COURSE OUTLINE

(1) GENERAL

SCHOOL			
ACADEMIC UNIT	PHYSICS DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**34**	**SEMESTER**	**3**
COURSE TITLE	COMPLEX ANALYSIS AND INTEGRAL TRANSFORMATIONS		

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**
	5	6
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=75

(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 to the student the basic knowledge of complex analysis (one of the most beautiful and important branches of mathematics with important applications in physics) at the undergraduate level. After successful completion of the course students will be able to:

- Handle with efficiency the elementary functions of one complex variable, such as polynomials, rational functions, the exponential function, the logarithmic function, the trigonometric and hyperbolic functions.
- Investigate the existence of the derivative of a function to a point through the Cauchy-Riemann equations and compute this derivative.
- Investigate the analiticity of a function and the nature of its singular points.
- Develop a function in Taylor or Laurent series.
- Calculate under parametrization a path integral in the complex plane.
- Perform contour integration using the theorem of residues.
- Use the method of residues for the evaluation of integrals with one real variable of integration.

- Use conformal transformations to solve Dirichlet problems in heat flow theory, in electrostatics and in fluid dynamics.
- Calculate the Fourier transform of a function.
- Use the Fourier transform method for solving differential equations of mathematical physics.

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…*
	…….

Analysis and synthesis of data with the use of the appropriate technologies.
Autonomous work.
Promotion of creative and inductive thinking.

(3) SYLLABUS

Functions of one complex variable. Cauchy-Riemann equations. Analytic functions, harmonic functions. Elementary functions of one complex variable: Exponential, logarithmic, trigonometric and their inverses. Path integrals. Cauchy-Goursat theorem. Cauchy's integral formula. Taylor and Laurent series. Residues and methods for their evaluation. Applications on the residues. Analytic continuation. Fourier transformations. Elements of the generalised functions (distributions). The distribution $\delta(x)$. Elements of the Hilbert spaces.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, 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.*	Written exams at the end of the course, which control both the knowledge of the theory and also the ability to apply it in order to solve problems.

Activity	***Semester workload***
Lectures	39
Tutorials	26
Study and analysis of bibliography	60
Independent study	22
Examinations	3
Course total	***150***

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Notes of the lectures from the teacher.
- R.Churchil-J. Brown, «Complex Variables and Applications», Πανεπιστημιακές Εκδόσεις Κρήτης.
- Ι.Δ. Βέργαδος, «Mathematical Methods in Physics" (Τόμος Ι), Πανεπιστημιακές Εκδόσεις Κρήτης.
- J. E. Marsden- M. J. Hoffman, «Basic Complex Analysis», Εκδόσεις Συμμετρία.
- Konrad Knopp, «Theory of functions», Εκδόσεις Α. Καραβία, Αθήναι 1970.

- Related academic journals: