΥΣΙΚΗ, KENSAL VAN HOLDE, W. CURTIS JOHNSON, P. SHING HO, 2009, ΕΜΒΡΥΟ - ΣΤΥΛΙΑΝΟΣ ΒΑΣΙΛΕΙΑΔΗΣ, ISBN: 978-960-8002-55-5		
2	ΑΑΕ103	**Planetary Systems and Space Exploration**	3	4
		Unavailable during 2020-21 academic year 1. ΔΙΑΣΤΗΜΑ: ΒΑΣΗΕΥΡΩΠΗ (SPACE EUROPE ESA EDITION 2007), G. REIBALDI, G. CAPRARA, UNIVERSITY STUDIO PRESS		
3	ΑΑΕ202	**Galactic and Extragalactic Astronomy**	3	4
		Unavailable during 2020-21 academic year 1. ΕΙΣΑΓΩΓΗ ΣΤΗ ΦΥΣΙΚΗ ΤΩΝ ΑΣΤΡΙΚΩΝ ΣΥΣΤΗΜΑΤΩΝ, Ν. ΚΑΡΑΝΙΚΟΛΑΣ, ΧΑΡΙΣ ΕΠΕ 2. ΑΣΤΡΟΦΥΣΙΚΗ,ΤΟΜΟΣ ΙΙ ΓΑΛΑΞΙΕΣ- ΗΛΙΑΚΟ ΣΥΣΤΗΜΑ, F.H. SHU, ΙΤΕ/ΠΑΝ. ΕΚΔ. ΚΡΗΤΗΣ		
4	ΠΣΕ501	**Nuclear Physics: Laboratory Course II**	3	4
		D. Sampsonidis, S. Stoulos, A. Ioannidou, A. Liolios, C. Eleftheriadis, K. Kordas COURSE MATERIAL FOR STUDY ARE PROVIDED BY THE LECTURERS		
5	ΣΥΕ206	**Physics and Technology of Semiconductor Devices**	3	4
		D. Tassis 1. ΕΙΣΑΓΩΓΗ ΣΤΙΣ ΔΙΑΤΑΞΕΙΣ ΗΜΙΑΓΩΓΩΝ, ΝΕΑΜΕΝ, 2014, FOUNTAS, ISBN: 9789603307617		
6	ΓΘΕ206	**Theoretical Statistic Solid State Physics**	3	4
		C. Polatoglou COURSE MATERIAL FOR STUDY ARE PROVIDED BY THE LECTURERS		
7	ΓΘΕ208	**Propagation of Electromagnetic Waves-Antennas-Microwaves & Applications**	3	4
		K. Siakavara COURSE MATERIAL FOR STUDY ARE PROVIDED BY THE LECTURERS		
8	ΕΦΕ203	**Non-Linear Circuits**	3	4
		I. Stouboulos, C. Volos 1. ΜΗ ΓΡΑΜΜΙΚΑ ΚΥΚΛΩΜΑΤΑ, Ι. ΚΥΠΡΙΑΝΙΔΗΣ, Μ. ΠΕΤΡΑΝΗ, ΣΥΓΧΡΟΝΗ ΠΑΙΔΕΙΑ		
9	ΣΥΕ204	**Crystal Structure and Applications**	3	4
		G. Vourlias COURSE MATERIAL FOR STUDY ARE PROVIDED BY THE LECTURERS		
10	ΣΥΕ205	**Magnetic Materials and Applications**	3	4
		M. Aggelakeris, C. Sarafidis 1. ΜΑΓΝΗΤΙΣΜΟΣ ΚΑΙ ΜΑΓΝΗΤΙΚΑ ΥΛΙΚΑ, ΑΓΓΕΛΑΚΕΡΗΣ Μ., ΕΥΘΥΜΙΑΔΗΣ Κ., ΚΑΛΟΓΗΡΟΥ ΟΡ.		
11	ΗΤΕ201	**Microelectronics**	3	4
		S. Siskos		

1. ΨΗΦΙΑΚΑ ΟΛΟΚΛΗΡΩΜΕΝΑ ΚΥΚΛΩΜΑΤΑ: ΜΙΑ ΣΧΕΔΙΑΣΤΙΚΗ ΠΡΟΣΕΓΓΙΣΗ, J. RABAEY, A. CHANDRAKASAN, B. NIKOLIC, ΚΛΕΙΔΑΡΙΘΜΟΣ
2. ΣΧΕΔΙΑΣΗ ΟΛΟΚΛΗΡΩΜΕΝΩΝ ΚΥΚΛΩΜΑΤΩΝ CMOS VLSI, N. WESTE, D.M. HARRIS, ΠΑΠΑΣΩΤΗΡΙΟΥ

12	ΓΘΕ205	Quantum Mechanics III	3	4

A. Petkou

1. ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΚΒΑΝΤΟΜΗΧΑΝΙΚΗ,ΤΑΜΒΑΚΗΣ ΚΥΡΙΑΚΟΣ, LEADER BOOKS
2. ΚΒΑΝΤΙΚΗ ΦΥΣΙΚΗ, STEPHEN GASIOROWICZ, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ

13	ΜΑΕ202	Mathematical Methods in Physics II	3	4

PDE funded Lecturer

ΜΑΘΗΜΑΤΙΚΕΣ ΜΕΘΟΔΟΙ ΓΙΑ ΦΥΣΙΚΟΥΣ: ΜΙΑ ΠΕΡΙΕΚΤΙΚΗ ΕΙΣΑΓΩΓΗ,TAI L. CHOW, 2018, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ, ISBN: 978-960-461-817-0

14	ΗΥΕ201	Digital Systems	3	4

S. Nikolaidis

1. Ψηφιακή Σχεδίαση, 6η Έκδοση,Mano Morris, Ciletti Michael, 2018, Παπασωτηρίου, ISBN: 978-960-491-113-4
2. ΨΗΦΙΑΚΗ ΣΧΕΔΙΑΣΗ: ΑΡΧΕΣ ΚΑΙ ΠΡΑΚΤΙΚΕΣ,JOHN F. WAKERLY, 2019, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ, ISBN: 978-960-645-001-3
3. Ψηφιακή Σχεδίαση,Κώστας Ευσταθίου, 2012, Εκδόσεις Νέων Τεχνολογιών, ISBN: 978-960-6759-82-6

15	ΔΨΕ501	Didactics of Physics Laboratory	3	4

C. Polatoglou, K. Chrysafis, E. Hatzikraniotis, A. Molochidis

1. Η ΟΙΚΟΔΟΜΗΣΗ ΤΩΝ ΕΝΝΟΙΩΝ ΣΤΗ ΦΥΣΙΚΗ, LEMEIGNAN GERARD, WEIL-BARAIS ANNICK, ΤΥΠΩΘΗΤΩ
2. ΠΕΝΤΕ ΕΥΚΟΛΑ ΜΑΘΗΜΑΤΑ, KNIGHT RANDALL D., ΔΙΑΥΛΟΣ
3. ΜΟΝΟΠΑΤΙΑ ΤΗΣ ΣΚΕΨΗΣ ΣΤΟΝ ΚΟΣΜΟ ΤΗΣ ΦΥΣΙΚΗΣ, ΚΟΥΜΑΡΑΣ ΠΑΝΑΓΙΩΤΗΣ, 2015, GUTENBERG, ISBN: 978-960-01-1680-9

16	ΓΘΕ203	Fluid Mechanics	3	4

G. Pappas

1. Δυναμική των ρευστών,Βλαχάκης Ν., 2019, ΕΚΔΟΣΕΙΣ ΠΑΠΑΖΗΣΗ, ISBN: 978-960-02-3526-5
2. Εισαγωγή στη μηχανική των συνεχών μέσων,Χατζηδημητρίου Ιωάννης Δ.,Μπόζης Γεώργιος Δ., 1997, ΤΖΙΟΛΑ, ISBN: 960-7219-39-2

17	ΑΜΕ701	Thesis for Bachelor – Introduction to research methodology	6	8

8th Semester

NO	Code	Course	Hours	ECTS
1	ΑΑΕ102	**Cosmology**	3	4
		C. Tsagkas		
		1. Το μικρό βιβλίο της μεγάλης έκρηξης,Hogan Graig J., 2009, Αλεξάνδρεια, ISBN: 978-960-221-434-3		
2	ΓΘΕ211	**Introduction to ionized gas Physics (Plasma Physics)**	3	4
		G. Pappas		
		1. Φυσική του πλάσματος,Βλάχος Λουκάς, 2000, ΤΖΙΟΛΑ, ISBN: 960-8050-32-4		
3	ΑΑΕ101	**Radio Astronomy – Astronomy in non Optical Wavelengths**	3	4
		N. Stergioulas, P. Papadopoulos		
		1. ΕΙΣΑΓΩΓΗ ΣΤΗ ΡΑΔΙΟΑΣΤΡΟΝΟΜΙΑ,ΓΙΑΝΝΗΣ Χ. ΣΕΙΡΑΔΑΚΗΣ, 2009, ΠΛΑΝΗΤΑΡΙΟ Θεσσαλονίκης, ISBN: 9789608904972		
4	ΠΣΕ101	**Nuclear Theory Subjects**	3	4
		T. Gaitanos		
		COURSE MATERIAL FOR STUDY ARE PROVIDED BY THE LECTURERS		
5	ΠΣΕ207	**Experimental Foundations of Particle Physics**	3	4
		K. Kordas		
		1. Σύγχρονη Σωματιδιακή Φυσική, Μάρκ Τόμσον - Mark Thomson, 2020, Ροπή, ISBN: 978-618-5289-46-1		
		2. ΕΙΣΑΓΩΓΗ ΣΤΗ ΦΥΣΙΚΗ ΣΤΟΙΧΕΙΩΔΩΝ ΣΩΜΑΤΙΔΙΩΝ, ALESSANDRO BETTINI, 2017, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ, ISBN: 978-960-461-782-1		
6	ΠΣΕ206	**Accelerators and Detectors in Nuclear and Particle Physics**	3	4
		PDE funded Lecturer		
		COURSE MATERIAL FOR STUDY ARE PROVIDED BY THE LECTURERS		
7	ΒΙΕ201	**Radiation Physics and Applications of Radioisotopes**	3	4
		A. Ioannidou,S. Stoulos		
		1. Φυσική Ακτινοβολιών και Εφαρμογές Ραδιοϊσοτόπων,Παπαστεφάνου Κωνσταντίνος, 2014, Ζήτη, ISBN: 978-960-456-417-0		
8	ΓΘΕ209	**Quantum Optics - Laser**	3	4
		K. Papagelis		
		1. ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΚΒΑΝΤΙΚΗ ΟΠΤΙΚΗ ΚΑΙ LASER,ΒΕΣ ΣΩΤΗΡΙΟΣ, 1999, ΓΙΑΧΟΥΔΗ, ISBN: 978-618-5092-23-8		
		2. Laser,ΠΕΡΣΕΦΟΝΗΣ ΠΕΤΡΟΣ, 2010, ΑΡΑΚΥΝΘΟΣ, ISBN: 978-960-9474-04-7		
9	ΑΠΕ102	**Atmospheric Diffusion and Dispersion**	3	4
		C. Meleti		
		1. Ατμοσφαιρική ρύπανση,Καραθανάσης Στ., 2007, ΤΖΙΟΛΑ, ISBN: 978-960-418-119-3		
		2. ΠΗΓΕΣ, ΔΙΑΣΠΟΡΑ ΚΑΙ ΕΛΕΓΧΟΣ ΑΤΜΟΣΦΑΙΡΙΚΗΣ ΡΥΠΑΝΣΗΣ,Γεώργιος Μπεργελές, 2006, Πανεπιστημιακές Εκδόσεις ΕΜΠ, ISBN: 960-254-660-3		
		3. Ανάλυση επικινδυνότητας,Ασσαέλ Μάρκος Ι.,Κακόσιμος Κωνσταντίνος Ε., 2007, ΤΖΙΟΛΑ, ISBN: 978-960-418-148-3		
10	ΑΠΕ101	**Atmospheric Technology**	3	4
		K. Tourpali, A. Bais, D. Balis, K. Garane		
		COURSE MATERIAL FOR STUDY ARE PROVIDED BY THE LECTURERS		

11	ΕΠΕ101	Global Environmental Changes	3	4

D. Balis, K. Tourpali

COURSE MATERIAL FOR STUDY ARE PROVIDED BY THE LECTURERS

12	ΗΤΕ501	Laboratory on Electronic Circuits	3	4

S. Nikolaidis, E. Nikolaidis

COURSE MATERIAL FOR STUDY ARE PROVIDED BY THE LECTURERS

13	ΓΘΕ204	Problems in Quantum Physics	3	4

PDE funded Lecturer

1. ΚΒΑΝΤΙΚΗ ΟΠΤΙΚΗ,FOX MARK, 2014, ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, ISBN: 978-960-524-407-1
2. ΣΧΕΤΙΚΙΣΤΙΚΗ ΚΒΑΝΤΟΜΗΧΑΝΙΚΗ,ΤΡΑΧΑΝΑΣ ΣΤΕΦΑΝΟΣ, 2000, ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, ISBN: 960-7309-18-9

14	ΕΦΕ202	Linear Circuits	3	4

I. Stouboulos, C. Volos

1. ΑΝΑΛΥΣΗ ΓΡΑΜΜΙΚΩΝ ΚΥΚΛΩΜΑΤΩΝ (τόμος Α),Ι.Μ. ΚΥΠΡΙΑΝΙΔΗΣ, 2007, ΣΥΓΧΡΟΝΗ ΠΑΙΔΕΙΑ, ISBN: 978-960-357-077-6
2. ΑΡΧΕΣ ΗΛΕΚΤΡΙΚΩΝ ΚΥΚΛΩΜΑΤΩΝ, ΑΠΟ ΤΗ ΘΕΩΡΙΑ ΣΤΟ ΠΕΙΡΑΜΑ,Κ. ΕΥΘΥΜΙΑΔΗΣ, Ο. ΚΑΛΟΓΗΡΟΥ, Ι. ΚΥΠΡΙΑΝΙΔΗΣ, Κ. ΜΕΛΙΔΗΣ, Α. ΣΙΑΚΑΒΑΡΑ..., 2002, ΣΥΓΧΡΟΝΗ ΠΑΙΔΕΙΑ, ISBN: 978-960-357-053-2

15	ΓΘΕ210	General Theory of Relativity	3	4

N. Stergioulas, C. Tsagkas

1. Ειδική Σχετικότητα, Γενική Σχετικότητα,Hartle J., 2011, ΤΖΙΟΛΑ, ISBN: 978-960-418-270-1
2. Γενική Σχετικότητα,Bernard F. Schutz, 2007, ΤΡΑΥΛΟΣ & ΣΙΑ ΟΕ, ISBN: 960-7122-21-6

16	ΗΥΕ202	Computer Architecture	3	4

K. Siozios

1. Η Αρχιτεκτονική Υπολογιστών,Δημήτριος Β. Νικολός, 2017, Παναγιώτα Παπακωνσταντίνου, ISBN: 978-618-83197-0-7
2. Οργάνωση και Αρχιτεκτονική Υπολογιστών, 11η Έκδοση,Stallings William, 2020, ΤΖΙΟΛΑ, ISBN: 978-960-418-892-5

17	ΣΥΕ402	Solid State Physics Laboratory	3	4

M. Katsikini, C. Lioutas, D. Tassis, M. Gioti, I. Arvanitidis, J. Kioseoglou, K. Efthymiadis, T. Zorba

1. ΕΡΓΑΣΤΗΡΙΑΚΑ ΘΕΜΑΤΑ ΦΥΣΙΚΗΣ ΣΤΕΡΕΑΣ ΚΑΤΑΣΤΑΣΗΣ, ΚΑΤΣΙΚΙΝΗ ΜΑΡΙΑ, ΒΕΣ ΣΩΤΗΡΙΟΣ, ΑΡΒΑΝΙΤΙΔΗΣ ΙΩΑΝΝΗΣ, ΓΙΩΤΗ ΜΑΡΙΑ, ΕΥΘΥΜΙΑΔΗΣ ΚΩΝΣΤΑΝΤΙΝΟΣ, ΚΙΟΣΕΟΓΛΟΥ ΙΩΣΗΦ, ΠΑΡΑΣΚΕΥΟΠΟΥΛΟΣ ΚΩΝΣΤΑΝΤΙΝΟΣ, ΤΑΣΣΗΣ ΔΗΜΗΤΡΗΣ, 2018, ΚΡΙΤΙΚΗ, ISBN: 978-960-586-265-7

18	ΑΜΕ701	Thesis for Bachelor – Introduction to research methodology	6	8

4.3.4. Generic elective courses

Winter Semester

NO	Code	Course	Hours	ECTS
1	BIE101	**Bioelectromagnetics**	3	4
		T. Samaras		
		COURSE MATERIAL FOR STUDY ARE PROVIDED BY THE LECTURERS		
2	ΕΦΕ208	**Physics of Liquids and Applications to Materials Science**	3	4
		P. Patsalas		
		COURSE MATERIAL FOR STUDY ARE PROVIDED BY THE LECTURERS		
3	BIE102	**Medical Physics-Dosimetry**	3	4
		S. Stoulos, G. Kitis		
		Εφαρμοσμένη Φυσική Ιοντιζουσών Ακτινοβολιών – Δοσιμετρία και Ακτινοπροστασία, Rodolphe Antoni, Laurent Bourgois, 2020, ΡΟΠΗ, ISBN: 978-618-5289-47-8		
4	ΙΦΕ101	**History and Evolution of Concepts in Physics**	3	4
		G. Kitis, A. Liolios		
		1. Εισαγωγή στις έννοιες & τις θεωρίες της φυσικής επιστήμης,Holton Gerald,Brush G Stephen(επιστ. επιμ. Σκορδούλης Κ.), 2018, GUTENBERG, ISBN: 978-960-01-1947-3		
		2. Ιστορία της φυσικής,Τόμος: Τόμος 1, Segre Emilio, 1997, Δίαυλος, ISBN: 978-960-531-020-2		
		3. ΙΣΤΟΡΙΑ ΚΑΙ ΕΞΕΛΙΞΗ ΤΩΝ ΙΔΕΩΝ ΣΤΗ ΦΥΣΙΚΗ,ΒΑΡΒΟΓΛΗΣ ΧΑΡΗΣ, 2011, ΠΛΑΝΗΤΑΡΙΟ Θεσσαλονίκης, ISBN: 978-960-9453-02-8		
5	ΓΘΕ201	**Metrology - Quality Systems**	3	4
		C. Polatoglou, C. Sarafidis		
		1. ΣΥΣΤΗΜΑΤΑ ΜΕΤΡΗΣΕΩΝ, ΠΕΤΡΙΔΗΣ Β., UNIVERSITY STUDIO PRESS		
		2. ΒΕΛΤΙΩΣΗ ΠΟΙΟΤΗΤΑΣ, ΤΣΙΟΤΡΑΣ Γ.Δ., ΜΠΕΝΟΥ		
6	ΓΛΕ201	**Foreign Language (English)**	3	4
		Unavailable during 2020-21 academic year		
		1. LEXICON, ΒΑΣΙΛΕΙΑΔΟΥ - ΖΑΧΟΥ ΜΑΡΙΑ - ΑΦΡΟΔΙΤΗ,ΔΗΜΕΛΗ - ΚΩΝΣΤΑΝΤΙΝΟΥ ΦΡΕΙΔΕΡΙΚΗ,ΣΤΕΠΑΝΙΑΝ ΜΠΕΡΤΣ,ΦΙΝΟΓΛΟΥ - ΧΑΡΣΟΥΛΗ ΕΥΘΑΛΙΑ, 2004, UNIVERSITY STUDIO PRESS, ISBN: 978-960-12-1276-0		
		2. ΑΓΓΛΟ-ΕΛΛΗΝΙΚΟ ΛΕΞΙΚΟ ΦΥΣΙΚΩΝ ΟΡΩΝ, ΠΑΠΑΓΙΑΝΝΑΚΟΠΟΥΛΟΣ Π., 2008, ΚΑΡΔΑΜΙΤΣΑ, ISBN: 9789603542261		
7	AME501	**Internship**	3	4
		G. Vourlias, I. Stouboulos, A. Molochidis		
8	ΕΦΕ205	**Characterization Techniques and Materials in Preservation of Cultural Heritage**	3	4
		Κ.Χρυσάφης,Τ. Zorba		
		1. ΝΕΕΣ ΤΕΧΝΟΛΟΓΙΕΣ ΣΤΙΣ ΑΡΧΑΙΟΓΝΩΣΤΙΚΕΣ ΕΠΙΣΤΗΜΕΣ, ΛΥΡΙΤΖΗΣ Ι., GUTENBERG		
		2. ΦΥΣΙΚΕΣ ΕΠΙΣΤΗΜΕΣ ΣΤΗΝ ΑΡΧΑΙΟΛΟΓΙΑ, (2Η ΕΚΔΟΣΗ), ΛΥΡΙΤΖΗΣ Ι.,ΤΥΠΩΘΗΤΩ, ΔΑΡΔΑΝΟΣ		
9	ΣΥΕ201	**Physics of Metals**	3	4
		T. Kechagias,G. Dimitrakopoulos		

1. Επιστήμη και Τεχνολογία Υλικών, 9η Έκδοση,Callister William D., 2016, ΤΖΙΟΛΑ, ISBN: 978-960-418-556-6
2. Επιστήμη και Τεχνολογία των Μεταλλικών Υλικών,Χρυσουλάκης Γιάννης Δ.,Παντελής Δημήτρης Ι., 2007, Παπασωτηρίου, ISBN: 978-960-7510-39-6

10	ΧΜΕ201	Physical Chemistry	3	4

D. Sazou, P. Giannakoudakis, S. Sotiropoulos, D. Tsiplakidis

1. Ηλεκτροχημεία,Μουμτζής Ιωάννης Α., Σαζού Δήμητρα Π., 1997, Ζήτη, ISBN: 960-431-129-8
2. ΑΡΧΕΣ ΚΑΙ ΜΕΘΟΔΟΙ ΜΕΛΕΤΗΣ ΗΛΕΚΤΡΟΔΙΑΚΩΝ ΔΡΑΣΕΩΝ, ΚΟΚΚΙΝΙΔΗΣ ΓΕΩΡΓΙΟΣ, 1992, ΓΙΑΧΟΥΔΗ, ISBN: 978-618-5092-55-9

11	ΓΘΕ212	Chaotic Dynamics	3	4

E. Meletlidou

1. ΔΥΝΑΜΙΚΑ ΣΥΣΤΗΜΑΤΑ ΚΑΙ ΧΑΟΣ, ΜΠΟΥΝΤΗΣ ΑΝΑΣΤΑΣΙΟΣ, 1995, ΠΑΠΑΣΩΤΗΡΙΟΥ, ISBN: 978-960-7510-22-8

12	ΠΣΕ203	Cosmic Radiation	3	4

A. Liolios, C. Eleftheriadis

1. ΕΙΣΑΓΩΓΗ ΣΤΙΣ ΚΟΣΜΙΚΕΣ ΑΚΤΙΝΕΣ, Α. ΛΙΟΛΙΟΣ, COPY CITY
2. ΚΟΣΜΙΚΗ ΑΚΤΙΝΟΒΟΛΙΑ, Ε. ΧΡΙΣΤΟΠΟΥΛΟΥ-ΜΑΥΡΟΜΙΧΑΛΑΚΗ, ΣΥΜΜΕΤΡΙΑ

