

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 <i>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</i>	WEEKLY TEACHING HOURS	CREDITS	
	5	6	
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
COURSE TYPE <i>general background, special background, specialised general knowledge, skills development</i>	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

<p>Learning outcomes</p> <p><i>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.</i></p> <p><i>Consult Appendix A</i></p> <ul style="list-style-type: none"> • <i>Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area</i> • <i>Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B</i> • <i>Guidelines for writing Learning Outcomes</i>
<p>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:</p> <ul style="list-style-type: none"> • 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 analyticity 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

Adapting to new situations

Decision-making

Working independently

Team work

Working in an international environment

Working in an interdisciplinary environment

Production of new research ideas

Project planning and management

Respect for difference and multiculturalism

Respect for the natural environment

Showing social, professional and ethical responsibility and sensitivity to gender issues

Criticism and self-criticism

Production of free, creative and inductive thinking

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Others...

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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 <i>Face-to-face, Distance learning, etc.</i>		
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i>		
TEACHING METHODS <i>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.</i> <i>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</i>	Activity	Semester workload
	Lectures	39
	Tutorials	26
	Study and analysis of bibliography	60
	Independent study	22
	Examinations	3
STUDENT PERFORMANCE EVALUATION <i>Description of the evaluation procedure</i> <i>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</i> <i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i>	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.	
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:

