COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES		
ACADEMIC UNIT	PHYSICS DEPARTMENT		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	**M142**	**SEMESTER**	**2**
COURSE TITLE	STATISTICAL ANALYSIS OF EXPERIMENTAL DATA (C++)		

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	7
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*	Special background
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek or/and English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	

(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*

This course provides advanced knowledge in statistical data analysis combining theory and computer programming. The student develops his knowledge in the statistical data analysis based on the probability and statistics theory. At the same time he develops his skills in programming using the powerful ROOT framework based on C++.

After the successful completion of the course the student is in position:

- **To possess advanced knowledge in statistical data analysis, probability and statistics.**
- **To possess advanced knowledge in basic statistical distributions, parameter fitting and hypothesis testing.**
- **To develop modern Monte Carlo technics.**
- **To develop computer programs using the CERN ROOT framework based on C++.**
- **To develop experimental data analysis programs using histograms, fitting histograms, graphics and to manage large amount of data in the form of**

structured Trees.

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…*
	…….

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

(3) SYLLABUS

- Experimental errors, the meaning of the standard deviation, combining errors.
- Probability and statistics.
- Uniform, Binomial, Poisson, Gaussian and χ^2 distributions.
- Parameter fitting, interpretation of estimates, the maximum likelihood method, least squares, hypothesis testing.
- Random numbers and Monte Carlo calculations.
- Short introduction to C++ and to the ROOT framework.
- Histograms, graphs and fitting histograms.
- Graphics and the Graphical User Interface.
- Data input/output and data Trees.
- Math libraries and geometry package.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face teaching
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• **A web page for notes and announcements is used.** • **Each student uses a computer during the laboratory part of the course.**
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,*	

Activity	*Semester workload*
Lectures	26
Laboratory practice	26
Bibliography study	60
Homework	60

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*	Examinations	3
	Course total	***175***
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.*	• Weekly homeworks and development of various computing problems. • Written exams and computer program development at the end of the course, relating to problems solving.	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

- "Statistical Methods for Data Analysis in Particle Physics", Luca Lista, ISBN:978-3-319-62839-4, Springer.
- "Statistics for nuclear and particle physics", Louis Lyons, ISBN:0-521-37934-2, Cambridge University Press.
- "Statistical Data Analysis", Glen Cowan, ISBN: 0198501552, Oxford Science Publications.
- ROOT Data Analysis Framework, https://root.cern.ch/, CERN.