Spring Semester

NO	Code	Course	Hours	ECTS
1	ΜΑΕ203	Numerical Analysis	3	4

N. Stergioulas

1. ΑΡΙΘΜΗΤΙΚΕΣ ΜΕΘΟΔΟΙ ΚΑΙ ΕΦΑΡΜΟΓΕΣ ΓΙΑ ΜΗΧΑΝΙΚΟΥΣ, 4Η ΈΚΔΟΣΗ, ΣΑΡΡΗΣ Ι.- ΚΑΡΑΚΑΣΙΔΗΣ Θ., 2017, ΤΖΙΟΛΑ, ISBN: 978-960-418-725-6
2. ΕΙΣΑΓΩΓΗ ΣΤΗΝ ΑΡΙΘΜΗΤΙΚΗ ΑΝΑΛΥΣΗ, ΑΚΡΙΒΗΣ Γ.Δ., ΔΟΥΓΑΛΗΣ Β.Α., 2015, ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, ISBN: 978-960-524-022-6

2	ΒΙΕ104	Biology	3	4

Z. Skouras, A. Baksevanis, N. Karaiskou, M. Tsiafouli, C. Pirini, E. Tsakiri, C. Antoniadou

1. Ταξιδεύοντας στην εποχή του ανθρώπου,Ζαχαρίας Σκούρας, 2020, Γερμανός, ISBN: 9786185389086

3	ΓΘΕ207	Geometrical Optics - Applications	3	4

I. Arvanitidis

1. ΓΕΩΜΕΤΡΙΚΗ ΟΠΤΙΚΗ,ΣΠΥΡΙΔΕΛΗΣ Ι., ΚΑΜΠΑΣ Κ., 1990, ΓΙΑΧΟΥΔΗ, ISBN: 978-618-5092-25-2
2. Πανεπιστημιακή φυσική με σύγχρονη φυσική,Τόμος: Β ΤΟΜΟΣ, Young H., Freedman R., 2019, ΕΚΔΟΣΕΙΣ ΠΑΠΑΖΗΣΗ, ISBN: 978-960-02-3536-4

4	ΕΠΕ202	Energy Production from nuclear and Fossil Fuels	3	4

E. Savvidis

1. Πυρηνική Ενέργεια και Ορυκτά Καύσιμα,Σαββίδης Ηλίας, 2013, C.City Publish, ISBN: 978-960-9551-09-0
2. Πυρηνική Ενέργεια και Τεχνολογικές Εφαρμογές,Πολυζάκης Απόστολος, 2019, Πολυζάκης Απόστολος ΣΙΑ ΕΕ, ISBN: 978-618-83590-8-6

5	ΓΓΕ401	Geophysics - Seismology	3	4

V. Karakostas

Εισαγωγή στη σεισμολογία,Παπαζάχος Βασίλειος Κ., Καρακαΐσης Γεώργιος Φ., Χατζηδημητρίου Παναγιώτης Μ., 2005, Ζήτη, ISBN: 960-431-979-5

6	ΔΨΕ502	**Educational Technology Laboratory**	3	4

E. Hatzikraniotis, A. Molochidis

1. ΝΕΕΣ ΤΑΣΕΙΣ ΣΤΗΝ ΕΚΠΑΙΔΕΥΤΙΚΗ ΤΕΧΝΟΛΟΓΙΑ, ΣΟΛΟΜΩΝΙΔΟΥΧ., ΜΕΤΑΙΧΜΙΟ
2. ΕΙΣΑΓΩΓΗ ΣΤΙΣ ΕΚΠΑΙΔΕΥΤΙΚΕΣ ΕΦΑΡΜΟΓΕΣ ΤΩΝ ΤΕΧΝΟΛΟΓΙΩΝ ΠΛΗΡΟΦΟΡΙΑΣ ΚΑΙ ΕΠΙΚΟΙΝΩΝΙΩΝ, ΚΟΜΗΣ Β.Ι., ΕΚΔΟΣΕΙΣ ΝΕΩΝ ΤΕΧΝΟΛΟΓΙΩΝ

7	ΗΤΕ502	**Laboratory in Communications and Networks**	3	4

S. Goudos

Πρόσθετο Διδακτικό Υλικό:

1. ΕΡΓΑΣΤΗΡΙΑΚΕΣ ΑΣΚΗΣΕΙΣ ΔΙΚΤΥΩΝ Η/Υ, Τύπος: Ηλεκτρονικό Βιβλίο, ΚΩΝΣΤΑΝΤΙΝΟΣ ΧΕΙΛΑΣ, ΑΝΑΣΤΑΣΙΟΣ ΠΟΛΙΤΗΣ, ΑΛΕΞΑΝΔΡΟΣ ΒΑΚΑΛΟΥΔΗΣ, 2016,ISBN: 978-960-603-056-7

8	ΑΜΕ201	**Methodology, Presentation of Physics Subjects**	3	4

COURSE MATERIAL FOR STUDY ARE PROVIDED BY THE LECTURERS

9	ΑΠΕ201	**Meteorology**	3	4

K. Tourpali, P. Zanis

1. ΓΕΝΙΚΗ ΜΕΤΕΩΡΟΛΟΓΙΑ,Χ. ΣΑΧΣΑΜΑΝΟΓΛΟΥ, Τ. ΜΑΚΡΟΓΙΑΝΝΗΣ, ΖΗΤΗ
2. ΜΑΘΗΜΑΤΑ ΓΕΝΙΚΗΣ ΜΕΤΕΩΡΟΛΟΓΙΑΣ,Τ. ΜΑΚΡΟΓΙΑΝΝΗΣ, Χ. ΣΑΧΣΑΜΑΝΟΓΛΟΥ, ΧΑΡΙΣ

10	ΓΛΕ201	**Foreign Language (English)**	3	4

M. Mathaiou

1. LEXICON, ΒΑΣΙΛΕΙΑΔΟΥ - ΖΑΧΟΥ ΜΑΡΙΑ - ΑΦΡΟΔΙΤΗ,ΔΗΜΕΛΗ - ΚΩΝΣΤΑΝΤΙΝΟΥ ΦΡΕΙΔΕΡΙΚΗ,ΣΤΕΠΑΝΙΑΝ ΜΠΕΡΤΣ,ΦΙΝΟΓΛΟΥ - ΧΑΡΣΟΥΛΗ ΕΥΘΑΛΙΑ, 2004, UNIVERSITY STUDIO PRESS, ISBN: 978-960-12-1276-0
2. ΑΓΓΛΟ-ΕΛΛΗΝΙΚΟ ΛΕΞΙΚΟ ΦΥΣΙΚΩΝ ΟΡΩΝ, ΠΑΠΑΓΙΑΝΝΑΚΟΠΟΥ-ΛΟΣ Π., 2008, ΚΑΡΔΑΜΙΤΣΑ, ISBN: 9789603542261

12	ΜΑΕ201	**Probability and Statistics**	3	4

K. Kosmidis, F. Zervaki

1. Θεωρία πιθανοτήτων &στοιχεία στατιστικής ανάλυσης,Φιλιππάκης Μ., 2019, τσότρας, ISBN: 978-618-5309-79-4
2. ΠΙΘΑΝΟΤΗΤΕΣ ΚΑΙ ΣΤΑΤΙΣΤΙΚΗ ΓΙΑ ΜΗΧΑΝΙΚΟΥΣ, ΜΥΛΩΝΑΣ ΝΙΚΟΣ - ΠΑΠΑΔΟΠΟΥΛΟΣ ΒΑΣΙΛΕΙΟΣ, 2016, ΤΖΙΟΛΑ, ISBN: 978-960-418-561-0

13	ΑΜΕ501	**Internship**	3	4

G. Vourlias, I. Stouboulos, A. Molochidis

14	ΠΣΕ202	**Enviromental radioactivity**	3	4

S. Stoulos, A. Ioannidou

1. Ραδιενέργεια περιβάλλοντος,Παπαστεφάνου Κωνσταντίνος Φ., 2010, Ζήτη, ISBN: 978-960-456-198-8

15	ΚΟΕ601	**Technology-Materials and Social-Economic Environment**	3	4

F. Komninou, J. Kioseoglou

COURSE MATERIAL FOR STUDY ARE PROVIDED BY THE LECTURERS

16	ΙΦΕ102	**Physics and Philosophy**	3	4

G. Kitis, A. Liolios

1. Εισαγωγή στις έννοιες & τις θεωρίες της φυσικής επιστήμης,Holton Gerald,Brush G Stephen(επιστ. επιμ. Σκορδούλης Κ.), 2018, GUTENBERG, ISBN: 978-960-01-1947-3
2. ΑΝΤΙΛΗΨΗ, ΘΕΩΡΙΑ ΚΑΙ ΔΕΣΜΕΥΣΗ,BROWN I. HAROLD, 1995, ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, ISBN: 960-7309-54-5
3. ΦΙΛΟΣΟΦΙΑ ΚΑΙ ΕΠΙΣΤΗΜΕΣ ΣΤΟΝ ΕΙΚΟΣΤΟ ΑΙΩΝΑ,Μπαλτάς Αριστείδης, Στεργιόπουλος Κώστας (επιμ.), 2013, ΙΤΕ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, ISBN: 978-960-524-395-1

17	BIE105	**Physics of the Human Body**	3	4

T. Samaras

1. Φυσική του ανθρώπινου σώματος,J. CAMERON, J. SKOFRONICK, R. GRANT, 2002, Επιστημονικές Εκδόσεις ΠΑΡΙΣΙΑΝΟΥ Α.Ε., ISBN: 9789603941026
2. ΦΥΣΙΚΗ ΙΑΤΡΙΚΗ ΤΟΥ ΑΝΘΡΩΠΙΝΟΥ ΣΩΜΑΤΟΣ, HERMAN I., 2009, ΕΚΔΟΣΕΙΣ ΠΑΣΧΑΛΙΔΗΣ, ISBN: 9789603999140

18	ΣΥΕ202	**Physics of Materials**	3	4

F. Komninou, J. Kioseoglou

1. ΕΠΙΣΤΗΜΗ ΚΑΙ ΤΕΧΝΟΛΟΓΙΑ ΥΛΙΚΩΝ, 9Η ΈΚΔΟΣΗ,CALLISTER WILLIAMTZIOΛΑ
2. ΕΠΙΣΤΗΜΗ ΚΑΙ ΤΕΧΝΟΛΟΓΙΑ ΥΛΙΚΩΝ, ΒΑΤΑΛΗΣ ΑΡΓΥΡΗΣ Σ.,ΖΗΤΗ

19	ΕΦΕ206	**Photonic Technologies and Applications**	3	4

K. Virsokinos

COURSE MATERIAL FOR STUDY ARE PROVIDED BY THE LECTURERS

	Lecturers
	Coursebooks
	Lecturing Schedule
	Exams' date
	Lecturing hours
	ECTS units

4.4. Courses Outline

4.4.1. Core Courses

1st Semester

PHYSICS I (MECHANICS)

Units and Vectors:Standards and units. Dimensions. Vectors. The unit vector. The position vector.
Components of a vector. Scalar andvector products. Types of vectors. The derivative of a vector. Problems.
Motion of a Particle:Rectilinear motion. Average and instantaneous velocity, acceleration. Motion in a plane.
Physical coordinates. General motion in space. Coordinate systems. Motion of a projectile. Circular motion. Examples – Prolems.
Forces and Motion:The concept of force. Fields of forces. The Newton's laws of motion. Universal gravitation. Inertial and gravitational mass. Friction. Balance. Motion under the influence of forces. Examples – Problems.
Frames of Reference:Relative velocity. Galilean transformation. Inertial and accelerated frames of reference. Inertial forces. Relativity and Equivalence principles. Motion in a rotating frame of reference. Centrifugal and Coriolis forces. Examples Problems.
Energy and Conservation Laws:Impulse. Energy. Work. Conservative forces. Kinetic energy. Potential energy. Power. Linear momentum. Angular momentum and torque. Conservation laws. Kepler's laws. Examples – Problems.
Motion of Systems: Mechanical system of particles. Internal and external forces. Internal energy. Center of mass. Center of mass frame of reference. Momentum, energy and angular momentum of a system. Collisions. Systems of variable mass. Examples – Problems.
MechanicalOscillations:The simple harmonic oscillator. Equation and energy of the simple harmonic motion. The pen dulum. Damped harmonic oscillations. Forced harmonic oscillations. Resonance of energy and amplitude. Examples – Problems.

MATHEMATICS I

Differential Calculus - Functions of one variable (Real Functions of a real variable, the derivative and the differential of the function, applications of a derivative, study of the real functions using derivatives) - Integral Calculus - Functions of one variable (Indefinite integrals, the definite integral, improper integrals, approximate methods, applications of integrals).

APPLIED MATHEMATICS I

Vector spaces and vector calculus - inner products, cross products, mixed products, linear independence and basis.
Linear transformations - polar and spherical coordinates.
Matrices and matrix calculus - determinants - eigenvectors, eigenvalues and diagonalization.
Linear Systems of equations - homogeneous and inhomogeneous systems.
Analytic geometry.

CHEMISTRY

Fundamental concepts of Chemistry. Periodic table of the elements. Nomenclature of compounds. Chemical reactions.
- Quantum theory of the atom. Electronic structure. Periodic properties.
- Ionic and covalent bonds. Molecular geometry. Chemical bonding theory.
- The states of matter: liquids, solids.
- Solutions and formation of solutions. Colligative properties. Colloids.
- Chemical equilibrium. Acids and bases. Thermodynamics and equilibrium.
- Electrochemistry: redox reactions, galvanic cells, electrolytic cells.
- Introduction to coordination compounds. Structures and isomers of coordination compounds.

APPLIED INFORMATICS LABORATORY

This 1st semester Laboratory Course aims to activate the students in the use of computer tools and skills for confronting reports, presentations and data treatment during their Physics studies. The course starts with
an Introduction to the operating system of WINDOWS, use of INTERNET for Literature Search and Word Processing based on Physics Projects (exercises 1-3),
continues with data processing and graphics with Spreadsheet programs and MICROCALC ORIGIN based on realistic laboratory examples (exercises 4-6)
and ends with the introduction of MATHEMATICA as a computing tools and a problem solver (exercises 7-10).

2nd Semester

PHYSICS II (HEAT-THERMODYNAMICS)

Thermodynamics of perfect gas: System, surroundings,thermodynamic variables, equilibrium, processes.
Temperature and the zeroth law, temperature scales, thermometric properties.
Heat and the first law, heat capacities, heat measurement and tranfer. Perfect gas laws and processes. Real gas. Thermal engines.
Second law, Carnot cycle, entropy, Clausius inequality. Axiomatic introduction of the laws. Generalization.
Thermodynamic potentials, Legendre transformations, Maxwell realations. Applications to several physical systems.
Conditions for equilibrium, phase equilibrium, Clausius-Clapeyron equation.The third law of Thermodynamics.

PHYSICS III (ELECTRICITY - MAGNETISM)

Electric fields - Coulomb's Law - Electrical flux - Gauss's law - Conductors - Electrical potential - Capacitance and dielectrics - Electrical current - Electrical conductivity - Electrical Power - DC electrical circuits - Kirchhoff's rules - RC circuits - Magnetic fields - Magnetic force - Hall effect - Magnetic field sources - Biot-Savart Law - Ambere's Law - Magnetic properties of matter - Faraday's Law - Lenz's rule

MATHEMATICS II

Basic topological concepts in n-dimensional space - Differential calculus of real functions of several variables with real arguments (geometrical picture of a function of several variables, limits, continuity, partial derivatives, differentiability, total differentials) - Composite function of several variables (Chain rule, Eulers theorem, the mean value theorem, Taylor's theorem) - Implicit function of several variables (Jacobians, transformations) - Calculus of real function with vector variables and vector functions of vector variables (divergence and curl of a vector function) - Geometrical application of differential calculus of several variables - Extreme values of a function of several variables and extreme values under constrains

COMPUTER PROGRAMMING AND COMPUTATIONAL PHYSICS

Basic concepts on programming code, compiling, linking and execution
C programming. Variables, number types, strings, operators, expressions.
Program flow : logical decisions and loops
Functions (mathematical and string) of the standard C-library
Functions in C – call and definition, range of variables (global and local)
Input/Output streams (console and text files)
Pointers and data arrays
Implementation of algorithms for numerical and data analysis

INTRODUCTORY PHYSICS LABORATORY

I a) Features of measuring instruments and methodologies of measurement. Statistical treatment of experimental data
b) Graphing techniques for 2 variables, treatment of experimental data, least-squares algorithm.
II a) Online measurement of velocity and acceleration on a rectilinear air track using a computer
b) Simulation of the x-y trajectory of a sphere in various environments using a computer
c) Introduction to electrical measurements, DC instruments and their modifications
d) Introduction to the oscilloscope and AC measurements.
e) Cooling of systems in constant temperature environment and measurement of specific heat capacity.
f) Introduction to wave phenomena using ultrasound devices

3RD SEMESTER

PHYSICS IV (WAVES – OPTICS)

Module 1. Elastic waves: Principles of wave motion, derivation of wave equation, harmonic waves, Mechanical waves, wave energy, exercises.
Module 2. Propagation of elastic waves: Wave Superposition, phase and group velocity.
Module 3. Propagation of elastic waves: Standing waves, beats, normal modes, exercises.
Module 4. Sound Waves: Creation of sound waves, perception of sound waves, applications, exercises.
Module 5. The wave nature and the propagation of light: The wave equation of electromagnetic waves, Electromagnetic waves in vacuum, Huygens principle, the laws of reflection and refraction, exercises.
Module 6. Dispersion: Origin of dispersion, equation of dispersion, dispersion of light, exercises.
Module 7. Geometrical Optics: Introduction remarks, mirrors, thin lenses, prisms.
Module 8. Polarization of light: The nature of polarized light, production and detection of polarized light, polarization in nature, applications, exercises.
Module 9. Polarization of light: Definitions, representations and properties of linear, circular, and elliptical polarized light, natural light, exercises.
Module 10. Interference and coherence of light: Spatial and temporal coherence, interferometers (wavefront -, amplitude-splitting), coherent sources.
Module 11. Interference and coherence of light: Basic interferometers, dielectric films, applications, exercises.
Module 12. Diffraction of light: Preliminary considerations, Fraunhofer and Fresnel diffraction. Single slit diffraction, exercises.
Module 13. Diffraction of light: Diffraction from typical apertures with high symmetry (rectangular - , circular- obstacles, grating), diffraction from many slits, spatial– and spectral– resolving power applications, exercises.

MATHEMATICSIII

Theory of lines and surfaces. Double, triple, lina and surface integrals. Green, Gauss, Stokes theorems. Application in Physics. Improper integrals.

APPLIED MATHEMATICSII

Introduction and solution existence theorems
Ordinary Differential equations (ODEs) of 1st order (separable,homogeneous, linear, exact, special cases
Problems with differential equations of 1st order
Special forms of higher order ODEs
Linear ODEs, theory of solutions. Linear ODEs with constant coefficients
Linear Oscillators – problems
Linear systems (2x2) of ODEs with constant coefficients
Problems with Linear systems (2x2). Systems with higher dimensions
Introductionary concepts of nonlinear systems of ODEs
Introduction to partial differential equations (PDEs)
Solutions of PDEs of 1st order
Linear PDEs of higher order with constant coefficients

ATMOSPHERIC AND ENVIRONMENTAL PHYSICS

Week 1: Origin, composition, and physical properties of air. Quantities of atmospheric constituents in the atmosphere. Equilibrium in the composition of atmospheric constituents. Escape of gases to space.
Week 2: Atmospheric thermodynamics. Gas laws. Variation of density and pressure with altitude. Hydrostatic equation.
Week 3: Simple atmospheric models. Adiabatic processes. Pressure scale height. The hydrostatic equation for different gases. Separation of atmospheric gases. Atmospheric layers.
Week 4: Nature and characteristics of the radiation from the Sun, the earth and the atmosphere. Radiometric quantities. Application of black body laws. Emission of radiation from a real body. Effective temperature.
Week 5: Basics of the transfer of monochromatic radiation through the atmosphere (absorption –scattering). Optical depth. Variation of radiation absorption with height. Chapman's theory.
Week 6: Equilibrium between solar – terrestrial radiation. The greenhouse effect.
Week 7: The equation of motion. Forces in a rotating coordinate system. Pressure gradient force. Apparent forces.
Week 8: Geostrophic wind. Thermal wind. General circulation
Week 9: Energy equation. Continuity equation. Vertical wind.

Week 10: Atmospheric waves. Vorticity. Orographic waves. Rossby waves.
Week 11: Introduction. Air pollution scales. Photochemical pollution of urban areas: causes, characteristics, impacts.
Week 12: Regional scale pollution – acid deposition: Introduction. Physicochemical processes of regional pollution. Impacts on forests and agriculture, water ecosystems and buildings. Large-scale transport of air pollution in Europe.
Week 13: Climate change: Emissions of greenhouse gases. The impact of suspended particulate matter. Future projections. International treaties.

ELECTRIC CIRCUITS LABORATORY

Resistive circuits
AC current (RMS values and complex power)
Electric circuit analysis
Thévenin and Norton Equivalent Circuits
Circuit theory
Electric resonance
Quadratic pole circuits
First-order transient circuits

4th Semester

MATHEMATICAL METHODS IN PHYSICS

Complex numbers, analytical functions, complex integrals, Taylor and Laurent series, residue and poles, applications of residues
Fourier series, Fourier transformations and applications
Delta function and applications

PHYSICS V (MODERN PHYSICS)

Identification of the Special Theory of Relativity: Axioms of ETHS. Consequences. Transformations Lorentz. Equivalence mass - energy. Relativistic energy and momentum.
Quantum nature of light: Planck theory for blackbody radiation. Photons. Photoelectric phenomenon. Effect Compton. Pair generation.
Atomic structure: Atomic spectra. Scattering Rutherford. Nuclear dimensions. The model of Rutherford - Bohr for the individual. Movement of the core. Excitation and decay individuals.
Wave nature of particles: Ylokymata De Broglie. Kymatosomatikos duality and the uncertainty principle of Heisenberg. Schrödinger equation and the meaning of the wave function. Simply dynamically. Particle in the box. Tunneling.
Hydrogen Atom: Quantum numbers in the hydrogen atom. Spins and magnetic moments.
Spin of the electron: Experiment Stern-Gerlach. Transitions. Selection rules. Effect Zeeman. Delicate texture.
Polyilektronika people: Prohibition beginning of Pauli. Periodic table of the elements. X-rays and electrons Auger. Law Moseley.
Molecular structure: Molecular Bonds. Molecular spectra.
Structure of materials: Grid, symmetry, cell, crystallographic planes, fire, symmetry groups. Basic types of crystalline structures.
X-Ray: Production ray. Interpretation of the spectrum ray. X-ray diffraction. The crystals as diffraction gratings. Law Bragg. Absorption coefficient.
Connecting with X-ray crystallographic data: Scattering of electron, atom, cell. Experimental methods and technical ap plications in X-ray examination of the structure of materials. Qualitative and quantitative analysis. Principles for deter mining crystal structures.

