COURSE OUTLINE

(1) GENERAL

SCHOOL	FACULTY OF SCIENCES		
ACADEMIC UNIT	PHYSICS		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**103**	**SEMESTER**	**7**
COURSE TITLE	ELEMENTARY PARTICLES		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/course/view.php?id=384

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Upon successful completion of the course the student is expected to be competent to,

1) describe an elementary particle interaction using Feynman diagrams

2) explain in simple terms (even in high school students) what
are the basic components of nature and the fundamental forces exerted on them. In other words, he can explain the standard pattern of elementary particles

3) to calculate particle cross sections (first order in perturbation theory) starting with Quantum Electrodynamics (QED), Quantum Chromodynamics (QCD) and ending with weak interactions (EW)

4) generalize the Lagrange method and the Noether theorem, recognize interactions and be able to make calculations about the experiment

5) look for solutions to key issues concerning the dynamics of our world e.g., dark matter, asymmetry of matter-antimatter, the involvement of the Higgs particle in

natural phenomena. It will be exposed to new theories, for example, supersymmetry or string theory, all of which are of course very introductory.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

Search for, analysis and synthesis of data and information, with the use of the necessary technology. Working independently. Production of free, creative and inductive thinking

(3) SYLLABUS

Standard Model : A historic introduction
Standard Model (in words and in …. Feynman diagrams!)
Relativistic Kinematics and Dynamics
P, C, T symmetries
Bound States – Baryons and Mesons (independent study)
Decays and cross sections
Quantum Electrodynamics (QED)
Quantum Chromodynamics (QCD) – Asymptotic Freedom
Weak Interactions – Unification of Electroweak Forces
Gauge Theories – Spontaneous Symmetry Breaking – Higgs Mechanism
Beyond the Standard Model

a) Neutrino Metamorphosis
b) Supersymmetry
c) Dark Matter
d) Matter-Antimatter asymmetry
e) Superstrings and Extra dimensions

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	**Use of ICT teaching (Moodle) for notes, references, communication with students.**
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	1) Weekly Homeworks (10 worksheets) 2) Example Classes 3) Intermediate Examination 4) A written project 5) Final Examination

Activity	***Semester workload***
Lectures	39
Tutorials	13
Study and analysis of bibliography	45
Non-directed study	25
Examinations	3
Course total	***125***

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

Elementary Particles:

1) D. Griffiths, Introduction to Elementary Particles, 2nd edition, 2008
2) F. Halzen and A. D. Martin, Quarks and Leptons, 1984
3) B. Martin and G. Shaw, Particle Physics, 2008
4) D. Perkins Introduction to High Energy Physics, 2000
5) C. Vayionakis, Particle Physics, Introduction to basic Principles, ΕΜΠ, 2013
6) I. Vergados, S. Lola and E. Triantafylopoulos, Elementary Particles, 2013

Advance QFT books:

1) A. Zee, Quantum Field Theory in a Nutshell, 2010
2) M. Peskin and D. Schroeder, Introduction to Quantum Field Theory, 1995.