THEORETICAL MECHANICS

Newtonian mechanics: axioms, laws of dynamics and vector form of the differential equations of motion. Conservation laws.
Motion in intertial and non-inertial reference frames: non-inertial forces and equations of motion. Examples.
Coordinate systems: differential equation of motion in cartesian, spherical and cylindrical coordinates. Examples.
Dynamics: equilibria and their stability. Study of conservative 1 degree-of-freedom system, using the method of Potential. Phase diagrams.
Applications to 1 d.o.f systems: harmonic oscillator, pendulum, systems with friction, forced oscillations.
Central forces: conservation of angular momentum, effective potential and study of the equivalent 1 d.o.f system

Solutions of the equations of motion for basic central-force fields in Physics: gravity, Coulomb, Yukawa and the two-body problem.
Analytical mechanics: constraints and reaction forces – degrees of freedom. Classification of mechanical systems. Principle of virtual work.
The d'Alembert principle and Lagrange's equations: the Lagrangean function for conservative forces (scalar and vector potentials). Examples
Applications: finding equations of motion and conserved quantities (integrals of motion) with Lagrange's method.
The analytical method of Hamilton: The Hamiltonian function, canonical equations, phase space and integrals of motion. Applications.
The principle of least action: Hamilton's principle and axiomatic foundation of mechanics. Physical importance of the least-action principle and relation to other fields of Physics.

ELECTRONICS

Basic principles of electrical circuits, Timing and frequency response of basic circuits. Introduction to semiconductors. Diodes, structure and basic rectifier circuits. The zener diode. Bipolar transistor, Field Effect Transistor (FET). Character istics and equivalent circuits. Analysis and design of amplifiers based on bipolar and FET transistors, Operational am plfiers

OPTICS LABORATORY

Module 1: Interference Phenomena (Experiment 4 hours)
Iinterference from nearly monochromatic– (Laser) and pseudomonochromatic– (spectral lamps Na, Hg, He, etc.) and-natural light–sources (incandescent lamps) by using specific interferometry setups (Lloyd, Newton, Michelson - theory of partial coherence of light)
Module 2: Diffraction Phenomena (Experiment 4 hours)
Fraunhofer and Fresnel diffraction from monochromatic and natural light sources with various diaphragms, (circular and rectangular apertures, single and multiple slits, gratings) using various diffractometry setups.
Determination of the spectral lines wavelength by using grating diffractometers.
Module 3: Geometrical Optics (Experiment 4 hours)
Are studied the basic laws of geometrical optics (rectilinear propagation, reflection, refraction) as key applications and function in lens present in various optical systems (optical diopter, prisms , thin -, thick -, converging- and diverging – lens systems, aberrations)
Module 4: Polarization Phenomena (Experiment 4 hours)
Production, analysis and detection of various states of polarization (linear- , circular- , elliptic - polarized light) and their application to the phenomena of reflection and refraction. A large part of the experiments is dedicated to crystal optics and specifically to the phenomena of double refraction of light, with the help of Iceland spar.
Module 5: Dispersion - Absorption: (Experiment 4 hours)
It is studied the phenomenon of light dispersion by prism (via spectroscopic setups) and its interpretation on the base of the refractive index atomic model as well as the effect of the thickness (Beer's law) and spectral distribution of inc dent beam on the absorption spectrum.

5th Semester

NUCLEAR PHYSICS AND ELEMENTARY PARTICLES

Basic Principles of Nuclear and Particle Physics
Constituents of nuclei: protons and neutrons
Size of nuclei, nuclear masses
Nuclear decays, Radioactivity a-decay, tunneling effect, Geiger-Nuttal rule
b-decay, electron capture, continuous spectrum of beta, neutrino, parity, selection rules in b-decay, Wu experiment
γ-decay, recoil energy, selection rules in γ-decay, internal conversion, nuclear resonance, Mossbauer effect
Fission and fusion, nuclear energy
Elementary Particles, quarks and leptons, basic interactions, Feynman diagrams, conservation laws

QUANTUM MECHANICSI

Historical review of old quantum mechanics. Mathematical introduction in quantum mechanics.
De Broglie theory of wave mechanics. Time-independent and time-dependent Schrodinger equations.
Time evolution of the wavefunction
One and three-dimensional study of simple quantum mechanical potentials.
One and three-dimensional study of the harmonic oscillator potential

ASTRONOMY AND ASTROPHYSICS

Basic principles of positional astronomy - Astronomical coordinates, Position triangle, Measurement of time, Stellar distances - Stellar photometry and stellar magnitudes, Colour indices - Spectra and spectral classification of stars – I terstellar matter and its phases - Sun, planets and their satellites, minor planets, comets – exoplanets and protoplan tary disks - Basic principles of stellar evolution and final stages of matter – Binary and Variable stars – Characteristics, classification, clusters, and evolution of galaxies – Observations of cosmological importance, theories of creation and evolution of the universe, cosmological models

ATOMIC AND MOLECULAR PHYSICS LABORATORY

Estimation of the experimental error of a single measurement. Error propagation. Least square fitting. Non-elastic ele tron scattering (Frank – Hertz experiment). Photoelectric effect (experimental estimation of the Planck's constant). Wave nature of the electrons (electron diffraction). Experimental estimation of the e/m ratio of electrons. Thermionic emission (Richardson formula). A study of the energy quantum levels of Na atoms via the observation of atomic spectra as well as observation of their fine structure.

ELECTRONICS LABORATORY

Rectifiers, bjt based switching typologies, bjt amplifiers and buffers, operational amplifier typologies (amplifiers, co parators, signal generators etc)

6th Semester

STATISTICAL PHYSICS

Thermal equilibrium, Isolated systems, Postulates of statistical physics.Microcanonical, Canonical and Grandcanonical ensembles.Applications: Ideal classical gas, Heat capacity of solids, Paramagnetic solids, Ideal quantum gas, Black-Body radiation, Fermi-Dirac statistics, Electron gas, Bose-Einstein statistics, Bose condensation.

ELECTROMAGNETISM

Section 1: Electromagnetic field equations: Maxwell equations in space and time domain, both in differential and inte gral form. Emphasis is laid to dynamic phenomena, which the third and fourth Maxwell equations explain and describe (electromagnetic induction, displacement current etc). Scalar and vector potentials are defined. Coulomb and Lorenz gauges are analyzed. The energy of electric charge and current distributions, the electromagnetic field energy and Poy ting vector are analyzed. The equation of electromagnetic field energy conservation is proved.
Section 2 : Solution of Maxwell's equation in Space and time domain-electromagnetic wave propagation: a) plane ele tromagnetic waves b) electromagnetic properties of materials c) propagation of electromagnetic waves in space and material media d) boundary conditions e)electromagnetic field of time varying charges and currents.
Section 3 :Electromagnetic field of moving charges: Global solution of Maxwell equations concerning retarded pote

tials. Solution is found for the electromagnetic field of moving particles with constant velocity or accelerated. Emphasis is laid to the limited velocity of electromagnetic force propagation.
Section 4: Relativistic electrodynamics: Postulate of electric charge conservation, Lorenz transformations and unchan ing of Maxwell' equations and their solutions. Transformations of scalar and vector potentials, electric and magnetic field intensities. Emphasis is laid to the unified entity of the electromagnetic force

QUANTUM MECHANICSII

Three dimensional problems, Angular Momentum, Spin, The Hydrogen Atom, Addition of Angular Momenta, Identical Particles, Time Independent Perturbation Theory

STRUCTURE OF MATERIALS LABORATORY

Introduction of the concepts of crystal lattice, unit and primitive cells, crystal systems, Miller indices, fractional coordi nates, equivalent positions. Operating principles of x-ray devices.
Lab Exercise 1: Analysis of a polychromatic X-ray beam using a single crystal wavelength analyzer and implementing Braggs law. Identification of the wavelength and energy of the emitted X-ray photons. Calculation of mass density from crystallographic data.
Lab Exercise 2: Identification of unit cell of unknown materials based on XRD data. Calculation of unit cell size and of the number of lattice positions in the cell. Experimental verification of correct cell. Finding of ionic radii of the constituents of an unknown ionic crystal from XRD data.
Lab Exercise 3: Experimental X-ray methods for the study of polycrystalline (powder) materials.
The Debye-Scherrer method. Indexing Debye diagrams. Identifiication of the crystal structure of known and unknown powder samples.
Lab Exercise 4: Experimental X-ray methods for the study of amorphous and nanocrystalline materials. The Bragg-Brentano Method. Identification and indexing Bragg-Brentano diagrams. Calculation of average grain size in nanocrystalline materials.

NUCLEARPHYSICS LABORATORY

RADIOACTIVITY and RADIATION, RADIATION INTERACTION WITH MATTER, PRINCIPLES OF RADIOPROTECTION
LAB EXERCISES WITH GAS DETECTORS

- Study of a Geiger-Müller detector characteristics
- Dead time and efficiency of a Geiger-Müller detector
- Study of the law for radioactive decays

LAB EXERCISES WITH SCINTILLATION DETECTORS

- Gamma-ray spectroscopy
- Energy calibration and energy resolution of a scintillation detector
- Absorption of gamma radiation

7th Semester

SOLID STATE PHYSICS

Module 1 (4 hours): 1 Chemical Bonding in Solids, The periodic table of the elements, covalent-, Ionic - , metallic -, hydrogen- and van der Waals Bond .
Module 2 (4 hours): Dynamics of Atoms in Crystals 1: Crystal potential, equation of motion, monoatomic and diatomic linear chain.
Module 3 (4 hours): Dynamics of Atoms in Crystals 2: Scattering from time-varying structures, phonon spectroscopy, elastic properties of crystals. Experimental setup Raman Spectroscopy. Problems.
Module 4 (4 hours): Thermal properties 1: Density of States, thermal energy of a harmonic oscillator, specific heat capacity. Problems.
Module 5a (2 hours): Thermal properties 2: Effects due to anharmonicity, thermal expansion, heat conduction by phonons.
Module 5b (2 hours): The "Free" electrons in solids 1: The Free-Electron Gas in an Infinite Square-Well Po-tential, Fermi Gas at T = 0 K.
Module 6 (4 hours): The " free" electrons in solids 2: Fermi statistics, specific heat capacity of electrons in metals, electrostatic screening in a Fermi Gas -the Mott Transition, thermionic Emission of electrons from Metals. Problems.
Module 7 (4 hours): The electronic Bandstructure of Solids 1: General symmetry properties, nearly free-electron approximation, Problems.

Module 8a (4 hours): The electronic Bandstructure of Solids 2: Tight-binding approximation, examples of bandstructures, Density of states - in crystalline and in Non-Crystalline solids, Photo-emission Spectroscopy.
Module 8b (2 hours): Motion of Electrons and Transport Phenomena 1: Motion of electrons in bands and the effective Mass, currents in bands and holes, scattering of electrons in bands, Problems.
Module 9a (4 hours): Motion of Electrons and Transport Phenomena 2: Boltzmann equation and relaxation time, electrical conductivity of metals, thermoelectric effect, Wiedemann-Franz law, electrical conductivity of localized electrons., Problems.
Module 10 (4 hours): Optical properties of Solids 1: Dielectric Function, absorption of electromagnetic radiation, dielectric function for a harmonic oscillator, longitudinal and transverse normal modes, surface waves on a Dielectric. Problems.
Module 10 (4 hours): Optical properties of Solids 2: Local Field, polarization catastrophe and ferroelectrics, free-electron Gas, interband transitions, excitons, dielectric energy Losses of Electrons. Experimental setups: Infrared Spectroscopy, The Frustrated Total Reflection Method. Problems.
Module 12 (4 hours): Semiconductors 1: Bandstructure of important semiconductors, charge carrier density in intrinsic Semiconductors, doping of semiconductors. Problems.
Module 13 (4 hours): Semiconductors 2: Conductivity of semiconductors, p-n Junction and the Met-al/Semiconductor Schottky Contact, Semiconductor Heterostructures and Superlattices. Experimental setups: Hall effect, Cyclotron Resonance in Semiconductors

4.4.2. Basic Elective Courses

7th Semester

ASTROPHYSICS

Brief introduction to the theory of gravitational fluids and black bodies. Creation of stars from interstellar clouds. Stars in hydrodynamic/hydrostatic equilibrium. Stellar winds and stellar jets. Stellar evolution, accretion discs, final states of stellar evolution, degenerated matter. White dwarfs, neutron stars black holes

ELEMENTARY PARTICLE PHYSICS

Interactions and the Yukawa mechanism. Classification of elementary particles. Natural system of units. Relativistic kinematics. Mandelstam variables. Resonances and invariant mass. Symmetries and conservation laws, Noether's theorem. Space inversion, charge conjugation, time reversal, CPT theorem. Kaons and kaon oscillations. CP violation and kaons. Isotopic spin. G-parity. Scattering and decays of particles. Deep inelastic scattering. Short description of the standard model.

RENEWABLE ENERGY SOURCES

Introduction to renewable and conventional energy resources. Energy reserves. Energy planning and management.
Fuel cells - heat pumps. Impact of conventional energy consumption to air quality and climate.
Solar power: Theoretical approach of solar radiation transfer through the atmosphere. Temporal and spatial variations of solar power. Measurements of solar radiation. Calculation of solar energy on horizontal, tilted and sun-tracking planes. Systems for harvesting and transformation of solar power. Direct transformation to thermal energy. Applications. Space heating. Solar concentrators. Transformation of solar energy to other energy types.
Wind power: Theoretical approach (wind forces and power extraction, power coefficients). Spatial and temporal variation of wind power. Wind turbines. Streamline theory for ideal and actual wind rotor. Power generation from wind turbines. Estimation of wind speed vertical profile. Estimation of the wind potential of a given region. Statistical analysis of wind characteristics. Wind farms.
Other renewable energy systems: Geothermal, tidal and, wave and biomass energy.
Renewable energy in Greece: Applications and prospects

ELECTRONIC CIRCUITS

Amplifier configurations with bipolar transistors (BJTs), Differential Amplifiers, Bias circuits, Current mirrors, Current sources and voltage references, AB class power modules(push-pull, Basic structure of Operational Amplifiers, Op-Amp based circuits in linear mode and in comparator mode (amplifiers, filters, multivibrators).

STRUCTURAL PROPERTIES OF MATERIALS

Structural properties of solids Factors and rules that determine the structure of crystalline solids. Relation of structural properties with growth and physical properties of materials. The solid agglomerates. Vacancies. Description of characteristic structures. Non-stoichiometric compounds. Order and disorder, Solids, Formed structures, Superstructures. Polymorphism, polytypism. Amorphous, polycrystalline, nanocrystalline materials. The case of coal.
Crystalline Symmetry and Applications Principles of symmetry. Processes and symmetry groups. Illustrations, subgroups, sidebars, classes, variants. Crystal displacement and point symmetry. Crystal groups of point and space of two and three dimensions. All-rounder. Compliant and non-compliant groups. Centrosymmetric and non-centrosymmetric crystals. Representations. Similarity transformations.
Structural defects and observation of structural characteristics Point, linear, two and three dimensional defects of the crystal structure. Imperfections and physical characteristics of materials. Basic principles of electron microscopy. Study of structural properties by electron microscopy. Newer microscopy techniques.

ATMOPHERIC ENVIRONMENT

Causes of Environmental Problems. Sustainability and Environmental Sciences. Atmospheric Pollutants - Physical and Chemical Properties. Photochemical Pollution. Acid Rain. Climate Change. Environmental Meteorology. Static stability of dry air. Inversions. Meteorological mixing height. General characteristics of the Atmospheric Boundary Layer. Turb lence characteristics. Simple statistical tools for the description of turbulence. Characteristics of the surface layer. Loarithmic law. Atmospheric Diffusion and Dispersion. Gaussian plume model.

NON LINEAR DYNAMIC SYSTEMS

Introduction to Dynamical systems, analytic and numerical approach - The programming tool "Mathematica"
Analytic and Numerical solution of Differential equations with Mathematica
Basic notions of the Dynamical systems - Phase space - Classification of systems and trajectories.
Conservative systems of one degree of freedom – oscillations
Autonomous linear systems 2x2
Autonomous nonlinear systems - Stability of equilibrium points and phase space diagrams. Applications (Lotka-Voltera models)
Limit cycles. Application to electrical circuit oscillators (Van der Pol)
Bifurcations
Linear perturbed oscillators – Periodic and quasi-periodic trajectories, limit cycles and Poincare maps.
Conservative Oscillators – Poincare maps - Homoclinic chaos.
Limit cycles and strange attractor in dissipative Duffing equation
Discrete dynamical systems
Summary and Discussion

COMPUTATIONAL PHYSICS AND APPLICATIONS

This course will analyze a wide range of computational problems of Physics. We will study algorithms to problems of physics, which will range from Classical Mechanics, Electrostatic and Environmental Physics to Statistical Physics and Quantum Physics. Prior experience in MATLAB and programming languages, such as C or C ++ deemed useful, although a brief overview of basic programming instructions will be provided at the beginning of the course. Course exercises will be in MATLAB.
Introduction to Computational Physics. The advent of modern computers. Introduction to programming and techniques for visualizing data.
Environmental impact from the production and use of energy. Renewable energy sources and technologies. Computational Applications of Renewable Energy.
Calculation of the wind potential of a region. Analysis of Wind Resource using the Weibull distribution. Analysis of wind energy potential using the Weibull distribution. Calculation of wind potential using numerical models.
Calculation of solar energy in an area. Models for calculating the solar radiation. Solar radiation databases. Random systems and stochastic processes: random walks and diffusion, formation of aggregates, the Monte Carlo method. The Metropolis algorithm.
Quantum systems: the time dependent and independent equation of Schrödinger.
Computational methods on equation of motion. Principles and use on the method of Molecular Dynamics. Effect of physical properties of the materials (e.g. temperature, pressure) in atomistic calculations. Effect of stress, and deformation.

Interatomic potentials. Interatomic potentials in connection with the various types of atomic bonds. Interatomic potentials for metals. Potentials for semiconductor compounds. Interatomic potentials for molecules. Interatomic potentials for ionic crystals.
ab initio calculations. Hartree Fock (HF), Linear Augmented Plane Wave (LAPW), Density Functional Theory (DFT), Linear combination of atomic orbitals (LCAO), Tight Binding (TB).

INTRODUCTION OF DIDACTICS OF PHYSICS

The aim of the course is students to develop skills in handling the theoretical background of Didactics (alternative stu dents' perceptions, objectives of a teaching, teaching tools and methods, questionnaires, etc.)
Analytically:
Knowledge in Physics and Teaching Practice
Students' ideas about concepts and phenomena of the natural world
Learning Theories
Teaching Methods
Questionnaires and the handling of students' questions
Concept Maps and their use as a teaching and evaluation tool
Planning and development of activities
Pedagogical Content Knowledge
Students take a Physics topic and choose the appropriate material to design a didactical intervention based on the learning model, focusing at students' alternative perceptions, set goals, and describe a complete teaching scenario that includes a worksheet to engage and assess the students, upon new knowledge, and finally present their work.

8th Semester

OBSERVATIONAL ASTRONOMY

This course is composed of a 3-hr lecture and additional compulsory lab-work of 2 hr (minimum) per week.
The topics treated include:
The Celestial Sphere
Telescopes
Solar observations
Observations of the Moon, planets and their satellites
Recognizing Constellations and Celestial objects
Measuring Astronomical Distances I (The Hyades open cluster)
Measuring Astronomical Distances II (The M15 globular cluster and the H-R diagram)
Measuring Astronomical Distances III (galaxies)
Photometry (photographic and CCD)
Classification of Galaxies (using the Palomar atlas)

NUCLEAR PHYSICS

Special Issues in Nuclear Physics. Nucleosynthesis - Creation of the Elements in the Universe

TELECOMMUNICATION SYSTEMS

Communication Systems is an optional course of the 8th semester in the curriculum of the School of Physics of the Aristotle University of Thessaloniki. The teaching program is composed of 3h weekly lectures including both theory and exercises. The course contains the following topics:
Spectral analysis
Amplitude Modulation Systems
Frequency Modulation Systems
Analog-to-Digital Conversion
Digital modulation techniques

SOLID STATE PHYSICS II

Major target of this course is to familiarize the students with magnetic (paramagnetism, ferromagnetism, ferrimagnetism, antiferromagnetism) and optical (Absorption and Scattering of electromagnetic radiation of solids, Non-linear interaction effects, non-elastic Raman and Brillouin scattering) interactions met in solid state. This course is divided in two sections:

Section A: Magnetism and Superconductivity: Introduction to Magnetism, Magnetic Environment-Interactions, Magnetic Ordering and magnetic structures, Introduction to Superconductivity, Phenomenology of Superconductivity, London equations, Basic principles of microscopic theory (BCS).
Section B: Optical Properties: Phonon Interactions, Phonon-Electron Interactions, Optical properties, Crystal defects, Techniques of materials characterization.

PHYSICS OF SURFACES AND NANOSTRUCTURES

Section 1 (2 hrs): Introduction to surfaces and nanostructures, the important differences from bulk materials.
Section 2 (4 hrs): Thermodynamics and electronic properties of surfaces: energy cost for the creation of a free surface, surface tension and surface energy, surface reconstruction, work function, electron affinity, surface states.
Section 3 (3 hrs): Vacuum conditions for the growth and characterization of clean surfaces and nanostructures. Basics of ultra high vacuum and kinetic theory of gases, conductivity of vacuum systems, pumping and vacuum measuremen systems.
Section 4 (4 hrs): Physisorption and chemisorption, initial stages of growth of thin films and nanostructures.
Section 5 (6 hrs): Epitaxial growth of thin films and nanostructures (molecular beam epitaxy, chemical vapor deposition and their modifications)
Section 6 (10 hrs) : Methods for the characterization of thin films and nanostructures: chemical composition (AES, XPS, SIMS, micro-XRF), surface structure and monitoring of the atomic layer-by-layer growth of epitaxial layers (LEED, RHEED), synchrotron radiation and the non-destructive identification of the nanostructure (EXAFS & SEXAFS) and ele tronic structure (NEXAFS, UPS, ARUPS).
Section 7 (6 hrs): Photolithography and current trends for the top-down fabrication of nanostructures. Principles of bottom-up approach for the fabrication of nanostructures.
Section 8 (4 hrs): Introduction to diffusion and oxidation of surfaces.
All sections include exercises and/or critical review of publications from the international literature.

HAMILTONIAN MECHANICS

Hamilton’s equation, symplectic formalism, Poisson’s theorem). Canonical transformations (generating function, symplectic matrices). Infinitesimal canonical transformations (Hamiltonian vector field, infinitesimal symmetries and integrals of motion). Stability of equilibrium points Liouville’s theorem, Poincare’s theorem. The method of Hamilton Jacobi, Integrable systems, Lax pairs. Action-angle variables, canonical theory of perturbation, small divisors, K.A.M. theorem. Poincare map, Poincare-Birkhoff theorem, chaotic motion in Hamiltonian systems.

4.4.3. Specialized Elective Courses

7th Semester

BIOPHYSICS

Introductory concepts: Chemical bonds (inter-atomic potentials of weak and strong bonds, non-central forces, bond energy, spring constant and bond elastic limit) rate of change of chemical reactions (free, internal energy, thermodynamics-statistical mechanics, kinetics of chemical reactions, radiation energy). Transport processes: diffusion, viscosity, heat transfer. Experimental techniques in biophysics: X-ray diffraction, nuclear magnetic resonance, scanning tunneling microscopy (STM), atomic force microscopy (AFM), optical tweezers, patch clamping. Biological polymers: nucleic acids (DNA, RNA) and the conformation and folding of proteins. Biological membranes: background, chemical composition and structure of organic membranes, physics of biological membranes. Excitable biological membranes: diffusion and ion mobility, resting potential, action potential, Hodgkin-Huxley model, neural impulse propagation (cable model, Fitz-Hugh-Nagumo model)

PLANETARY SYSTEMS AND SPACE EXPLORAITON

Description of the solar system: physical and orbital properties (planets, satellites, small bodies). Fundamentals of Celestial Mechanics: equations of motion, perturbation theory, gravitational and non-gravitational forces. Stability of the solar system: secular orbital perturbations and climate, resonant motion. Space exploration: artificial satellite orbits and use, design of interplanetary trajectories. Extra-solar planetary systems: observational techniques, dynamics and systems classification. Theory of planet formation: proto-planetary discs, planet formation and evolution of young systems. Time-line of our solar system.

NUCLEAR PHYSICS LABORATORY II

Neutron Detection with activation counter. Horizontal and vertical neutron flux distribution in a subcritical nuclear reactor. Measurement of cosmic ray muons. Time spectroscopy. Trigger system. Analog Drift detector. Data analysis of the ATLAS experiment.

PHYSICSAND TECHNOLOGY OF SEMICONDUSTOR DEVICES

Causes of Environmental Problems. Sustainability and Environmental Sciences. Atmospheric Pollutants - Physical and Chemical Properties. Photochemical Pollution. Acid Rain. Climate Change. Environmental Meteorology. Static stability of dry air. Inversions. Meteorological mixing height. General characteristics of the Atmospheric Boundary Layer. Turbulence characteristics. Simple statistical tools for the description of turbulence. Characteristics of the surface layer. Logarithmic law. Atmospheric Diffusion and Dispersion. Gaussian plume model.

NON LINEAR CIRCUITS

Nonlinear Circuit Elements. The nonlinear resistor (series and parallel connections, concave and convex resistors, dc operating points, small signal analysis). Nonlinear capacitors and inductors.
Operational-amplifier circuits. Device description, characteristics and model. OP-AMP circuits operating in the linear region. OP-AMP circuits operating in the nonlinear region.
First-order circuits. Circuits driven by dc sources, circuits driven by piecewise-constant signals, the dynamic route, jump phenomenon and relaxation oscillation). Second-order circuits. Tunnel diode and Josephson junction circuits, equilibrium states and operating points.
Nonlinear oscillation. Basic negative-resistance oscillator, physical mechanisms for oscillation, phase portrait of typical oscillators. Van der Pol oscillator, Duffing oscillator, Duffing-Ueda oscillator.
Introduction to nonlinear dynamics. Poincaré maps, bifurcation diagrams, Lyapunov exponents. From periodicity to chaos. Routes to chaos (period-doubling, collapse of tori, intermittency). Antimonotonicity. Crises of chaotic attractors.
Chaotic dynamics of the R-L-varactor diode circuit.
Chaotic dynamics of Chua's circuit family.
Memristors (from periodicity to chaos)

THEORETICAL STATISTICAL PHYSICS OF THE SOLID STATE

Computer simulation methods using the Monte-Carlo technique of basic problems inCondensed Matter Physics.
Use ofrandom numbers. Diffusion in lattices and in continuousspace, Random walks, Trapping phenomena
Crystal growth and diffusion limited aggregation. Fractals and fractal dimension.

Probability distribution functions. Boxing techniques.

PROPAGATION OF ELECTROMAGNETIC WAVES – ANTENNAS - MICROWAVES

Guided waves: Maxwell equations and waves guided by transmission lines and waveguides
Transmission lines(open and coaxial): TEM mode, signal propagation at high and low frequencies, signal quality, standing waves, signal power, matching to the loads. Scattering coefficients of transmission lines as two port networks. Analysis of signal propagation in time domain.
Microstrip transmission lines: Structural characteristics. Analysis of TEM mode of operation with the methods of a) separation of variables b) Fourier and c)Moment Method. Determination of characteristic parameters of operation. Applications
Wireless propagation of radio waves and antennas: Radiation of current distributions(Maxwell equations), indices of antennas' operation, antennas in radio-communication networks and radars. Dipole antennas
Microstrip antennas: structure, analysis of operation kinds of microstrip antennas
Antenna arrays: Uniform(linear and planar), non-uniform, mutual impedance)

CRYSTALLOGRAPHY AND APPLICATIONS

Introduction, Symmetry in direct and inverse space, Crystal systems, Indices de Miller, inverse space, Equation Bragg, Sphere Ewald. Single crystal X-ray structure study. Methods Laue, rotating crystal method, Weissenberg, transition, indexing, identification of crystalline constants. Crystalline powder X-ray structure study. Methods Debye - Sherrer, Guinier. Automatic powder diffractometer. Method Bragg - Brendano. Data processing, phase separation, Indexing, Identification of crystalline constants. Characterisation of materials, databases, applications. Analysis of profile of powder diagram and determination of the crystalline structure. Method Rietveld. Automatic four-circle single crystal diffractometer. Collection, data processing, statistical Wilson. Structure factors, electron density. Methods to determine the single crystal structure (indirect test directly). Functions Fourier, Patterson in structure determination. Improvement of the structure parameters. Geometry of the crystal cell.

MAGNETICMATERIALSAND APPLICATIONS

History of Magnetism, Magnetism and Hysteresis, Magnet Applications, Magnetic dipole moment, Magnetic fields, Magnetostatic Energy and Forces Orbital and spin moment Molecular field theory, Antiferromagnets, Ferrimagnets, Amorphous magnets, Micromagnetic energy, Anisotropy, Magnetic Domain Theory, Soft magnetic materials, Magnetic circuits, Permanent magnets, Ferromagnetic phenomena (Magneto-optic, Magnetocaloric, Magnetotransport effects), Magnetic recording, Magnetism and Nanoscale, Modern Magnetic Materials and Applications, Magnetism in Biology and Medicine, Planetary and Cosmic Magnetism

FLUID MECHANICS

General concepts and definitions. Fluid statics and mechanics. Continuity equation, equation of motion and integration Ideal and real fluids. Kelvin-Helmholtz and Rayleigh-Taylor instabilities. Acoustic waves. Turbulence

MICROELECTRONICS

Technology of Integrated Circuits (ICs). Implementation of passive and active electronic devices in ICs. Modern IC technologies. Design of basic digital structures in MOS technology. Design of basic analog circuits. Design rules and methodologies. Design tools.

QUANTUM MECHANICS III

Theory of potential scattering. Phase shifts. S-Matrix and the optical theorem. Green functions and the Born approx. mation. Interaction picture and the time ordered exponential. Time dependent perturbations and the adiabatic appro imation. Periodic potentials and Bloch's theorem. Electromagnetic interaction and the quantum Hall effect. WKB a proximation.

MATHEMATICAL METHODS IN PHYSICS II

Solutions of ordinary 2nd order differential equations with non constant coefficients, Frobenius method, orthogonal polynomials, Bessel functions.

DIGITAL SYSTEMS

Introduction to Digital Systems, Binary arithmetic, signed numbers, codes. Boolean logic and gates, Boolean functions, digital logic gates, Combinational logic, Analysis, Synthesis, Design methodology, Adder, Size comparators, Decoders, Coders, Multiplexers, Three state gates. Sequential logic, memory cells, flip/flops, Analysis of synchronous sequential circuits, Design of synchronous sequential circuit. Registers, Shifters, Counters, RAM, ROM, programmable logic.

DIDACTICS OF PHYSICS LABORATORY

The aims of the course are to provide students with instructional designing skills and be able to implement and evaluate lessons of Physics.

- Visualizing concepts - Sensory perception,
- Aims and objectives of teaching,
- Designing Lesson's Plan,
- Evaluation of teaching.

Students can choose a physics topic, which they analyze and present to their classmates and subsequent discussion in the selection of teaching aids and methods to support teaching,in designing and development of instructional media and experiments, in designing and implementing of educational activities and lesson's plan, in developing worksheet, in reflection and in evaluation and self-evaluation.

8th Semester

COSMOLOGY

Newtonian cosmology. The Friedmann models, their dynamics and kinematics. Solutions of the Friedmann equations. Elements of relativistic cosmology. The Big-Bang scenario and its epochs. Inflation, the Planck era and the first stages of the universe's evolution. Introduction to cosmological perturbation theory. Linear Newtonian perturbations and large-scale structure formation. Dark matter, dark energy and the recent universal acceleration

INTRODUCTION TO PHYSICS OF IONIZED GASES

Introductory concepts, Motion of particles in electromagnetic fields, Methods of analysis of ionized gases (Kinetic theory, two fluid description, Magnetohydrodynamic). Waves in Plasma. Generation or diffusion of plasma inside the magnetic field. Stability and instabilities in Plasmas. Non linear phenomena in plasma.

RADIOASTRONOMY – ASTRONOMY IN NON OPTICAL WAVELENGHTS

Introduction to radio astronomy – Radio telescopes – The radio-Sun and the solar system at radio waves – The radio sky – The centre of our Galaxy – Supernova remnants (Classification, evolution of supernova remnants, shock waves) – HII regions – Neutral hydrogen – Molecular radio astronomy – Infrared astronomy – X-ray and γ-ray astronomy – Radio galaxies and quasars.

TOPICS IN NUCLEAR THEORY

Liquid drop model-Semi empirical mass formula-Saturation of nuclear forces-Basic principles of nuclear scattering T-matrix, electron scattering from nuclei, nuclear mass distribution, nuclear charge distribution.

Electromagnetic moments and transitions.
Collective excitations in liquid drop model: vibrations, rotations, nuclear fission.
Properties of the fundamental nuclear interaction. Deuterium. Nuclear effective interactions.
Nuclear models: Fermi gas model, nuclear shell model, nuclear mean field model.
Pairing correlation. BCS approximation. RPA model and collective vibrations.

EXPERIMENTAL VERIFICATION OF ELEMENTARY PARTICLE PHYSICS

The course will provide to the students a good overview of the key discoveries in particle physics and their consequences in the development in the field, with emphasis in the recent experiments at LHC, CERN.

It is a necessary base for those who are interested to carry graduate studies and research in the field.
Main chaters:
-Relativistic Kinemtatics, cross sections, Golden rule of Fermi and Feynman diagrams
-Electromagnetic interactions (Bhabha scattering)
-Weak interactions (V-A interaction, the pion decay, weak neutral curents, weak mixing angle, CKM matrix, observation of the W and Z bosons
-Deep inelastic scattering, Structure functions of the proton, Neutrino-nucleon scattering
- Strong interactions
-Unification of weak and electromagnetic forces, the Standard model, the discovery of the Higgs boson at LHC
-Searches for New Physics, Physics beyond the Standard Model

ACCELERATORS AND DETECTORS IN NUCLEAR AND PARTICLE PHYSICS

The aim of the course is the study of particle acceleration basic principles and types of accelerators. It is the study of basic physical principles used in the detection, the identification and measurement of particles and methods in managing nuclear and particle physics experiments data.

· Cross section, decays and lifetimes, interactions kinematics.
· Accelerators, history and applications.
· Accelerator Physics, particle acceleration.
· Magnetic fields, particle beam focus, beam cooling.
. Particle detection; Principles and Applications
· Interaction of charged particles.
· Interaction of radiation with matter.
· Trajectories of charged particles.
· Scintillation.
· Radiation Cherenkov.
. Calorimetry.
· Trigger and data acquisition
. Reconstruction of physical objects

RADIATION PHYSICS AND APPLICATIONS OF ISOTOPES

Introductory concepts of atomic and nuclear physics. Radioactivity (natural, artificial, exotic). Nuclear fission. Nuclear fusion. Nuclear radiation (alpha, beta, gamma). Non-nuclear radiation (delta, Bremsstrahlung, Cerenkov, Roentgen, Laser, microwave). Cosmic radiation. Nuclear radiation detectors. Radio dating. Natural applications of ionizing radiation. Radioisotope applications: (i) geology, (ii) medicine, (iii) industry, (iv) agriculture. Nuclear power (Nuclear Reactors, Nuclear Accidents, Nuclear Weapons and Nuclear Tests). Principles of radio protection. Methods of radioisotope production. The course also includes laboratory exercises.

QUANTUM OPTICS- LASERS

Module 1 (3 hours): Nature of radiation, various forms of radiation, Mathematical description of radiation.
Module 2 (3): Quantum theory of the interaction between radiation and matter: Absorption, emission, Particle photon properties.
Module 3 (3): Quantum theory of the interaction between radiation and matter: Elementary theory of interaction of a quantum system and electromagnetic radiation.
Module 4 (3): Quantum theory of the interaction between radiation and matter: Lifetime of excited states and energy width.
Module 5 (3): Statistical properties of photons and sources: the concept of elementary cell. Temporal- and spatial- coherence. The elementary bundle.
Module 6 (3 hours): Statistical properties of photons and sources: Fluctuation Phenomena. Measurements in many elementary cells. Monochromaticity and coherence.
Module 7 (3): Lasers: Optical resonance cavities, spatial form of modes in open resonance cavities. Stability of optical resonance cavities.
Module 8 (3): Lasers: Optical resonant cavity frequency spectrum, Population inversion. Modes in a Laser. Amplification factor and output power.
Module 9 (3): Lasers: 3- and 4- levels Lasers.
Module 10 (3 hours): Types of Lasers: Overview, of types of Lasers, Gas Lasers.
Module 11 (3): Types of Lasers: Lasers, fluids, Chemical Lasers, Lasers solid
Module 12 (3 hours): Types of Semiconductor Lasers: Lasers,
Module 13 (3): Types of Lasers: free electron Lasers, Lasers

ATMOSPHERIC DIFFUSION AND DISPERSION

• Air pollution and principles of air quality management. Air Quality Indices.
• Atmospheric dispersion: Processes and factors affecting. The atmospheric dispersion cycle. Units of atmospheric pollutant concentration. Exercises.
• Atmospheric pollutants: Classification – Properties – Sources – Effects. Particulate matter. Exercises.
• Spatial and temporal scales of dispersion. Atmospheric dispersion models I: Basic definitions - Fields of applications - Types - Classification.
• Atmospheric dispersion models II: Structure - Lagrangian and Eulerian approach. Examples of simple models application.

• Turbulent diffusion – Theoretical treatments of the turbulent diffusion with emphasis on gradient transfer theory. Exercises.
• Gaussian plume modelling I: Gaussian distribution - Assumptions – Gaussian plume equation - Pasquil Stability class - Determination of the standard deviations of the concentration distribution – Accuracy of estimates.
• Gaussian plume modelling II: Expanded Gaussian plume equations for point stack. Equations for specific situations. Nomogram for determination of distance to ground level maximum and maximum concentration. Exercises.
• Practical assignment: Demonstration of the Gaussian plume model RAM (theory and use). Application of the RAM model to calculate the dispersion from industrial stacks. Evaluation of the results.
• Variation of wind speed with height. Effective height of emission. Buildings and stack effects on the atmospheric dispersion.
• Plume rise: Buoyant and momentum rise. Final rise for unstable-neutral and stable conditions. Gradual rise.
• Atmospheric removal processes: Chemical transformations - Gravitational particle sedimentation - Dry deposition – Wet deposition. Exercises.

ATMOSPHERIC TECHNOLOGY

Week 1: Theoretical background for the laboratory exercises: Radiometry, Ozone sounding, and Meteorology.
Week 2: Introduction to the measurements of environmental parameters. Representativeness of a measurement. Quality control - quality assurance.
Week 3: Measurements of meteorological parameters 1: Temperature. Reference points and temperatures scales. Meteorological thermometers. Sources of errors in temperature measurements.
Week 4: Measurements of meteorological parameters 2: Humidity, Pressure. Parameters of humidity determination. Psychrometers and hair hygrometers. Spectroscopic hygrometers. Operational principles of other hygrometers. Pressure units. Characteristics and operational principles of barometers.
Week 5: Measurements of meteorological parameters 3: Wind. Scales and units. Characteristics and operational principles of anemometers. Wind-vanes. Calculation of the wind vertical distribution.
Week 6: Radiation measurements: Introduction to measurement methods and quantities. Spectral response of radiation instruments. Geometry of measurements – Radiation flux and intensity. Angular response error.
Week 7: Spectrophotometers 1: Description, characteristics, the grating equation, spectral resolution, stray (scattered) light error.
Week 8: Spectrophotometers 2: Absolute calibration and determination of the wavelength scale. Applications.
Week 9: Broadband radiometers: Determination of spectral response function. Calibration with standard lamps and prototype instruments. Errors due to instrument's internal temperature variability.
Week 10: Remote sensing of the column number density of atmospheric species from the ground and satellites: Differential optical absorption spectroscopy method, Brewer-Dobson method.
Week 11: Atmospheric remote sensing using lasers (LIDAR)
Week 12: In situ measurements of atmospheric species vertical profiles.
Week 13: In situ measurements of air quality: Atmospheric pollutants NOx, SO2, O3, CO, hydrocarbons, aerosols.

GLOBAL ENVIRONMENTAL CHANGES

Spatial and temporal scales of atmospheric processes. Mechanisms of emission and removal of atmospheric constituents. Life time.
· Global circles of atmospheric constituents that contain sulphur, nitrogen, halogen and carbon.
· Introduction to the ozone layer. Mechanisms of ozone production and destruction. Dynamics of the ozone layer.
· Depletion of the ozone layer. Periodic changes. Long-term trends.
· Global changes of atmospheric transmission due to aerosols. Size distribution of particles. Classification of Particles.
· Aerosol optical properties. Phase function. Aerosol effects on surface albedo.
· Emission of radiation from the Sun. Solar radiation at the top of the atmosphere (spectral characteristics and temporal changes).

· Factors that affect the transition of the solar radiation through the atmosphere. Spatial and temporal changes of solar radiation reaching the ground.
· Chemical and photochemical processes in the atmosphere. Photolysis rate of atmospheric molecules (calculation and measurement). Biological effects of solar ultraviolet radiation (calculation of the absorbed dose, measurements).
· Emission and propagation of the earth's radiation through the atmosphere. Calculation of the absorbed and transmitted radiation flux.
· Climate change. The Earth's energy balance. Natural and anthropogenic greenhouse effect.
· Solar flux changes and climate forcing. Anthropogenic changes of radiation effective atmospheric constituents and effects on radiation fluxes.

· Solar activity and effects on the atmosphere and the Earth's climate.

ELECTRONIC CIRCUITS:LABORATORY COURSE

Supply circuits (voltage rectifier and stabilizer using circuits with the zener dioder), Circuits with operational amplifiers (amplifiers, integrators, comparators), Oscilators, Power amplifiers (push-pull), Waveform generators with operational amplifiers, Combinational and sequential circuits.

TOPICS IN QUANTUM PHYSICS

Study of Quantum Mechanics Problem with the use of Mathematica: One dimensional problems, the potential well, the ammonia molecular, the Kromig-Penney model, one dimensional harmonic oscillator, one dimensional scattering and the tunneling effect.

LINEAR CIRCUITS

Circuit elements. General Resistive circuits (theorems and methods of analysis).
First-order circuits (Circuits driven by sinusoidal signals, by arbitrary signals, or by an impulse; zero-input response).
Second-order signals (Circuits driven by sinusoidal signals, by arbitrary signals, or by an impulse; zero-input response). Experimental realization.
General dynamic circuits (Linear coupled inductors: characterization, stored energy, sign of M, transformers). Experimental realization.
Two-port circuits. Frequency response. (Response diagrams, Resonance).
Filters (LP, HP, Band-pass, Band-stop, Double-tuned). Experimental realization.
Laplace and Fourier transformation.

GENERAL THEORY OF RELATIVITY

Tensor Calculus (Algebraic Operations, Symmetries, Covariant Diferentiation, Connections, Parallel Transport, Geodesics, Curvature Tensor) - Riemann Geometry (Riemannian Spaces, Metric Tensor, Christoffel Symbols, Geodesics, Curvature Tensor, Geodesic Deviation, Weyl Tensor, Algebraic Classification, Lie Derivatives, Isometries, Killing Vectors) - The Gravitational Field (Linearized Field Equations, The Principle of Equivalence, Einstein's Field Equations of General Theory of Relativity) - Physics in the Presence of Gravitation - Solutions to the Einstein Equations (Schwarzschild, Reissner-Nordstrom, Kerr, Kerr-Newman) - Tests and Applications of the General Theory of Relativity (Advance of the Perihelion of a Planet, The Deflection of the Light Rays, Gravitational Red Shift, The Delay of Radar Signals) - Gravitational Collapse, Black Holes (Schwarzschild, Kerr, Kerr-Newman) - Weak Gravitational Fields, Gravitational Waves (Sources, Propagation, Detection

COMPUTER ARCHTECTURE

Introduction to the structure, organization, operation and evaluation of the computer systems, Arithmetic data Floating point arithmetic, Types of data, Types of Instructions, Addressing modes, CISC-RISC architectures, Central Processing Unit, Data path, Arithmetic Logic Unit, Register file, Control unit, Microprogramming, Nanoprogramming, Memory system, Memory technologies, Memory hierarchy, Cache memory, Main memory, Input-output procedure, Interconnection system, Synchronous-asynchronous buses, Arbitration, Interrupts, Direct Memory Access.

SOLID STATE PHYSICS LABORATORY

1. Introduction to fundamental concepts related to the structural and electric characterization techniques.
2. "Reciprocal space and Brillouin zone". Perceptualization of the relation between the diffraction pattern and the reciprocal space and of the diffraction pattern as a Fourier transform. Consolidation of the relation between the real and reciprocal space. Reciprocal space and Brillouin zone for the fcc, bcc, hcp, diamond, sphalerite and wurtzite structures.
3. "Electron microscopy". Modes of operation of the electron microscope and related interactive software. Imaging with an electron microscope (magnification, resolution). Evaluation of the electron diffraction patterns of a mono- and a poly-crystalline material. Polytype identification.
4. "Study of surfaces and surface defects". Microscopic surface imaging using the NanoEducator Scanning Probe Microscope. Qualitative and quantitative surface characterization of representative samples (e.g. surface roughness).
5. "I-V characteristics". Characterization of p-n rectifying junctions by means of their current-voltage characteristics. Determination, using proper software, of the diode saturation current, ideality factor, series and parallel resistance.
6. "Conductivity measurements and Hall effect". Characterization techniques of the electric properties of semiconducting materials and devices. Two- and four-contact resistivity measurements (Van der Pauw). Determination of the carrier type and concentration by means of the Hall measurements.

7. Introduction to fundamental concepts related to the optical and magnetic characterization.
8. “Electronic structure of the solids”. Calculation of the crystal structure and band structure of semiconductors (e.g. Si, GaN) using ab initio methods. Conduction and valence band, Brillouin zone. Calculation of the density of states and Fermi energy. Electronic configuration and bonding.
9. “Absorption and reflectivity”. Electronic transitions and absorption spectroscopy. Determination of the energy gaps of semiconductors from their visible light absorption spectra. Effect of the n-type carriers on the position of the absorption edge Reflectivity curve and color of transparent materials (using the AVANTES spectrometer).
10. “Vibrational properties of matter: Raman spectroscopy”. Molecular vibrations of polymers or other organic materials. Determination of the vibration frequency following proper fitting procedures and substance identification from the Raman spectrum. Phonons in solids: study of the effect of the type of the atoms, the symmetry and crystallinity on the vibrational mode frequency (using the AVARAMAN spectrometer).
11. “Vibrational properties of matter: FTIR spectroscopy. Vibrational spectroscopy measurement methods, mid/far IR spectroscopy using Fourier transform (FTIR), interferometers, FTIR microspectroscopy. In situ optical characterization. FTIR reflectivity and transmittance spectroscopy and material identification. Characterization of inhomogeneous materials with FTIR microspectroscopy
12. “Magnetic hysteresis loop”. Classification of magnetic materials (diamagnetic, paramagnetic, ferromagnetic). Acquisition and evaluation of the hysteresis loop of magnetic materials. Effect of temperature of the magnetization and magnetic susceptibility.
13. Overall discussion on the characterization techniques and presentation of selected student reports.

4.4.4. Generic Elective Courses

Winter Semester

HISTORY AND EVOLUTION IN PHYSICS

Physics as a science. Physical Philosophy of ancient Greeks – Aristoteles
Galileo's work as the beginning of present-day Physics - Mechanics and Astronomy
Mathematics as tool of Physics - Newton, Lagrange, Hamilton
New ideas in Optics: light as wave – Huyghens
Electricity and Magnetism: first attempt to unify fields in Physics - Faraday, Maxwell
Heat: from the imponderable fluid to the model of energy state - Carnot, Kelvin, Helmholtz, Clausius
Heat and kinetic theory of gases - Maxwell, Boltzmann
Physics of 20th century: Quantum Mechanics, Relativity, Chaos theory
Universities and research

PHYSICAL CHEMISTRY

Electrochemical thermodynamics. Theories of electrolyte solutions. Electrolyte melts. Electrochemical interfaces. Thermodynamics of galvanic cells. Contemporary views about electrode potentials.
Ion and electron transport in electrolyte systems.
Industrial and technological applications of electrochemistry.

PHYSICS OF LIQUIDS AND APPLICATIONS TO MATERIALS SCIENCE

Physics and Physical Chemistry of Solutions; colloids, biological fluids, gels; Contact angle and drying effects on surfaces, the coffee stain effects; hydrophobicity and hydrophilicity of surfaces, morphological factors, the lotus leaf effect; surface tensions, the Gecko effect; fabrication of thin films and nanostructures with wet methods: sol-gel, spin coating, dip coating, spray pyrolysis. Printing methods: principles, technological evolution, spatial resolution; fabrication of inks for inkjet printing of conductors, semiconductors and dielectrics; Applications of wet methods to thin film transistors, light emitting diodes, photosensors, photovoltaics, telecoms; Laser sintering and integration into printing lines; photoexcite chemical reactions of wet precursors. Electrodeposition: I-V curves, process parameters, conformality effects; fabrication of micro- and nano-structures by wet chemical etching.

PHYSICS OF METALS

Metallic bond. Crystal lattices and structural defects in metallic materials. Diffusion mechanisms in solids. The Kirkendal phenomenon. Fick’s laws of diffusion. Stress. Strain. Elasticity and Hooke’s law. Isotropic elastic behavior. Elasticity modulus. Elastic strain energy. Atomic bond and anisotropic elastic behavior. Generalized Hooke’s law. Stress-strain curves. Ductile and brittle metals. The structural defects as carriers of plasticity. Plastic deformation of single crystalline and

polycrystalline metals. Resolved shear stress and yield criteria. Hardening mechanisms. Plastic and brittle fracture. Toughness. Hardness. Creep. Fatigue. Thermodynamic equilibrium. Two components systems. Phase diagrams of isomorphic and partial solubility systems. Lever rule. Eutectic and peritectic reactions. Thermal analysis. The Fe-C system. Problems.

ENERGY PRODUCTION FROM NUCLEAR AND CONVENTIONAL SOURCES

Neutron physics, neutron nuclear reactions, nuclear fission, neutron moderation, neutron diffusion, nuclear reactors, nuclear fuels and enrichment, nuclear energy production, radioactive waste and environmental pollution, nuclear fusion and energy production, energy production from fossil fuels, environmental pollution from the fossil fuels, energy production and selection criteria.

BIOELECTROMAGNETICS

Part 1 (9 hours); Radiation protection elements for non-ionizing radiation: Introduction to physical quantities, sources of non-ionizing radiation, biological effects of electric-magnetic fields and electromagnetic radiation, radiation protection guidelines, measurements and surveillance.
Part 2 (18 hours); Therapeutic techniques: Thermal ablation (introduction to the technique, thermal damage to human tissue, cancer thermal ablation), hyperthermia (historical overview, biological mechanisms, hyperthermia and other cancer treatment modalities, application and devices, magnetic nanopartiples, clinical practice, treatment planning), electrosurgery (application and devices, clinical practice, precaution during application), magnetic stimulation of the neural system (introduction and principle of operation, equipment, clinical practice, numerical calculations).
Part 3 (9 hours); Diagnostic techniques: Electrical properties of tissue (description, measurement of electrical resistance, plethysmography, electrical impedance tomography).

FOREIGN LANGUAGE (ENGLISH)

The lesson 'English for Physics' is offered as an option both in the 5th and 6th semesters respectively in the department of Physics. The course focuses on vocabulary acquisition through current authentic material on physics subjects from various scientific fields extracting the desirable information from articles, scientific magazines, books, journals and the internet. Besides, students are given practice to specific reading & writing techniques which enable them to better handle various textual analyses. Guidance is offered on a) the structure of a scientific paper b) the standard format of scientific research with information on the procedure followed on how to write such papers c) development of practical reading skills & d) project work and assignments submitted at the end of the semester, too. Class interaction is of primary concern as various scientific topics are introduced and proposed for discussion and dialogue. The course gives students the opportunity to refresh background knowledge and express their point of view and ideas, be involved in issues that interest them and are relevant to their specialty, too.

METROLOGY AND QUALITY SYSTEMS

Purpose of metrology. Standards and their realization. Traceability. Uncertainties. Modern achievements of metrol ogy. Solid State Physics and metrology. Applications. Meaning and the definition of quality. Quality measurement. ISO 9000, EN 45001. Certification. Applications

MEDICAL PHYSICS AND DOSIMETRY

Dosimetry - Biological effects of radiation
Interaction of nuclear radiation with matter, direct and indirect interaction, RBE, LET and quality factor of the radiation
Transferred-absorbed energy dose definitions, dose measurement and units
Interaction of radiation in water (hydrolysis)
Buildings biological disasters (sub cellular level - cell - tissues - organs) directly and ulterior results. Modifying factors (physical and biological)
Newest fields in dosimetry (micro-dosimetry and nano-dosimetry, space dosimetry)
Medical Physics
Isotopes Production used in Medicine, Special requirements, isotope concentration and half-life (natural and biological half-life)
Diagnostic methods, static and dynamic tests (CT - MRI, γ-camera, SPECT, PET, PET-CT)
Computer imaging, detection of radiation (image formation, collimators, resolution of image, criteria method compare son)
Radiotherapy - Medical accelerators (construction-beam -produced reactions) Photon, electron and hadron therapy
Isotopes application (Brachytherapy)
Principles of radiation protection and international regulations

LABORATORY IN COMMUNICATIONS AND NETWORKS

Network troubleshooting commands, Discover the Internet structure, Network packet analysis, TCP/IP Packet Analy sis, Network monitoring with protocol analyzers, Performance simulation of a simple home network, WLAN simulation, Wireless infrastructure network simulation, Simulation of network perimeter security design (Firewalls, DMZ, Access Lists)

INTERNSHIP

The internship aims: to exchange experience between the workplace and education, developing professional awareness of students, now and beyond their education and the emergence of a feedback process of the existing problems between education and production.
The students of the Department of Physics may be exercised in the following areas:
- Schools secondary or primary education and special schools, teaching physics
- Civil Airport Service
- Hospitals on Physics-Medical Laboratory Science Centers
- Company and / or Y, where dealing with data processing and control and software development
- Hardware Industry
- Communications (OTE)
- Energy (DEI)-Metrology
- Computational Physics

Apart from that, students can also work in other places (organizations, companies, etc.), which used knowledge of Physics. This is done in consultation with the head of the course or internship supervisors.

Spring Semester

MATERIALS AND CHARACTERIZATION TECHNIQUES IN CONSERVATION OF WORKS OF ART

MODULE 1 (6 Hours): History and principles of restoration. Studies on the authenticity of artifacts. The effects of microclimate on the monuments (particularly byzantine monuments).
MODULE 2 (9 Hours): Characterization techniques applied in the study of cultural objects (Microscopies, X-Ray Diffraction analysis and fluorescence, Infrared spectroscopy, Raman spectroscopy, Optically stimulated luminescence and Thermoluminesence, Laser applications, SIMS method, neutron activation analysis, Radiocarbon dating using the 14C isotope technique, Thermal analysis, micro- and macro- photography in visible, ultraviolet and infrared light, and others).
MODULE 3 (12 Hours): Materials of the artifacts which are studied and restored with the aforementioned techniques (along with examples): Murals and portable icons, Ceramics (technology, corrosion, restoration), Glass, Marble, Porcelain, Ancient and historic metallic artifacts, gold objects, Coins, Paper, Mosaics, Textiles, Wooden objects (wooden iconostases), and others.
MODULE 4 (9 Hours): Examples applications of restoring famous artists' artifacts, and study of their artistic work. Modern materials used in conservation of works of art (e.g. epoxy resins, etc.).

NUMERICAL ANALYSIS

The course deals with numerical and approximative methods of solving mathematical problems that are frequently met in Physics: Root finding and solution of nonlinear equations. Linear systems and matrices. Finite differences discretization and numerical derivatives. Numerical calculations of definite integrals. Numerical solutions of ordinary differential equations - error analysis and convergence. Introduction to numerical solution methods for partial differential equations. Computer applications of the above methods..

PROBABILITY AND STATISTICS

PROBABILITY
Theory of sets and probability,(events, axioms of probability, conditional probability, Bayes' theorem, combinatorial analysis, tree diagrams) - random variables - probability distributions (discrete and continuous probability distributions, joint distributions, independent random variables, change of variables, convolutions) - mathematical expectation - variance and standard deviation - functions of random variables - standardised random variables - covariance - correlation coefficient - Chebyshev's inequality and the law of large numbers - specific probability distributions (binomial, normal, Poisson, uniform, Cauchy, gamma, chi-square and Student's distributions, relations between distributions, central limit theorem).
STATISTICS
Sampling theory (population and sample, random samples, sampling distributions, population parameters (means, proportions, differences, sums), sample statistics (sample mean, sample variance) - estimation theory (confidence intervals for means, proportions, differences, sums, variances) - tests of hypotheses and significance (statistical hypotheses, type I and type II errors, level of significance, one- and two-sided tests, special tests of significance, fitting of theoretical to sample frequency distributions, chi-square test, contigency tables) - curve fitting (regression, least squares method, standard error of estimate, multiple regression, linear and generalised correlation coefficient, sampling theory of regression and correlation).

GEOPHYSICS-SEISMOLOGY

Main geophysical features of the earth, theory of the plate tectonics.
Theory of elasticity and elastic waves, seismic waves and their propagation in the earth's interior.
Seismographs, seismometers and determination of the earthquake focal parameters.
Seismotectonics.
Earthquake Prediction.
Macroseismic effects.
Seismic reflection and seismic refraction in Seismology and Applied Geophysics

COSMIC RADIATION

Discovery of cosmic rays (CR). Effect of the geomagnetic field and of solar wind on CR. Passing radiation through matter. Cherenkov radiation. Primary and secondary CR. Extensive Atmospheric Showers. CR propagation in the Galaxy. Cosmic clocks. Origin and acceleration of CR. Ultra high energy CR and GZK-cutoff. Gamma Ray Bursts. Dark Matter and methods for its detection. Dark energy

PHYSICS OF THE HUMAN BODY

Part 1 (hours: 6): Energy, heat and power in the body: Conservation of energy in the body, energetic body changes, work and power
Part 2 (hours: 3): Energy, heat and power in the body: Heat loss mechanisms from the body (through radiation, condution and breathing), thermoregulatory mechanisms, the effect of clothing
Part 3 (hours: 3) Pressure in the body: Pressure measurement, the body pressure in the skull, the eye, the digestive system and bladder, tension in the skeleton, pressure during diving
Part 4 (hours: 6): Osmosis: Transfer of substances in liquids through membranes (forced by solvent movement, diffusion, volume flow versus diffusion, osmotic pressure, active transport - moving in the opposite way), regulation of the extr cellular (interstitial) fluid.
Part 5 (hours: 6): Physics of the cardiovascular system: the main components of the cardiovascular system, exchange of O2 and CO2 in the capillary system, the work of heart, blood pressure measurement, pressure in the vessel wall, the principle of Bernoulli in the cardiovascular system, blood flow velocity, laminar and turbulent flow, physical some card ovascular diseases
Part 6 (hours: 3): Electric and magnetic signals from the body: electric cell potentials, electrocardiogram, the heart as a dipole, cardiac leads, the Einthoven triangle
Part 7 (h 3): Electrical and magnetic signals from the body: the nervous system, the neuron, neuronal electrical potentials, electroencephalography, magnetic signals from the heart and brain
Part 8 (hours: 3): Physics of the eyes and vision: parts of the eye to focus, other parts of the eye, the retina, the threshold of vision, diffraction phenomena in the eye, visual acuity
Part 9 (hours: 3): Physics of the eyes and vision: defective vision and its correction, instruments used in ophthalmology
Part 10 (hours: 3): Problem-solving

GEOMETRICAL OPTICS, PHOTOMETRY AND APPLICATIONS

Propagation of light. Reflection. Refraction. Lenses. Stops. Mirrors. Prisms. Fiberoptics. Optical systems. Thin lenses. Ray Tracing. Aberrations. Human Eye-Eyeglasses. Microscopes. Telescopes. The camera. Photometry.

BIOLOGY

The beginning of life-Chemistry of life (proteins, enzymes, DNA)- Methods in cell examination-The cell and the cell organelles-Proteinosynthesis and genetic code-From the cell to the organism (cell reproduction, mitosis, meiosis) -Tissues and organs-Mechanisms of heredity-Biotehnology in health, agriculture, cattle-raising, environment, industry.

PHYSICS OF MATERIALS

The course focuses on the presentation of the physical properties of materials and aims not to teach the respective concepts in detail, but to present them comparatively for different materials. It includes the following sections: Introduction to materials science, Classification of Materials, Physical properties of materials: Nomenclature, definitions, charts, presentation of comparative data of various materials. Mechanical properties, thermal properties, electrical properties, magnetic properties, optical properties, environmental behavior of materials, advanced materials and applications.

METEOROLOGY

Introduction for the Earth's atmosphere, atmospheric humidity, thermodynamics of atmospheric air, static stability of the atmosphere, cloud physics, motion of air masses, fronts and barometric pressure systems, general circulation in the troposphere, weather forecast.

LABORATORY IN COMMUNICATIONS AND NETWORKS

Network troubleshooting commands, Discover the Internet structure, Network packet analysis, TCP/IP Packet Analy sis, Network monitoring with protocol analyzers, Performance simulation of a simple home network, WLAN simulation, Wireless infrastructure network simulation, Simulation of network perimeter security design (Firewalls, DMZ, Access Lists)

TECHNOLOGY-MATERIALS AND SOCIAL-ECONOMIC ENVIRONMENT

Basic concepts and technology development phases, economic and social environment. The evolution of technology and development models, progress of technology and humanity, technology and materials, the Materials Science, the main phases of development to produce a new product, basic research and knowledge, the relationship of Research and Development (R&D) with users, industry-universities.
Technology and Academic Research. Research and experimental development, criteria for distinguishing R & D from

related activities, the definition of the researcher, industry and knowledge, academia interactions and industry career in R & D, research training, spin-off companies.
Copyright, certification and quality assurance. Throwback, vesting reasons of intellectual and industrial property protection diplomas, international framework and institutions, the role of patents in promoting innovation and the adverse impact, patent acquisition procedures, standardization, certification and quality assurance, ISO standards.

PHYSICS AND PHILOSOPHY

Nature and the ancient Greek thought. The Ionians philosophers and the atomists. Platonic Timaios. Mathematics, Logic and Science. The program of Russel and Frege. The dispute between Hilbert and Brouwer. Measuring the infinity with Cantor. Godel's theorem. The limits of knowledge. Quantum Mechanics. The uncertainty principle and the coupling subject-object. Bell's inequalities. Quantum Logic, Physics,Metaphysics and Ontology. The anglosaxon epistemology (Popper, Kuhn, Feyerabend). Unity and diversity in nature. The search of meaning and the late Wittgenstein..

ENVIRONMENTAL RADIOACTIVITY

Radioactive nuclides of cosmogenic and terrestrial origin.
Radioactivity of the atmosphere.
Atmospheric dispersion of radioactive nuclides.
Radioactivity in marine environment, rivers and lakes, tap water and thermal springs.
Radioactivity in soil and plants.
Radioactive nuclides of man-made origin.
Uranium mines, enrichment and depleted uranium, radioactive wastes.
Nuclear accidents and radioactive fallout.
Radiation dosimetry

SENIOR THESIS

Writing a scientific report, writing a scientific paper, conference presentation:

a) How to prepare an oral presentation
b) How to prepare a scinetific poster
c) Presentation procedure
d) Writing a prosposal for funding

PHOTONICS AND APPLICATIONS

Introduction to Photonic Technology
Photonics vs. Electronics: Similarities and differences
Materials of Photonic Technologies (LiNbO3, Si, Ge, GaAs, InP, Polymers)
Electromagnetic waves in nm scale
Optical fibers and waveguiding
Sources and detectors of light in Optical Fibers and Photonic Integrated Circuits (Lasers, Modulators, Photodiodes)
Passive elements in Photonic Integrated Circuits (waveguides, filters, Multiplexers/Demultiplexers, Couplers, Elements for coupling light with optical fibers, polarization splitters/combiners and rotators, Photonic Crystals
Linera and Non linear phenomena in Photonic Applications (Kerr, Pockels, 2nd Harmonic Generation)
Plasmonics and plasmonic waveguides
Integration Technologies for Photonic Circuits
Applications to Biology, Medicine and Imaging
Applications to Datacom, Telecom and Information transportation

EDUCATIONAL TECHNOLOGY LABORATORY

The aims of the course are students be able to design and develop an integrated teaching scenario where included and used issues of Educational Technology (experiment with synchronous recording, video-measurements, data analysis and modeling processes).

- Traditional forms of Education Technology
- Synchronous forms of Education Technology. Information and communications technology.
- Physics Experiments

Demonstration experiment
Hands on experiments
Microcomputer based laboratories and Video based laboratories
Simulations and virtual labs
Remote experiments

• Scenarios where included and used issues of Educational Technology
• Presentations (Powerpoint – web pages)
• Pedagogical and educational use of the Internet. Distance and open learning.

The students, after an initial familiarization with the requisite software, undertake a physics issue and encounter it with synchronous recording experiment (MBL) and video-measurements (VBL). They analyze the experimental data and modeling the phenomena.

CHAOTIC DYNAMICS

One dimensional maps, fixed poinds, periodic points, the logistic map, definition of chaos, propertiew pf chaos, Bernoulli shift and the proof that it is chaotic, the Cantor set of the middle third, two dimensional maps, fixed points and their stability, from the linear to the non linear system, transversal intersections of the stable and the unstable manifolds of a saddle, the creation of a Smale horseshoe, and the appearance of chaos, the Smale horseshoe

4.5. Pedagogical and Teaching Adequacy Program (PPDE)

(Subject to its approval by the Foundation's Senate)

The Pedagogicaland Teaching Adequacy Program (PPDE) is certified by a certificate issued by the school of Physics of the Faculty of Science of the AUTh. It is a certification that ensures that graduates who intend to follow professional teaching disciplines have satisfactory teaching and pedagogical adequacy. The legislation governing Pedagogical and TeachingAdequacy Program is the Law **3848/2010** (FEK A'/71)("Upgrading the role of the teacher – establishing rules of evaluation and meritocracy in education and other provisions") article 2, as amended by the paragraph 22 of article 36 of the Law **4186/2013** (FEK A'/193) and Article 111 of the N.**4547/2018** (FEK A'/102).

ThePedagogical and Teaching Adequacy Program (PPDE) of the school of Physics of the Faculty of Sciencesconstitues a **parallel** to the undergraduate program of studies with courses mentioned and categorized in the Table**: "**Courses of the Studies ***for the Pedagogical and Teaching Adequacy Program of school of physics"***.The programme requires the attendance of at least 6 courses as follows:

I. One of the thematic Module A
II. Two or three from thematic Module B
III. At least one of thematic Module C1
IV. Two from thematic Module C2

4 of these are compulsory courses of the undergraduate program and the rest (at least 2 courses) are elective cources. The PPDE is certified by **completing at least 30 ECTS and** byelective courses in accordance with the above.

Remarks:

1. Thematic Module A is covered by courses of cooperating schools (schools of Philosophy & Pedagogy, schools of German Language & Literature and schools of Informatics). The course chosen by this thematic module is NOT taken into account in the sum of the ECTS for obtaining the degree, unless declared as a free choiceelective course.
2. Thematic Module C1 contains courses that support micro-teaching and are courses of the Laboratory of Didactics of Physical and Educational Technology. These courses can be selected independently of the Curriculum and can only be counted in Pedagogical and Teaching Adequacy. In this case, a declaration by the Student to the administration office of the school of Physics is required.
3. The course "Practical Exercise" is accepted as a course of study for the PPDE, ONLY if it is implemented in a school(secondary education). (PRACTICAL ASSESSMENT (see page 59))

Table. *Courses of the Studies for the Pedagogical and Teaching Adequacy Program of school of Physics*

THEMATIC Module A: Education and Education Issues Elective courses of other schools (1 course is selected)	**Semester**	**hours/week**	**ECTS**
School Pedagogy I (School of Philosophy & Pedagogy)	X	3	5
School Pedagogy II (School of Philosophy & Pedagogy)	E	3	5
Educational Psychology (Schoolof Philosophy &Pedagogy)	X	3	5
Introduction to Pedagogy (School of Philosophy & Pedagogy)	X	3	6
Introduction to pedagogical research (School of Philosophy & Pedagogy)	X & E	3	6
Introduction to Pedagogy: Pedagogical Training Issues (School of German Language & Literature)	X	3	6
Learning Theories & Educational Software (Schoolof Informatics)	E	4	5
THEMATIC MODULE B: Learning and Teaching Issues Compulsory courses of the UP of the School ofPhysics + Seminar (as an optional option)	**Semester**	**hours/week**	**ECTS**
Laboratory of Applied Informatics C (1st semester)	X	4	5
Computer Programming & Computational Physics C (2nd semester)	E	3	4
Seminar: Teaching Topics of Physics (School of Physics)	X & E	1	2
THEMATIC MODULE C1: Special Teaching and Practical Courses Elective courses of the UP of the School of Physics (at least 1 course is selected)	**Semester**	**hours/week**	**ECTS**
Educational Technology Laboratory General Selection	E	3	4
Laboratory of Teaching of Physics Special Selection	X	3	4
Practical exercise (in a school unit) General Selection	X/E	3	4
Introduction to the Teaching of Physical Basic Selection	X/E	3	5
THEMATIC MODULE C2: Special Teaching and Practical Courses Compulsory courses of the UP of the School ofPhysics			
General Laboratory C (2nd semester)	E	4	5
Laboratory of Electrical Circuits C (3rd semester)	X	3	5
Minimum sum of ECTS			**30**

C=Compulsory, E=Elective

4.6. Expected Learning Results of the UP of the School of Physics of the University of AUTh

The learning results of the undergraduate curriculum of the School of Physics include general and specific objectives:

Total knowledge and skills

Graduates are expected to have acquired:

- Knowledge of the laboratory - experimental methodology of studying and receiving data on the basic concepts that govern Physical phenomena.
- Ability to handle complex experimental devices, use techniques to describe Physical phenomena and perform a combined analysis of experimental data with simulation data by extracting the corresponding conclusions.
- Knowledge and ability to use various problem-solving strategies
- Understanding the need to use theoretical and numerical calculations and apply them to theoretical and experimental problems.
- Ability to justify and explain specific approaches to problem solving.
- Ability to combine knowledge from various fields of Physics.
- Understanding the importance of the theory-experiment relationship in the evolution of scientific knowledge.
- Ability to work together and collaborate.
- Development of written and oral communication skills.
- Ability to apply knowledge to independent research work.
- Tools and encouragement for lifelong learning.

Fundamental and Basic Knowledge of Physics

Graduates are expected to have developed a solid understanding of Physics, both conceptually and in the ability to solve problems in the following areas:

- Mechanics: Establishment of Classical Mechanics at the base of differential and vector calculus with emphasis on its connection to everyday life. Fundamental principles governing momentum, energy, and momentum, with applications in dynamic system interaction, principles of change and concepts beyond Newton'sMechanics, symmetry, integralism and chaos.
- Electromagnetism: Electrical and magnetic load interaction, electrical and magnetic properties of materials, linear electrical circuits, classical and relativistic theory of electromagnetic field, formulation and resolution of Maxwell's equations and propagation of electromagnetic waves.
- Thermodynamics and Statistical Physics: Fundamental Laws of Thermodynamics. Basic concepts of energy, temperature, entropy. Macroscopic and microscopic description of systems. Connection of the two descriptions.
- Quantum Physics: Basic principles of quantum mechanics, the wave function and equation of Schrödinger, applications of quantum mechanics in atomic, molecular, and nuclear physics, modern quantum mechanics issues (quantum entanglement, quantum measurement, etc.).
- Astrophysics-Relativity: Radiation propagation, stellar spectra, creation and evolution of stars and planetary systems, final star states, basic principles of cosmology, basic principles of General Relativity Theory, gravitational waves.
- Modern Physics: Introduction to Special Relativity and Quantum Physics. Terms and concepts of the physics of the microcosm in the context of these theories. Basic phenomena with photons and electrons. Individual phenomena of study of the structure, properties, and quantum changes of atoms. Particle-wave dualism, Schrödinger equation, hydrogen atom, molecular spectra.
- Optical-Wave: Mechanical, sound, and electromagnetic waves, light dissipation, geometric optics, polarization of light and double refractivity, confluence of light and coherence, diffraction of light.
- Mathematical methods: Developing understanding and problem-solving ability in common and partial differential equations, complex variables, linear algebra, vector algebra and vector calculus, partial differentiation, multiple integrals, Fourier series, integral transform, variation calculus and probabilities.
- Experimental Physics: Error analysis, regression curves, data analysis, application of fundamental experiments, such as: optical spectroscopy, electron diffraction, crystallography and X-ray diffraction, detection and counting of ionizing particles and radiation to describe phenomena of Atomic and subatomic Physics, electronics and telecommunications, and familiarity with basic experimental methods.

- Solid State Physics: Bonds and structure of solids, theory of lattice vibrations, thermal and optical properties of solids, electrons in a periodic potential and Fermi statistics, electronic structure of solids, electron migration processes and transport phenomena, semiconductors (electronic structure, impurities, conductivity & scattering of carriers, applications).
- Electronics: Semiconductor elements (diodes, transistors), operation of electronic circuits.
- Environmental physics: Atmospheric processes (structure and composition, radiation propagation, dynamics). Climate change, global environmental problems.

Applications of Advanced Physics Knowledge

In addition, students have the opportunity to explore selected areas of specialization at a level sufficient to prepare for their studies in Master of Science programs. These fields include materials physics and technology, electronics and telecommunications, atmospheric environment, nuclear physics, computational physics, nanosciences, advanced classical mechanics, advanced statistical mechanics, particle physics, high-energy theoretical physics, astrophysics, and cosmology.
These specializations additionally support a key objective, that of obtaining sufficient knowledge and skills from students, in order to be able to integrate into high quality Master of Science programs inside and outside Greece, and to successfullygraduate.

Specific objectives

Among the expected learning outcomes is the acquisition of basic knowledge in Physics, sufficient for graduates to successfully career in fields related to the science of Physics, such as high-tech enterprises and industry. Finally, graduates can choose to acquire pedagogical adequacy in order to be employed in secondary education as well as in higher stages of public and private education.

5. ERASMUS Mobility Programme

ERASMUS is aEuropean Union action programme for cooperation in the field of education.It concerns the mobility of students and faculty of AEI and applies in all member states of the European Union as well as in all associated countries.

The objectives of the ERASMUS programme are:

- Develop the European dimension of education.
- Cultivate exchanges of information and experience.
- Encourage open and distance education.
- Promote language learning, especially the less widely used, in order to enhance understanding and solidarity between the peoples who make up a united Europe.
- Improve the quality of education and promote the intercultural dimension of education.
- Encourage student and teacher mobility as well as contacts between students.
- Encourage academic recognition of diplomas.
- Promote cooperation between AEI.

The programme supports the establishment of the European Credit Transfer and Accumulation System (ECTS) which facilitates academic recognition of the work carried out at the Host Foundation and student mobility. The School of Physics fully implements the ECTS system for the academic recognition of the studies of both its students visiting other European universities and foreign students coming to study at the School.

Sources of Information

All issues related to ERASMUS educational collaborations are managed by the Department of Educational Programs of AUTh, a two-storey building of the Administration (Rectory) building, which is open to the public Monday to Thursday 11:00-13:30. It should be noted that each student is responsible for the consultations concerning the host HEI. The staff of the Department of Educational Programs gives all the necessary information and supports students both in the application process and in their contacts with the host institutionwww.eurep.auth.gr.
Every year around mid-February, and before the deadline for the submission of applications, the School of Physics organizes an information event for the students concerned.

The ERASMUS Committee of the School of Physics includes:

Mr. K. Papagelis and Mr. D. Tassis (outgoing students, new agreements, incoming students)
Mr I. Arvanitidis (Erasmus+ Practical training, Erasmus+ International, member mobility for teaching, training).

About Us

School of Physics: www.physics.auth.gr/erasmus,
Department of European Education Programmes: www.eurep.auth.gr

For any topic related to ERASMUS+ for the School of Physics, send an e-mail: erasmus@physics.auth.gr

6. Internal Operating Regulations

Article 1. General Principles - Relevant Committees

1. The purpose of the Undergraduate Program (UP) of the School of Physics is to provide high level studies in Physics so that its graduates a) have an excellent degree of basic knowledge of Physics, b) have advanced knowledge in specialized subjects of Physics, c) have skills for finding employment in research or technological areas of the labor market, and d) have the necessary knowledge and skills to continue their studies in postgraduate programs and participate in research activities.
2. The UP is adapted to the quality policy of the study programs of the Aristotle University of Thessaloniki (AUTh) and its operation is subject to the control of the Quality Assurance Unit (MODIP) of AUTh.
3. The planning and monitoring of the implementation of the UP is the responsibility of the **Curriculum Committee (CC)** of the School. The Committee's term is one academic year and it is chaired by the Vice President of the School. The CC consists of a representative of each Department who is a member of the Assembly of the School (Assembly). The representatives and their replacements are appointed by the sectors during the nomination of the representatives of the sectors in the Assembly. A student representative and his / her replacement, who are appointed by the student association, also participate in the CC. A member of the Secretariat and up to two members of the School involved in the implementation and monitoring of the UP participate in the CC with an advisory role (but without the right to vote) following a decision of the President. The responsibilities of EPS are:
   a. It recommends to the Assembly the necessary changes in the UP or the study regulations in order to improve or modernize the UP. To achieve this purpose it gathers all the necessary data from the Secretariat,

   b. It is responsible for determining the teaching and examination programs in collaboration with the Program Schedule Committee of the School,

   c. It suggests to the Assembly changes in the elective courses at the request of the faculty and with the consent of the Sections that are responsible for the courses.
4. Suggestions for changes in the UP are made until April 30[1], which, if approved by the Assembly, are valid from the following academic year. For reasons of smooth operation of the UP, changes during the academic year are avoided, as well as significant changes that affect the basic principles of operation of the current UP, the conditions for obtaining the degree, and the calculation of the average degree grade of the graduates. In these cases, the Curriculum Reform process is followed.
5. The UP remains in force and is supported for at least eight (8) years (ie twice the duration of study). After the expiration of this period and if the Reformed UP has entered into force, provisions are defined for inclusion of the students of the previous UP in the new program.
6. At the latest after 6 years of operation of anUP, the CC evaluates the operation of the UP and examines the need for its reform, taking into account the evaluations of the UP by students and faculty, the new scientific challenges in Physics, and the current social needs.
7. For the coordination and the proper operation of the laboratory courses, a **Laboratory Committee** is established with an annual term. The purpose of the Committee is to coordinate and homogenize the operation of the Laboratories, to propose improvements in the provided laboratory training of the students of the School and to prevent or solve problems that arise. The Committee consists of the coordinators of the laboratory courses appointed by the respective course committees, and two students, appointed by the Students' Association.
8. A **Student Affairs Committee** is set up to settle student issues related to the UP courses, which:
   a**. Decides** on student applications regarding suspension of studies, extension of studies, late registration of courses, recognition of elective courses and control of course material from other Schools.

   b. **Proposes** to the Assembly regarding the applications for recognition of courses to transferred students and students who have passed the qualifying examinations of the School.
9. For matters concerning the classroom program and the examination program, the **Timetable Committee** is established. The committee cooperates with the respective committees of the other Schools of the Faculty of Sciences so that there is coordination and better planning of the use of the available rooms. The committee also takes care of finding rooms in cases of special courses (eg, for any replacementsof lectures).

[1]Presidential Decree 160, Article 31

Article 2. Study Guide - Graduation - Course Evaluation

1. At the beginning of each academic year, the School issues a detailed Study Guide in digital structure and in printable form (pdf), which is freely accessible through the website of the School. The study guide describes: the structure of the UP, the procedures that govern its operation, the structure and contents of all courses (type of course, teaching hours, credits, instructors, curriculum, etc.), as well as information for the School which concern students (eg, faculty, infrastructure, other activities).
2. The courses are **theoretical** and their teaching is carried out in classrooms of the Faculty of Sciences, or **laboratory courses** and are conducted in the Laboratories of the School. The number of Teaching Classes of theoretical courses is determined by the Assembly based on the number of students and the available infrastructure. The UP also provides the opportunity to write a Thesis and complete an Internship.
3. The courses of UP are divided into **Compulsory** and **Elective**. The School ensures the uninterrupted teaching of all the compulsory courses of the UP, as well as a sufficient number of elective courses (at least three times the elective courses that are requiredfor obtaining the degree). Following the suggestion of the CC, the Assembly defines the elective courses that will be taught during the next academic year.
4. The duration of the PP is four years and the studies are conducted with the system of semester courses. In no case is the degree awarded before the completion of eight (8) semesters of study from the time of the student's enrollment in the School.
5. Each semester includes at least thirteen (13) full weeks of teaching. Extension of the duration of a semester is allowed only in exceptional cases in order to complete the required minimum number of teaching weeks. The extension can not exceed two weeks and a decision of the Rector is required, following a proposal by the Dean of the Faculty.
6. Degree awarding[2].A student completes his studies and is awarded the degree when he/she successfully passes the courses provided by the study program and obtains the required number of 240 credits (ECTS). These do not include ECTS of courses obtained from special study programs (eg Pedagogical Adequacy Program), or from foreign language courses required by the regulations of the Institution or the respective legislation and are not included in the regular UP. Upon completion of studies, students are awarded a Certificate of Completion of Studies. The Degree is awarded in a special swearing-in ceremony of the graduates organized by the Dean of the Faculty within 2 months from the end of the respective examination period, ie 3 times per year.
7. **Evaluation of courses and Teaching Ability**. The objective of the Evaluation of Courses and Teaching Ability (ECTA) measure is the expression and recording of the opinion of students who attend the educational process on the teaching ability of the instructors, the quality of the course, and the adequacy of the distributed textbooks. The evaluation is confidential, it is a the duty of the students, and is done through the website of the Quality Assurance Unit (MODIP-AUTH http://qa.auth.gr) during the period between the 8th teaching week and the end of the semester courses, according to the respective instructions of MODIP.
8. The **Internal Evaluation Team** (OMEA) of the School, which is formed by the Chair, examines at the beginning of each semester the results of the evaluation of the previous semester and reports to the Assembly, according to the instructions of MODIP and the decisions of the AUTh Senate.

Article 3. Structure of the Curriculum

1. The Curriculum includes 43 courses which are divided into compulsory courses and elective courses. The compulsory courses are 31 (23 theoretical courses + 8 compulsory laboratories) and the elective courses 12, or 10 plus the Thesis. Each course corresponds to a specific number of ECTS that is determined according to the workload of the students. The total number of ECTS completed with the above courses is 240.
2. In all compulsory courses, a maximum of 150 students per class is set. If there are more students enrolled in a course, additional classes are created to include all students, taking into account the School's capabilities in terms of available faculty and infrastructure. These limits are set by the Assembly in May each year following a proposal by the CC.

[2]N.4009/2011 όπως τροποποιήθηκε και ισχύει Άρθρο 33 12.

3. **Compulsory courses:** The teaching hours of the compulsory courses are divided into hours of Theory (Th), ie hours of theory lectures (lectures), and hours of Practice (P), ie hours of explanations, questions, and solving exercises. The weekly curriculum clearly states the type of teaching of each lesson (Th or P).

4. **Elective courses**: The elective courses that each student is required to attend are a total of 12 and are provided in the 7thand 8thsemesters. These courses aim to enhance the knowledge that a student acquires in one or more thematic areas of his choice, but without providing specialization, which is offered in the postgraduate programs of the School. The elective courses are divided into three groups with specific characteristics: 1) **Basic** elective courses, 2) **Special** elective courses and 3) **General** elective courses. The student must choose 4 courses from the Basic Elective courses group, and the remaining 8 from the other two groups, with at least 3 from each group.

5. If an elective course is abolished from the UP, this course cannot be chosen and examined, regardless of whether the student had attendedthe course and was unsuccessfully examined in this course in a previous semester. In this case the student is obliged to register and attend another elective course, without violating the ratio of courses between the three groups defined by the Study Guide.

6. The indicative study program does not bind students in the choice of courses and in the definition of their personal study program. Nevertheless, the School recommends attending certain courses as prerequisites for the successful understanding of courses in subsequent semesters. Exceptions are the laboratory courses, which may require the successful attendance of other laboratory courses of previous semesters, and are defined in the operating regulations of each laboratory course.

7. Students have the opportunity to choose a course from another School of AUTh(**Free choice**), which has at least 4 ECTS and corresponds to a General elective course with 4 ECTS. This option is approved by the Student Affairs Committee to which the student submits a timely application stating the basic elements of the course (Title, School that offers it, teaching hours, course website or content).

8. **Upper and lower limits on the number of student per elective course:**

   a. The following **thresholds** are set per category of elective courses: 10 students for the Basic elective courses and 5 for the Special or General elective courses. The minimum number of students per course is determined by the number of students who took the course exams in February, June and September (each student counts once). If a course does not meet the minimum number in two consecutive academic years, the Department in charge of the course suggests: a) extension of teaching for another year with justification, b) ways of upgrading the quality of the course, c) replacement of the course . Otherwise the course is deleted from the curriculum.

   b. The **maximum number** of students who can register for each elective course in decided by the Assembly. Different ceilings may be set by the Departments for the elective laboratory courses, depending on the educational abilities.

9. **Thesis**: The Thesis is optional and it is referenced in the UP as a course entitled Introduction to Research Methodology. It is equivalent to two Special elective courses in addition to the three Special courses that the student is required to choose. The Thesis is presented in public. The announcement of the presentation is posted on the website of the Department and on the bulletin board of the Department or Laboratory of the supervisor. The grading of the thesis is assigned by a three-member committee made up of members of the teaching staff (Professors, Lecturers, EDIP) who are appointed by the supervisor in collaboration with the Director of the respective Department or Laboratory.

10. **Courses taught in two semesters:** The courses Internship and Thesis are offered in both semesters. Laboratory courses are also offered in two semesters, when it is not possible to accommodate the total number of students in the regular semester. Some of the courses of the compulsory program can be taught in the next semester in a single class (only those who have registered in the specific semester have the right to take the exams). These courses are selected by the CC and every year the necessity of offering them in both semesters is re-evaluated.

11. **Degree Grade**: The way of calculating the degree grade, as well as the characterization of the overall performance of the student are determined by the current legislation, as it is specified by the decisions of ADIP and MODIP/AUTh. For the calculation of the degree grade and the composition of the courses listed in it, only the compulsory courses of the UP and the 12 elective courses are counted (or 10 electives plus the Thesis). Additional elective courses that the student has successfully attended and examined are not counted in the degree grade but are listed in the Diploma Supplement. For the calculation of the degree grade (Υ.Α. Φ.141/Β3/2166, ΦΕΚ308/Β'/18-6-1987) the grade of each course is multiplied with the weight index of each course, and the sum of the product is divided by the sum of the weight indices of all courses. The courses weight indices are equal with the ECTS for each course. The total ECTS credits that are required for graduation is 240.

12. The **Diploma Supplement** is issued by the Secretariat automatically upon completion of the studies and accompanies the Degree.

Article 4. Course Registrations and Enrolment Declarations

1. At the beginning of each semester, students a) register and b) complete an enrolment declaration for the courses they will attend during the current semester through the Electronic Secretariat Services at AUTh (https://students.auth.gr/ or https://sis.auth.gr/old/), using their personal password. The dates for the registration and the enrolment declarations are set by the School and are announced on the School's website.
2. For those courses that have not been registered electronically, students are not able to receive free textbooks and participate in the exams.
3. The Secretariat of the Department sends to the students by e-mail the proof of registration and enrolment declarationfor the courses. These proofs are necessary elements in a possible relevant objection to the Department.
4. The number of courses that a student is entitled to register per semester is 2xN, where N is the total number of courses of the specific semester he is attending. According to the indicative curriculum, these correspond to about 60 ECTS. Of these courses, two (2) courses may be from a higher semesters, and in case these are elective courses it is recommended to be from the categories of the generic elective courses, free choise elective cources or from the Pedagogical and Teaching Adequacy Program.
5. Upon admission to the 8thsemester, students have the opportunity to register for elective courses of the 7thsemester to be admitted to the June exams, provided they meet the following conditions cumulatively: a) they had declared them when they were studying in the 7thsemester, b)they have attended them, and c) they meet all possible special requirements of the course.
6. Students who have completed the minimum period of study (**"senior" students**) are not subject to a course registration restriction. Registration for a course in a semester in which it is not taught presupposes that the course has previously been registered in the semester in which it is taught normally, and that this course continues to exist in the Curriculum. The exam period of June also includes the elective courses of the winter semester.
7. In addition to the required elective courses to obtain a degree, students can register and be examined in two additional elective courses to improve the degree by replacing elective courses for which a grade has already been registered. Additional courses are not counted for the calculation of the degree, but are listed in the transcriptof grades along with the corresponding ECTS credits. The replacement of courses registered under the Erasmus program requires the approval of the Student Affairs Committee, to which the student submits a relevant application. A free choice offered by other Departments cannot be included in the enrolment declaration, if an Erasmus course has already been recognized as a free choice.
8. From academic year 2012-2013[3]onwards, students who are admitted from other Schools are given the opportunity to apply for recognition of courses that have been taught and have been successfully examined in their School of origin. The recognition of the courses required a decision of the Assembly after a recommendation of the Student Affairs Committee and the students are exempted from the examination of the respective courses of the UP of the School and can be placed in a different semester from the one of their registration.

Article 5. Unregistration or Suspension of Studies

1. A student may be unregistred upon request or as dictated by the rules of the Institution and applicable law.
2. In case of any serious misconduct or violation of academic ethics by a student, the Assembly reaches a decision, which can refer the matter to the Senate of the University, even with the recommendation of unregistration.
3. Students can, upon application to the Secretariat of the School,suspend their studies[4]. The Internal Regulations of the University determine the procedure for determining the suspension of studies, the supporting documents that

[3]Law 4115/2013, Article 35
[4]Law 4009/2011, Article 33, par. 4 and Law 80, par. 9, sec. d.

accompany the application and the maximum allowable period of suspension, as well as the possibility of exceptionally exceeding this period. Student status is temporarily suspended for the period of interruption of study, unless the interruption is proven to be due to health reasons or force majeure.

4. The suspension of studies can not last for less than one year, due to objective impossibility of implementing the Curriculum.
5. When the suspension period is over, the student is re-enrolled in the semester in which the decision of suspension was approved.

Article 6. Framework of studies

1. The start and end dates of the courses of each semester are defined by the academic calendar of the University. The teaching schedule for the winter semester is announced in early September and for the spring semester in early January.
2. The number of weekly teaching hours of each course, as mentioned in the Program of Studies, reflects the total duration of students' work in a classroom for this course (lectures, tutorials, exercises, repetitions, etc.). Instructors are required to adhere to teaching hours without omitting or exceeding the number of hours per week, except in cases of necessary rescheduling of class hours due to unforeseen loss of teaching hours.
3. Attending theoretical courses is optional. Attendance at laboratory courses is mandatory.
4. The timetable is compiled in such a way as to ensure, as far as possible, a similar schedule for all classes of the same course, as well as the continuation of attendance without large gaps between lectures, at least for compulsory courses.
5. At the beginning of each academic year, a welcoming event is organized for newly arrived freshmen, which presents basic information about the structure and operation of the School, the structure of the UP, the evaluation of courses and teachers, the electronic services provided to students, and for various other activities.
6. The School appoints a team of Study Advisors from faculty members who guide and support students in the UP. The names of the consultants are posted on the website of the Department (http://www.physics.auth.gr/studies_advisors). At the beginning of each academic year, new students are assigned to one of the study advisors.
7. The framework for the elaboration of a Thesis is as follows:
    1. The members of the Teaching Staff (Professors, Lecturers) announce at the beginning of each semester the general title or the research area of the Thesis which they intend to supervise and invite the students to express interest. The instructors inform the Director of the Department about the dissertations they have assigned.
    2. Supervisors assign Thesis projects to studentsafter selection -when there is more than one application per assignment- and specify the title of the Thesis. The selection criteria are determined by the supervisor, and include the relevant courses that the candidates have been taught as well as their performance in them, but also the evaluation by the supervisor during an interview.
    3. The Thesis can also be co-supervisedby a faculty member of the same or another School of AUTh or by an EDIP member of the School holding a doctorate. In this case the co-supervisor is included asa member of the examination committee.
    4. The Thesis can be prepared in collaboration by two students, with the same topic, but with separate subjects, and the same supervisor. The public presentation is done jointly and the examination committee evaluates them separately.
    5. At the end of the preparation of the Thesis the student delivers the text of the Thesis to the supervisor. The Thesis is presented publicly to a three-member examination committee, consisting of the supervisor and two instructors (faculty members or EDIP), or in case of co-supervision by the supervisors and an additional faculty member of the School.The presentation of Theses takes place during the examination periods and in addition within fifteen days before the beginning and after the end of the examination periods.
    6. After the completion of the presentation the student submits to the Library of the School the text of the work in digital form as well as a separate summary in Greek and English. In case of elaboration of a Thesis in collaboration between two students, the above procedure is followed separately for each student.
    7. The Thesis can also be written in English. In this case, an extensive summary in Greek is included before the English text.

8. The following documents are submitted to the Secretariat: 1) the grade, 2) the certificate of public presentation and 3) the certificate of submission of the Thesis received by the student from the library of the School.
9. The supervision of the elaboration of the Thesis by the instructprs is equivalent to two (2) hours of weekly teaching. In no case, however, does this replace the obligation of the members of the Teaching Staff to offer teaching work by undertaking the independent teaching of courses of the UP.
10. Detailed instructions for writing a Thesis are presented on the website of the School.

8. The framework of the Internship course is as follows
    1. Through the Internship, the students of the School practice under conditions of real and paid work, in private and public institutions with subjects related to Physics.
    2. It is a General Elective course and it is available to students studying from the 7th to the 12th semester.
    3. It is prepared in the following two-month periods: November - December during the winter semester, and February - March, April - May during the spring semester.
    4. Internship is assigned to students who have already accumulated more than 80 ECTS credits.
    5. For the selection of students, the following are taken into account and co-examined: The average grade of the courses in which the student has been successfully examined, the number of ECTS he/she has obtained, the average grade in related courses, and the percentage of related courses completed successfully in all the relevant courses he/she was enrolled.
    6. Detailed information regarding the Internship and the relevant regulations are presented on the website: http://praktiki.physics.auth.gr/.
9. The European mobility program Erasmus gives the opportunity to the students of the School to complete part of their studies (lasting up to one year) at a University of another European or associated country. In this context:
    1. Each student is responsible for the arrangements concerning the host university. The staff of the Department of Educational Programs provides all the necessary information and supports the students both during the application process and in their contacts with the host Institution.
    2. Each year and before the application deadline for the Erasmus program, the School of Physicsorganizes information events for interested students. All information regarding the outgoing students of the School of Physics and the conditions of their participation in the program, are posted on the website of the Department: http://www.physics.auth.gr/erasmus.
    3. The selection of students who will participate in the Erasmus program is done according to the general rules and algorithm described on the website of the Erasmus-AUTh office (https://eurep.auth.gr/el/students/studies) and are valid for all departments of AUTh.
10. The School of Physics accepts students from other domestic H.E.I.s or corresponding foreign institutions in the framework of educational or research cooperation programs and registers them as guest students.
    1. The guest students have the same rights and obligations that the students of the Department have for as long as their study in the Department lasts, according to the approved cooperation program.
    2. The hosted students do not have the right to permanently enroll or obtain a degree at the host H.E.I., unless the cooperation program, in the context of which they move, provides for the possibility of granting a common degree by the collaborating H.E.I.s.

Article 7. Assignments and Teaching of Theoretical Courses

1. The courses of UP are assigned to the Departments of the School depending on the relevance of their area of expertise. The Department has the responsibility for the organization of the material, for the teaching and for the examination of the courses assigned to it. Courses in the general scientific field may be the responsibility of the School.
2. Compulsory courses(theoretical and laboratory) in the UP have priority in teaching assignments. Once the teaching needs are met for these courses, then teaching work is assigned for the elective courses of the UP.

3. The Departments recommend to the Assembly the teaching assignmentsfor their courses to members of the teaching staff that belongs to them, or to teaching staff of other Departments or other Schools of the Aristotle University of Thessaloniki. The assignments are made during the period May - June and relate to the next academic year.
4. The final decision and responsibility for the assignment of UP courses to instructors is taken by the Assembly in June. Amendments to the assignments may be made during the academic year, if there are special reasons and only by decision of the Assembly.
5. For courses assigned to more than one instructor (regardless of the number of classes) a "Course Committee" is appointed comprising all the instructors of the course and with a coordinator appointed by the Assembly upon the recommendation of the Department.
6. The course coordinator ensures the orderly cooperation of the instructors so that the same material is covered in all classes and at the same pace throughout the semester. In case of problems in the cooperation ofinstructors, the CC should be informed, which submits a proposal to the Assembly.
7. The CC may propose to the Assembly the replacement of an instructor on the basis of a substantiated proposal.
8. One teaching hour corresponds to a period of 45 minutes and can not be shared with more than one instructor. A theoretical course may not be taught for more than three consecutive hours of instruction.
9. If for any reason the number of teaching weeks held in a course is less than 13, the course is considered not to have been taught and is not examined, any examination is invalid and the grade is not calculated for the award of the degree.
10. Once a semester, there is the possibility of interrupting the courses during the Assembly of the student association, after a relevant decision of the Chair. The Students' Association informs in writing the Chair or the Secretariat of the School at least two days in advance of the decision of the Association to hold the Assembly. The Secretariat then informs the instructors about the duration of the break, as well as about the time and place of the Assembly.
11. Course deliveries that do not take place due to the Assembly or events of the students and up to 2 days per semester are replaced in days and hours determined in consultation of the instructor with the students. For loss of more teaching hours per semester the issue is examined by the Assembly.
12. Instructors must arrange for the rescheduling of teaching hours that did not take place due to the instructors themselves.
13. In case for reasons of force majeure (eg illness) an instructor is scheduled to be absent for more than one week, the relevant Department must appoint a substitute. Instructors must plan their extracurricular activities so that they are not absent during the teaching hours of the courses assigned to them. Arbitrary substitution of an instructor is not allowed without informing the Director of the Department and the substitution is done only by a member of the Teaching Staff of the Department.

Article 8. Organization of Examinations in Theoretical Courses

1. There are three examination periods:
    1. January, for the winter semester courses.
    2. June, for the courses of the spring semester and
    3. September (repetitive), for the courses of both semesters.
2. The duration of each examination period shall be a maximum of three weeks, except for September for which it is four weeks.
3. "Senior" student examinations or other special cases as well as the thesis presentations can be held one week before or after the regular examination period.
4. The schedule of the January and June examination periods shall be announced at the beginning of the respective semester at the latest. If, for any reason, it is decided to extend the teaching of the semester, the examination program is shifted in parallel. The September schedule is announced in June at the latest.
5. The January and June exams are conducted exclusively for the courses taught in the respective semesters. Students are entitled to be examined only in the courses included in the course enrolment statement they have submitted at the beginning of the semester. During the September exam period, students are entitled to be examined in the courses of both semesters and only in those that have been registered during the current academic year.
6. In each examination period the "senior" students can be examined in all the compulsory courses.

7. Special care is taken for the oral examination of students with dyslexia, disabilities, or other health problems that do not allow them to be examined with the standard examination system, provided that these are proven by public documents. In particular, the case of dyslexia must be proven before the student is admitted to the Department.
8. The exam material of each course corresponds to the teaching of 13 weeks and is announced by the instructor at the beginning of the course.
9. For courses with more than one class, the material, the questions, and the procedure of the examinations are determined by the Course Committee. The subject matter and questions are common to all examinees in this course. With the exception of laboratory courses, the written examinations take place on the same day and time for all classes.
10. The written examination of each course, when it is the only way of evaluating the students for the course, can not last less than two hours. In no case may the examination (written, laboratory, or oral) exceed three hours.
11. The Department that is responsible for the course determines the necessary number of supervisors for the smooth and uninterrupted conduct of the examinations. Supervisors can be faculty members, EDIP, ETEP and postdoctoral fellows. PhD candidates and postgraduate students can contribute to the supervision if a faculty member, EDIP or ETEP is present.

Article 9. Examination Procedure – Student Obligations

1. Only students who have enrolled for the course have the right to participate in the course examination.
2. The instructors may issue, a certificate of student participation in the course examination upon request. It is granted after checking that the student has the right to participate in the examination and is validated by the Secretariat of the Department.
3. The examined students are prohibited from attempting to copy the answers or any other way of falsifying the result of the examination process as well as to introduce books, aids, notes or use electronic means of communication in the examination rooms.
4. The examinees must respect the examination procedure and comply with the instructions of the invigilators. Otherwise, the invigilator informs the instructor who can make recommendations, change the seat of the student or even expel the student.
5. In case of copying during written examinations, the decision of the Senate of AUTh is applied. (Ref. No. A. 11508 / 14.6.1989), which provides for a penalty of exclusion from the examination of all courses of the next examination period.
6. invigilators must check the official student identity of all the examined students, verify the indication of the name and the special registration number of the student on the exam papers, sign each paper, constantly monitor the entrances and exits of the classroom, especially at the end of the examination and deliver timely the papers, and to ensure that no one leaves the examination room before the expiration of 30 minutes from the distribution of the contentof the examination.
7. After collecting the papers, the invigilators count the papers they have received and one of them declares to the instructor the number of papers that have been received. The papers are then delivered to the instructor, who counts them and certifies with his/her signature in the presence of the invigilator the number of papers he/she has received.

Article 10. Course Score

1. The score scale consists of integers from zero (0) to ten (10). The minimum transferable grade is set at five (5).
2. The mode of assessment of students in the courses is determined exclusively by the instructor (or the course committee) who can organize at his/her discretion written or oral exams, or to include the evaluation of essays, homeworks or laboratory exercises.
3. For each course, the same examination policy is followed for all students. In special cases, teachers may call a student for further explanations.

4. In case of disagreement between the co-instructors of a course in matters of grading, the moderator of the course informs the EPS or which attempts to bring the instructors to an agreement or suggests the settlement of the problem by the Assembly.
5. During the grading, the instructor is prohibited to take into account any request of the student to reject the score of the examination, in case he/she does not achieve the desired score for him/her. Also, the instructor is prohibited to transfer the score of the course to the next examination period.
6. If a student fails more than three times in a course may request to the Dean to assign a a three-member committee of instructors of the Department or the School, who have the same or related subject and are appointed by the Dean, to re-examin his/her paper. The instructorss of the course are excluded from the committee. In case of failure, the student continues or not to continue his studies in accordance with the terms and conditions set out in the Internal Regulations of the Aristotle University of Thessaloniki, which determines the maximum number of repetitions of the examination in a course.
7. The scoring statements for each course are posted on the bulletin boards of the Department or the Laboratory. Only the special registration number is displayed in the statements and not the names of the students. Instructors can also announce their grades through the e-learning platform.
8. The scores of the courses are submitted exclusively through the system of the Electronic Secretariat as soon as possible and definitely not later than 10 days after the end of the examination period. After this period the scores will not be received by the Secretariat. Exceptional cases of inability to submit a score in time (e.g. illness of the instructo) are examined by the Assembly, or after authorization by the Chairman, no later than one week after the end of the examination period.
9. Exceptionally and due to the specificity of the course, the scores of the Diploma Thesis can be submitted up to two weeks after the end of the examination period.
10. Change of scores registered in the Secretariat is allowed only after application and written justification of the instructor and approval by the Assembly.
11. The student has the right to be informed by the instructor about the way of grading, regardless of the type of examination, at a specific day and time set by the instructor. Objections by students are not accepted after one week from the day of the announcement of the grade or the registration of the grade in the electronic system of the Secretariat.
12. In case of failure in a course (compulsory or elective), the student is obliged to repeat it, and, therefore, to be examined according to the new conditions if there is any change (e.g. in the content of the course).

Article 11. Organization of Laboratory Courses

1. Laboratory courses are governed by the provisions of current legislation and consequently by the articles of this regulation that refer to the compulsory courses.
2. The assignment of the course to instructors is recommended by the Department, which is offering the course, to the Assembly, as it also applies to the theoretical courses (Article 7). In case that the course if offered directed by the School, the recommendation of isntructors is made by the Coordinator of the Laboratory.
3. Due to their special operating conditions, each of the laboratory courses has a special regulation for specialized subjects that are not mentioned in this general regulation. In any case, the special regulations are in accordance with the general instructions or directions of this general regulation and are approved by the Assembly upon the recommendation of the Committee of Laboratories.
4. Students must attend the laboratory and related theoretical courses in the chronological order specified in the curriculum. Prerequisite courses are required by the laboratories as follows:
    a. The Laboratory of Applied Informatics is a prerequisite for all laboratory courses of the Department
    b. The General Laboratory is a prerequisite for all subsequent laboratory courses of the Department
    c. The Electrical Circuits laboratory is a prerequisite of the Laboratory of Electronics

Article 12. Enrollement in the Laboratories and Conditions for Successful Completion

1. In addition to the enrollement to the laboratory course in the secretary of the department, students must register in each laboratory in order to attend it. Registrations are made at the beginning of each semester according to the announcements of the Coordinators of the laboratories. Enrollment priority may be given to students who meet specific requirements according to the lab regulations.
2. The instructors of the laboratory courses are available to the students during each semester on predetermined days and hours for topics related to the respective laboratory course. The students address the instructor of the individual laboratory section that they are attending.
3. In each laboratory section, students are divided into two-member groups to conduct the exercises. The members of each group perform the experimental work together and present the written results individually, according to the instructions of each laboratory.
4. The laboratory exercises include the following stages, which are carried out according to the individual regulations of the laboratories: Preparation of the students in the theoretical part of the exercises. Experimental work. Written report. Examination of students in the theoretical and / or experimental part of the exercises.
5. The final score in each laboratory course results as a combination of the evaluation of the students' performance in each of the above stages.
6. All laboratory exercises are mandatory. Only one (1) or two (2) fully justified absences (for courses with less or more than six (6) laboratory exercises respectively) can be reassigned to another date during the semester and after consultation with the instructors.
7. Students are given the opportunity to arrange in time any issues regarding the conduct and completion of laboratory exercises during the current semester. If the outstanding issues are not settled, the students are obliged to repeat the laboratory course.

Article 13. Textbooks and Teaching Notes

1. The textbooks for each course are proposed by the instructor or the members of the course committee and are approved by the Assembly of the Department that is offering the course and then by the Assembly.
2. Students choose through the website Evdoxos (http://www.eudoxus.gr) of the Ministry of Education the textbook they wish to obtain for each course. The supply of books is done from the distribution points, as determined by the respective publishing house after notification to the relevant list of beneficiaries after the end of the course enrollemnt and textbook selection statement.
3. Presidential Decree 226 of the Ministry. Education (Government Gazette 256 / A / 20.11.2007) among other things stipulates that "students of Universities are entitled to free supply and selection of a number of textbooks equal to the total number of compulsory and elective courses required to obtain the degree. If students choose more elective courses than are required to obtain the degree, the right to free supply and selection of textbooks does not extend to the additional courses chosen by the student, even if they are counted for the degree ».
4. Free textbooks and textbooks are eligible for all students, including those from qualifying exams or transfers.
5. According to the provisions of P.D. 226 (256 / A / 20.11.2007) and of Φ.12 / 32655 / Β3 / 13.3.2008 circular of the Ministr of. Education:
    a. *Students have the right to state the textbook of their choice for each compulsory or elective course of the study program, at the beginning of the semester in which the respective course is taught.*
    b. *They are entitled to choose from the list of proposed* ***books one (1) book for each compulsory and selected course.***
    c. *They are entitled to a free supply of a number of textbooks equal to the total number of compulsory and elective courses required to obtain the degree.*

d. Even in case of failure of a student or change of the proposed books for a specific course, he/she can not receive a second book for the same course again.

e. Selection of a second book for the same course which is declared is not allowed even if they have not covered the number of books they are entitled to, or even if a new book is proposed by the teacher.

6. Instructors can provide additional teaching material, in addition to the textbook, in electronic form and through the "e-learning" system or the course website. The School is not obliged to distribute the printed additional teaching material.
7. Instructors or any member of the School are not allowed to provide educational material and receive any compensation for it.
8. In cases when the additional teaching material is evaluated by the Department of the respective course or the EPS that it does not sufficiently meet the desired quality and scientific documentation, the instructor is obliged to withdraw it.

Article 14. Special Cases and Special Programs

1. Students who are proven to work at least 20 hours per week may apply to enroll as part-time students; their application os approved by the Dean of the Faculty.
2. Part-time students follow the "Part-time Study Program" which sets the minimum study limit for obtaining a degree. The Internal Regulations of the Aristotle University of Thessaloniki define the more specific conditions and the procedures for the application of the previous paragraph, as well as the more specific conditions and the procedures for facilitating the study of students with disabilities.
3. The part-time status may not be changed to a full-time status during the same academic year, even if the the studentrequests so, due to practical impossibility of implementing the special part-time study program.
4. Students who are admitted after qualifying exams can enroll in a more senior semester, after they applyso and after evaluation and approval by the School.
5. In parallel with the Curriculum, the School provides the Pedagogical and Teaching Adequacy Program (https://www.physics.auth.gr/ppde) which is optional. This programcertifies that graduates who intend to pursue professional education have satisfactory teaching and pedagogical competence, in accordance with current legislation. The certificate of Pedagogical and Didactic Adequacy is issued after the student completes the PPS of the School of Physics.
6. Students of previous study programs can fulfill the conditions for obtaining a degree based on the Inclusive Study Program defined by the Department when they cannot, for objective reasons, support older study programs. Students who are not covered by the Admission Program are enrolled in the current Curriculum, with the right to apply for course recognition which is examined by the Student Affairs Committee.
7. The Department provides a Certificate of Computer Adequacy to its graduates if they have successfully attended and been examined in a series of courses which are defined by a decision of the Assembly or the Board and are posted on the School's website. These courses are: Laboratory of Applied Informatics, General Laboratory, Optics Laboratory, Materials Structure Laboratory, Nuclear Physics Laboratory, and Computer Programming and Computational Physics. The certificate is not provided before the completion of the studies.

Article 15. Educational Staff

1. The teaching staff of the Schools consists of Professors, Lecturers (Members of Faculty) and members of the Laboratory Teaching Staff (EDIP).
2. The work of the Professors and Lecturers includes teaching and research, the supervision of Dissertations, Postgraduate Theses and Doctoral dissertations, and their participation both in the collective bodies and in various committees of the School.

3. The work of EDIP members includes auxiliary or/and independent teaching work, co-supervision of dissertations (if they hold a doctoral degree), participation in committees of the School and representative participation in the collective bodies of the Department. The minimum teaching hours of EDIP members are determined by the current legislation.
4. The minimum weekly teaching time limit for faculty members, as defined by applicable law, may not be limited to postgraduate programs.
5. All members of the teaching staff of the School (Faculty, EDIP and SPD) are required to have afternoon hours, if this is necessary for the operation of educational procedures (such as, for example, laboratory courses).
6. The School is obliged to assign to its members the minimum number of teaching hours defined by the respective law or the regulation of the Institution. Priority is given to faculty members who must provide independent teaching work.
7. The faculty members or EDIP can provide teaching work in other Schools of the Institution after the approval of the Assembly and if the teaching needs of the Physics department are met first.
8. The instructors of the Department are obliged to take into account the results of the evaluations of didactic ability and courses carried out by the students for the improvement of the teaching, in accordance with the instructions of MODIP and the decisions of the Senate of AUTh.
9. In cases of short or medium duration leave (participation in conferences, short educational visits, personal, etc.), the faculty member appointed as a replacement is informed by the Secretariat and assumes all relevant obligations (courses, tutorials, workshops, exams, overview, test results, etc.) for the corresponding period.
10. All instructors set student visiting hours (at least two hours per week on different days) which are announced on the website of the School and the instructor's website.

Article 16. Courses (Deliveries - Exams)

1. The lessons of the winter semester start on the 2nd half of September and last for 13 weeks. The syllabus is announced in early September.
2. The courses of the spring semester start after the end of the exams of the winter semester and also last 13 weeks. The syllabus is announced in January.
3. In all courses there is an upper limit (and for elective courses a lower limit as well) for the number of students who can attend them while creating new sections for the compulsory courses when possible. These limits are set by the School Assembly following a recommendation by the curriculum committee, which has previously reached an agreement with the instructors.
4. Course Deliveries can becanceled twice per semester due to Student activities (e.g. Assembly of student events); these deliveries must be rescheduled. For this purpose, the student association or the student board of the year: a) Informs in writing at least two days in advance the Chairman or the Secretary of the Department, who then informs the instructors about the time and place of the student assembly, and b) Collaborates with the respective instructors, in order to find time and room for replacement.
5. If the above procedure is not followed, the isntructor is obliged to notify in writing the Secretary of the School and the teaching is considered as not done.
6. If a lesson is not delivered because of the instructor, he/she must arrange for its replacement.
7. In cases of *force majeure* (e.g. illness) that an instructorwould be absent for more than a week, the corresponding Department must appoint a replacement instructor. Instructors must plan their extracurricular activities so that they are not absent during the teaching period. Arbitrary replacement of aninstructor is not allowed without informing the Chairma and the replacement is done only by a member of the Teaching Staff.
8. The examination periods are three:
   a. *January, for the winter semester courses.*
   b. *June, for the courses of the spring semester and*
   c. *September (repetitive), for the courses of the two semesters.*

   The duration of each examination period is three weeks maximum.
9. The exam schedule for each semester is announced at the beginning of the semester. If, for any reason, it is decided to extend the teaching of the semester, the exam period is transferred accordingly. The schedule for the September period is announced in June.

10. Each student must register, attend and be examined, in each semester, in the elective courses, which are selected from the list of courses announced by the School of Physics at the beginning of the academic year. Throughout his/her studies, the student can choose a course of interest from any other Schoolof AUTh, after his/her application to the Secretariat and approval by the Student Affairs Committee.
11. The applications for the elective courses of the winter and spring semesters are done at the beginning of the semester.
12. No student has the right to attend the examination of an elective course which he / she has not previously enrolled in electronically, and it is taken for granted that in the Laboratory courses the student can not practice either. Course statements are valid for each semester and consequently for a single - academic year.
13. Regarding the Thesis:
    - The members of the Teaching Staff (Professors, Lecturers) submit at the beginning of each semester the general title or the research area in which the dissertation of each student will be relevant, the exact title of the thesis is specified afterwards,
    - Supervisors select the student, if there is more than one application.
    - The Director of the respective Department, the supervising professor and the student must fill in the "Thesis Statement" that exists in the Secretariats of the Departments.
    - The public presentation of the dissertation is made with three-member examination committee being present.
    - Students during the presentation are required to submit the written paper, which will include a summary in English or another foreign language. In case of a cooperative work, each student submits a separate paper. The student delivers a CD to the School's library with the dissertation together with the "Thesis Delivery Document" and receives a certificate of delivery of the dissertation.
    - The Secretary submits: 1) the grade, 2) the certificate of public presentation, 3) the document "Declaration of dissertation", 4) the certificate of submission of the dissertation received by the student from the library of the Department, and 5) the brief summary of the work in Greek and English (or other foreign language)
14. The course material corresponds to the teaching of 13 weeks and is announced by the instructor at the beginning of the course. In case of division of the audience into sections, it is determined by the course committee.
15. In case of division of the audience into sections , the topics and the way of examinations are determined by the course committee. The topics should be common to all examinees in a particular course.
16. In case of copying during written examinations, the decision of the Senate of AUTh is applied. (reference number A. 11508 / 14.6.1989), which provides for a penalty of exclusion from all courses of the next examination period.
17. The score of the courses (including the dissertation) must be submitted to the Secretariat as soon as possible and definitely not later than ten days after the end of the examination period. After this period the scores will not be received by the Secretariat. Exceptional cases (eg illness) will be examined by the Board. (Meeting 2760 / 25-2-2004, at the latest one week after the end of the examination period).
18. Exceptionally, due to the specificity of the course, the grade of the dissertation may be submitted up to two (2) weeks after the end of the examination period, accompanied by a written confirmation of the supervisor that the thesis was defended in public.
19. The student has the right to be informed by the instructor about the way of grading, regardless of the type of examination. The instructor can set a specific day and time at which he will make the briefing.
20. Change of a registered score is allowed only by decision of the Board, after registration justification of the instructor which is accompanied by the re-graded paper.
21. In case of failure in a course (compulsory or elective), the student is obliged to repeat it, and therefore to be examined according to the new conditions if there is any change (e.g. in the material).

7. The School of Physics

7.1. Structuring and Administrative Organisation

The Assembly (A) of the School of Physics is the highest governing body of the School, chaired by the Head or the Deputy Head of the School. It is comprised of the Department Directors, thirty (30) Faculty members (Professors, Lecturers) elected proportionally from the Departments by level of academic position, and one representative from each serctor of technical staff, teaching fellows and academic community members, namely (a) undergraduate students, (b) post-graduate students, (c) members of the Special Technical and Laboratory Staff (ETEP), and (d) members of the Special Scientific Teaching Staff (EDIP).

Head
Dimitrios Melas, Professor
melas@auth.gr 2310998124

Deputy Head
Alexandra Ioannidou, Associate Professor
anta@physics.auth.gr 2310998599

DEPARTMENTS

Astrophysics, Astronomy and Mechanics (AAM)
Director: Nikolaos Stergioulas, Professor
niksterg@astro.auth.gr 2310998233

Nuclear Physics & Particle Physics (NPh&PPh)
Director: KonstantinosKordas, Associateprofessor
Kostas.kordas@cern.ch 2310994121

Solid State Physics (SSPh)
Director: Thomas Kehagias, Professor
kehagias@auth.gr 2310998023

Electronics and Computers (E&C)
Director: SpyridonNokolaidis, Professor
snikolaid@physics.auth.gr 2310998078

Applications of Physics and Environmental Physics (AP&EP)
Director: Panagiotis Patsalas, Professor
ppats@physics.auth.gr 2310998298

7.2. The Departments - Staff & Activities

EmeritusProfessors of the School of Physics

Argyrakis Panagiotis
Varvoglis Charalambos
Ves Sotirios
Gounaris Georgios
Dimitriadis Charalambos
Karakostas Theodoros
Karympakas Konstantinos
Manolikas Konstantinos
Masen Stylianos
Bozis Georgios
Paraskeuopoulos Konstantinos
Persidis Sotirios
Polychroniadis Eystathios
Sachalos Ioannis
Seiradakis Ioannis Hugh
Stergioudis Georgios
Stoimenos Ioannis
Haralambous Stefanos

SummaryofstaffdistributionperDepartment

The following is a brief reference to the personell in each sector. The officialAreas of Expertiseare also listed, following the decision of the Board of Department Directors (Session No. 12/21-2-1986), published in the Greek Official Journal No 185/6-4-87 sect. B, as well as the locations (areas) in which each sector is housed.

Professors & Lec-turers	Departm ent AAM	Department NPh&PPh	Departm entSSPh	Departm entE&C	Department AP&EP	Total
Professors	4	8	12	3	10	**37**
Associate Professors	3	5	6	0	3	**17**
Assistant Professors	1	0	6	2	2	**11**
Lecturers	0	0	1	0	0	**1**
Total	**8**	**13**	**25**	**5**	**15**	**66**

Other staff (Scientific and Technical)	Depart ment AAM	DepartmentNPh&PPh	Depart mentSSPh	Depart mentE&C	DepartmentAP&EP	Departa-mental Staff	Total
EDIP	2	2	8	2	5	1	20
ETEP	0	0	3	0	2	1	6
Total	**2**	**2**	**11**	**2**	**7**	**2**	**26**

A. Departmentof Astrophysics, Astronomy and Mechanics (AAM)

Professors	Plionis Manolis Stergioulas Nikolaos Tsagas Christos Vougiatzis Georgios	**Assist. Professors**	Pappas Georgios
Associate Professors	Meletlidou Efthymia Papadopoulos Padelis Tsiganis Kleomenis	**EDIP**	Oikonomou Vasilis Zervaki Foteini

AREAS OF EXPERTISE

a) Dynamics
b) Continuum mechanics
c) Observational astronomy
d) Astrophysics
e) Theory of Relativity
f) Mathematics for physicists (mathematical methods of physics, differential equations and numerical analysis)
g) History and philosophy of physics

LOCATION

The members of Astrophysics, Astronomy and Engineering Department are housed in the Observatorybuilding (Astronomy Laboratory) and in the building of the Faculty of Sciences, 4th floor (Study of Mechanics)

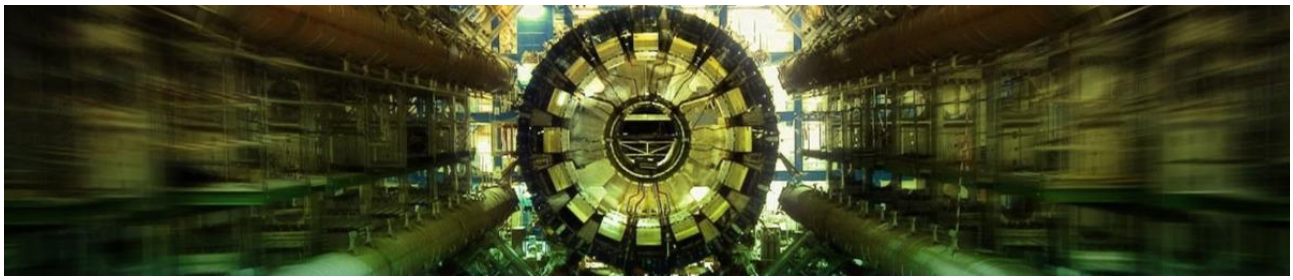
DEPARTMENT INFORMATION

Director : StergioulasNikolaos

COMMUNICATION

Tel : (+30) 231 0 99-8963
e-mail : niksterg@astro.auth.gr
URL : http://www.astro.auth.gr/

B. Departmentof Nuclear Physics & Particle Physics (NPh&PPh)



Professors	Eleftheriadis Christos	**Assist. Professor**	
	Kitis Georgios		
	Lalazisis Georgios		
	Liolios Anastasios		
	Petkou Anastasios	**EDIP**	Kosmidis Kosmas
	Sampsonidis Dimitrios		Topaloglou Chrysanthi
	Savvidis Ilias		
	Tzamarias Spyridon		
Associate	Gaitanos Theodoros		
Professors	Ioannidou Alexandra		
	Kordas Konstantinos		
	Moustakidis Charalampos		
	Stoulos Stylianos		
	Eleftheriadis Christos		

AREAS OF EXPERTISE

a) Physics of Radiation and Isotopes
b) Nuclear Reactions with Trace Detectors
c) Positron Physics
d) Thermoluminescence and Docimetry
e) Experimental Physics of Elementary Particles
f) Astroparticle Physics
g) Theoretical Physics of Elementary Particles
h) Theoretical physics of low and intermediate energy
i) Mathematical physics
j) Theoretical physics in medicine

LOCATION

The Laboratory of Atomic and Nuclear Physics is located on the 1st floor (east) and in the basement (west) of the Faculty of Sciencesbuilding. The Theoretical Physics Study is located on the 4th floor.

DEPARTMENT INFORMATION

Director : KordasKonstantinos

COMMUNICATION

Tel : (+30) 231 0 99-8175
e-mail : Kostas.kordas@cern.ch
URL : https://www.physics.auth.gr/sections/2

C. Departmentof Solid State Physics (SSPh)

Professors	Angelakeris Mavroeidis	**Assist. Professors**	Doni-Karanikola Efthymia
	Chrissafis Konstantinos		Gioti Maria
	Dimitrakopulos George		Laskarakis Argiris
	Fragkis Nikolaos		Molohidis Anastasios
	Hatzikraniotis Euripides		Samaras Ioannis
	Kehagias Thomas		Vyrsokinos Konstantinos
	Komninou Philomela		
	Logothetidis Stergios	**Lecturers**	Vigka Eleni
	Paloura Eleni		
	Papagelis Konstantinos	**EDIP**	Andreadou Ariadne
	Pavlidou Eleni		Chastas Nikos
	Polatoglou Chariton		Gravalidis Christoforos
			Kassavetis Spyros
			Mantzari Alkioni
			Metaxa Chrysoula
Associate	Arvanitidis Ioannis		Tsiaoussis Ioannis
Professors	Katsikini Maria		Zorba Triantafillia
	Kioseoglou Joseph		
	Lioutas Christos	**ETEP**	Galariniotis Georgios
	Tassis Dimitrios		Kioutsouk – Kyriakopoulos Vassilios
	Vouroutzis Nikolaos		Pantousi Kyranna

AREAS OF EXPERTISE

a) Optics, optical properties of solids, solid spectroscopy
b) Electronic properties of semiconductors and semiconductor devices
c) Electronic microscopy and structural properties of solids
d) Theoretical solid state physics
e) Didactics of physics

LOCATION

The offices of the Department staff are housed in the basement (east), ground floor (east) and second floor (east), as well as in the Glass Building (GB). Teaching laboratories are located in the basement (east and center), while the research laboratories are located in the basement (east and center) and on the ground floor (east and center) of the Faculty of Sciencesbuilding.

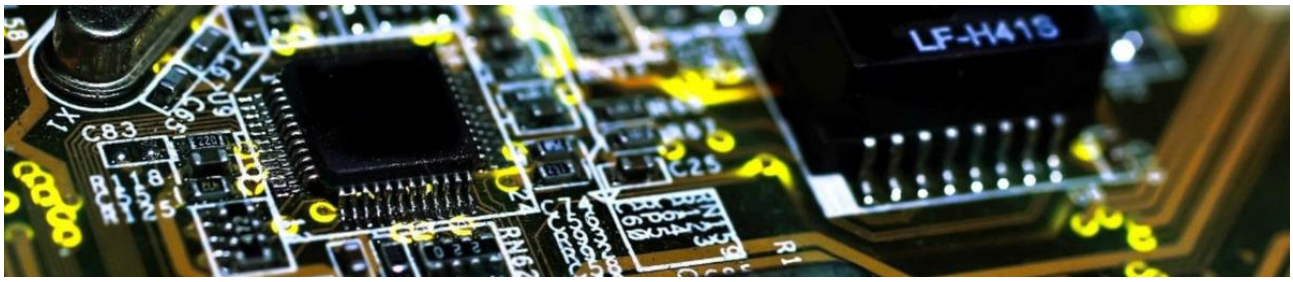
DEPARTMENT INFORMATION

Director : Kehagias Thomas

COMMUNICATION

Tel : (+30) 231 0 99-8172
e-mail : kehagias@auth.gr
URL : http://ssph.physics.auth.gr/

D. Departmentof Electronics and Computers (E&C)



Professors	Laopoulos Theodoros Nikolaidis Spyridon Siskos Stylianos	**EDIP**	Nikolaidis Emmanouil Pappas Ilias
Assistant Professors	Noulis Thomas Siozios Konstantinos		

AREAS OF EXPERTISE

a) General Electronics
b) Microelectronics
c) Communication Systems
d) Automated Control Systems
e) Computer Architecture - Digital Systems
f) Software systems, computer programming
g) Computer Science Theory
h) Applied Informatics

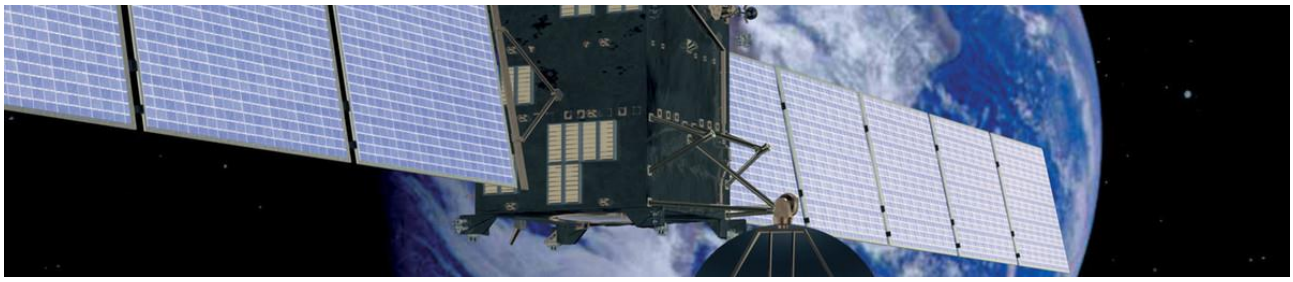
LOCATION

The Department is housed in three areas on the 1st floor of the Faculty of Sciences building (east and center)

DEPARTMENT INFORMATION
Director : NikolaidisSpyridon

COMMUNICATION
Tel : (+30) 231 0 99-8078
e-mail : snikolaid@physics.auth.gr
URL : http://electronics.physics.auth.gr/

E. Departmentof Applications of Physics and Environmental Physics (AP&EP)



Professors	Bais Alkiviadis	**Assist. Professors**	MeletiCharikleia
	Balis Dimitrios		SarafidisCharalampos
	Efthymiadis Konstantinos		
	Kalogirou Orestis	**EDIP**	BabasDimitrios
	Melas Dimitrios		Garane Katerina
	Patsalas Panagiotis		KaifasTheodoros
	Samaras Theodoros		Kyritsi Konstantina
	Siakavara Aikaterini (Katherine		Mpaltzis Konstantinos
	Stouboulos Ioannis		
	Tourpali Kleareti	**ΕΤΕΠ**	Kopalidou Ourania
			Miaris George
Associate Professors	Goudos Sotirios		
	Volos Christos		
	Vourlias George		

AREAS OF EXPERTISE

a) Electricity - magnetism - magnetic and electrical properties of matter
b) Electromagnetic waves propagation- antennae - microwaves
c) Acoustics and applications
d) Crystal Structure
e) Physics of crystals and structural defects
f) Development and technology of materials
g) Atmospheric physics
h) Environmental physics
i) Forms of energy and applied thermodynamics
j) Non-linear Electrical Circuits

LOCATION

The Department is housed in: 3rd Laboratory of Physics, 4th floor (west) and 1st floor (center), Laboratory of Applied Physics, 4th floor (east), Laboratory of Atmospheric Physics, 2nd floor (east) and floor (west).

DEPARTMENT INFORMATION
Director : PatsalasPanagiotis

COMMUNICATION
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e-mail : ppats@physics.auth.gr

7.3. MSc Master of Science Programs

The School of Physics operates seven (7) Master of Science Programs (MSc) and one (1) Interdisciplinary Master of Science Program (IMSP). The programs are the following:

MSc "Electronic Physics (Radioelectrology)"
Thematic Areas/Directions:

- **Electronics**
- **Telecommunications**

Director: ProfessorSp. Nikolaidis
Website: http://elecom.physics.auth.gr/?lang=en

MSc "Materials Physics and Technology"
Director: Professor E. Paloura
Website: http://pms.physics.auth.gr/materials/?lang=en

MSc "Environmental Physics"
Director: Professor D. Balis
Website: http://msc-env.physics.auth.gr/?lang=en

IMSP "NanosciencesandNanotechnologies"
The IMSP is organised by the Schools of Physics, Chemistry and Medicine in collaboration with the NCSR "Demokritos", CERTH, University of Patras, University of Ioannina, University of California, Berkeley and University of Oxford. The School of Physics is responsible for the operation and the administrative support of the IMSP.
Thematic Areas/Directions:

- **Thin Films & Organic Printed Electronics Technology**
- **Nanomechanics, Nanobiomaterials & Nanoparticles**
- **Nanomedicine – Nanobiotechnology – Bioelectronics**

Director: ProfessorS. Logothetidis
Website: https://www.physics.auth.gr/en/postgrads/4 , http://nn.physics.auth.gr

MSc "Computational Physics"
Director: Assoc. Professor Ch. Moustakidis
Website: http://pms.physics.auth.gr/comphys/?lang=en

MSc "Didactics in Physics and Educational Technology"
Director: Professor Ch. Polatoglou
Website: https://www.physics.auth.gr/en/postgrads/6

MSc "Subatomic Physics and Technological Applications"
Director: Assoc. ProfessorK. Kordas
Website: http://subatomic.physics.auth.gr/

Administration

The administration of the School of Physics is located on the 1st floor of the Faculty of Sciences Administration Building, next to the School of Biology Builiding. The building entrance is in the east side of the building.
The Head of the Adninistration Office is Mrs Vigli-Papadaki Lefkothea (Tel: +302310998120, e-mail: lvigli@physics.auth.gr).
Office hours for the undergraduate and postgraduate students: Monday – Friday, 10:30 - 12:00.
e-mail: info@physics.auth.gr, Tel: +302310998140, +302310-998150, Fax: +302310998122

Teaching Rooms

- RoomsΔ13, A11, A12, A13, A21, A22 andA31 intheFaculty of Sciences Building. (Δ = WestWing, A= East-Wing, indices 1 = basement, 2 = Ground floor, 3 = 1st floor).
- Room "B. Xanthopoulos" in the στοObservatory Building.

Library of the School of Physics

- The Library of the School of Physics is located on the ground floor of the new building of the Faculty of Sciences (building of the School of Biology). All the books, scientific magazines and journals of the School have been collected there. It has > 20,000 books, most of them in foreign languages, and 200 journal titles (70 current subscriptions). The Library uses new technologies for its services: an on-line catalog of books, which is accessible to all users, and access to a number of bibliographic databases of the AUTh Central Library through the University network.
- The Library of the School of Physics is one of the first and most active members of HEAL - Link (Hellenic Academic Libraries - Link).Through HEAL-Link the library has access to 12 bibliographic databases of 0CLC FisrtSearch information service.It also has access to 2,500 journals from the following publishers: Elsevier, Kluwer, Academic Press, Springer and MCB.
- The Library of the School of Physics lends the books/items of its catalogue only to users that hold an ID card issued by the Library of the School of Physics.Due to the limited space of the Library premises, it is not operate as reading/study room, except for the service of those who are looking for the literature.The Library during the academic year is open daily from 8:30 to 14:30.
- Website of the Library: http://library.physics.auth.gr/

ITandComputerLabs

In the School of Physics, there are three (3) IT & Computer Lab Rooms available for curriculum courses (capacity 10,15 and 20 positions), while there are two (2) open access IT & Computer Lab Rooms for the students of the School of Physics (40 available positions). Office hours: Daily 09:00 – 19:00. All the IT & Computer Lab rooms are located in the the 4th floor of the Glass Building. Operate with the voluntary work of the School's students.
IT Administrator: T. Chatziantoniou (EDIP), Tel: +30 2310-998223
IT Support K. Liakakis (ETEP): +30-2310-998370, email: pclab@physics.auth.gr

School of Physics Staff

Administration

Permanent Staff	Dorkas Ilias
Employees	Chatzitrianatfillou Apostolos
IDAX	Vigli – Papadaki Lefkothea
	Kaimakamis Georgios
Library	
IDAX	GkamprelaMaria
ETEP	Emmanouil Kiriaki

IT&ComputerLabs

EDIP	ChatziantoniouTriantatfyllos
ΕΤΕΠ	Liakakis Konstantinos

8. The Faculty of Sciences

The Faculty of Sciences continues on the tradition of the Faculty of Physics and Mathematics, founded along with the University of Thessaloniki in 1925, started operating in the academic year 1927-28. It was renamed and operateswith a new administrative structure since 1982.Today, the Faculty of Science includes the following six Schools: Physics, Mathematics, Chemistry, Biology, Geology, Informatics. The Schools of the Faculty of Sciences grant the respective bachelor.

FACULTY OF SCIENCES DEANSHIP COMMITTEE

Dean: Chariton – Sarl Chintiroglou, Professor of the School of Biology

Members: Professor Dimitrios Melas, Head of the School of Physics
ProfessorDimitriosPoulakis, Head of the School of Mathematics
ProfessorPanagiotisSpathis, Head of the School of Chemistry
ProfessorMinas Giagkou, Head of the School of Biology
Professor Konstantinos Papazachos, Head of the School of Geology
Professor Elefterios Aggelis, Head of the School of Informatics

9. Contact Details

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GLOSSARY - INITIALS

PGCP	Post Graduate Courses Program
FS	Faculty of Sciences
SP	School of Physics
IPGC	Interdepartmental Post Graduate Course
GB	Glass Building
AAM	Astrophysics, Astronomy and Mechanics
NPh&PPh	Nuclear Physics & Particle Physics
SSPh	Solid State Physics
E&C	Electronics and Computers
AP&EP	Applications of Physics and Environmental Physics

THE COURSE CODES OF THE SCHOOL OF PHYSICS (ΧΧΨαββ)

XX = CODE

LESSONS CODE NUMBER OF PHYSICS DEPARTMENT (ΧΧΨαββ)

XX = Topic code

ΓΛ	Languages (Greek, Foreign Languages)
ΜΑ	Mathematics – Mathematical Physics
ΧΜ	Chemistry – Physical Chemistry & Their Applications
ΒΙ	Biology- Biophysics – Medical Physics
ΓΓ	Geology – Geophysics
ΗΥ	Informatics (Digital – Computers- computing)
ΓΘ	General Theories of Physics
ΑΑ	Astronomy – Astrophysics – Cosmology- Space
ΠΣ	Nuclear Physisc – Elementary Particles
ΣΥ	Condensed Mater Physics & Material Sciences
ΗΤ	Electronics – Telecommunications
ΑΠ	Atmosphere – Environment – Ecology
ΕΦ	Other Topics of Applied Physics
ΙΦ	History and Philosophy of Sciences
ΔΨ	Physics Education – Pedagogical – phycology
ΕΠ	Energy – Natural resources (Resources, Implementation, Manufactoring)
ΑΠ	Architecture - Urban Planning Spatial Planning
ΜΠ	Engineering - Shipbuilding
ΤΟ	Geodesy-Transportation Constructions (Technology –Materials)
ΓΕ	Geotechnical Sciences (Agriculture, Forestry, Veterinary Medicine)
ΕΥ	Health Sciences
ΘΕ	Theology- Thresciology
ΝΟ	Legal-Law
ΦΑ	Philology (Greek, Foreign Literature)
ΙΑ	History – Archaeology – Folklore
ΚΟ	Sociology-Economics Political Science
ΔΣ	Administration-Public Relations Journalism
ΚΤ	Fine Arts-Music- Theater
ΑΘ	Athletics
ΑΜ	Other scientific subjects

Ψ = group of lesson

YCompulsory Course ESelection

α = Kind of Lesson and Department

0 Seminar (without grades)	4 Theory and Laboratory
1 Theoretical lesson	5 Laboratory lessons
2 Theory and Tutoring	6 Theory, Tutroring,lLaboratory
3 Tutorial lesson	7 Diploma work

ββ = Course Number (00-99)

The serial number of the specific course as determined by the codesXXYα

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