VNIVERSITAT ĞİD VALÈNCIA

COURSE DATA

Data Subject	
Code	34248
Name	Mathematical methods II
Cycle	Grade
ECTS Credits	6.0
Academic year	2020 - 2021

Study (s)			
Degree	**Center**	**Acad. year**	**Period**
1105 - Degree in Physics	Faculty of Physics	2	Second term

Subject-matter		
Degree	**Subject-matter**	**Character**
1105 - Degree in Physics	8 - Mathematical methods	Obligatory

Coordination	
Name	**Department**
LLEDO BARRENA, M. ANTONIA	185 - Theoretical Physics

SUMMARY

- Objectives: To acquire the knowledge of complex variable necessary for the degree Physics
- Relationship with previous, current and future courses: Because the subject is instrumental, all the other courses of the degree in Physics may require the concepts and techniques
developed in this course. It is advisable to have passed the Mathematics courses (Algebra and Geometry I and II, Calculus I and II).
- Descriptors: Complex Numbers and Functions of complex variable. Differentiation, integration and series. Applications to the calculation of certain integrals. Integral transforms. Laplace and Fourier Transforms.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

It is essential to have already a good understanding of the objectives included in the Mathematics courses of the first year (Algebra and Geometry I and II, and Calculus I and II), namely

1. Differential calculus in one and several variables.
2. Integration in one variable and multiple integrals.
3. Real, numerical sequences and series
4. Power series
5. Linear systems
6. Vector Spaces
7. Matrices and determinants, linear operators, eigenvalues and eigenvectors.

OUTCOMES

1105 - Degree in Physics

- To know how to apply the knowledge acquired to professional activity, to know how to solve problems and develop and defend arguments, relying on this knowledge.

- Capacity to communicate information, ideas, problems and solutions to a specialist and a general audience.

- Developing learning skills so as to undertake further studies with a high degree of autonomy.

- Destrezas Generales y Específicas de Lenguas extranjeras: Mejorar el dominio del inglés científico-técnico mediante la lectura y acceso a la bibliografía fundamental de la materia.

- Modelización y resolución de problemas: Saber resolver problemas, siendo capaz de identificar los elementos esenciales de una situación y de realizar las aproximaciones requeridas con objeto de reducir los problemas a un nivel manejable.

- Ser capaz de proseguir con el estudio de otras materias de la física gracias al bagaje adquirido en el contexto de esta materia.

- Communication Skills (written and oral): Being able to communicate information, ideas, problems and solutions through argumentation and reasoning which are characteristic of the scientific activity, using basic concepts and tools of physics.

- Destrezas matemáticas: comprender y dominar el uso de los métodos matemáticos y numéricos más comúnmente utilizados para la resolución de problemas en el contexto de la mecánica.

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LEARNING OUTCOMES

1. To be able to perform computations with complex numbers. To know the characteristics of complex variable functions and the conditions of analyticity.
2. To understand the residue theorem and its applications to the calculation of integrals and series.
3. To be able to compute the Fourier or Laplace transform of a function and the inverse transforms.
4. To be able to construct a Fourier series

DESCRIPTION OF CONTENTS

1. 1. Complex numbers and complex functions.

Representation and operations with complex numbers. Curves C. The point of infinity. Functions of a complex variable. Differentiability and analyticity. Cauchy-Riemann conditions. Multivalued functions. Branch cuts, singularities and zeros. Power and logarithm function. Exponential trigonometric functions, hyperbolic functions

2. Integrals in the complex plane. Cauchy Theorem.

Integrals in the complex plane. Primitives. Cauchy theorem. Cauchy integral formula.
High derivatives of a regular function.

3. Series in the complex plane. Residue theorem.

Numerical and functional series in the complex plane. Power series: Taylor and Laurent.
Singularities. Classification. Residue theorem. Calculating residues. Examples.

4. Applications

Real improper integrals. Integration of single-valued functions. Poles in the way of integration.
Examples. Integration of multiple-valued functions. Sum of series. The Gamma function. Properties.

5. Integral Transforms: Laplace and Fourier

The concept of integral transform. The Laplace transform and its properties. Inverse transform.
Convolution. Heaviside function and Dirac delta. Operating Rules. Application to the resolution of differential equations. Fourier series. Dirichlet conditions. Fourier coefficients. Theorem of
Parseval. Fourier transform and properties. Convolution and Fourier transforms.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	45,00	100
Tutorials	15,00	100
Development of individual work	30,00	0
Study and independent work	60,00	0
TOTAL	150,00	

TEACHING METHODOLOGY

The methodology of the course will be the following: 3 of the four weekly hours would correspond to theoretical and practical classes and 1 hour to tutoring classes for small groups.

In theoretical and practical classes the professor will develop the contents with emphasis on the resolution of questions, problems and applications. Some demonstration and / or application may be left as work for tutorials.

Tutoring classes will be devoted to solve and / or discussing the problems that the professor will make available to the students previously, in paper or via the virtual classroom. They will corrrespond to each chapter of the syllabus explained in theoretical and practical classes. Also, theoretical issues can be assigned to the to students, who would present the results to the class. The presentations will be assesed. In general, each set of problems will contain `model' problems, which will be solved in the theoretical and practical class and others that will be solved by students. All the doubts and part of the problems assigned to students will be solved in tutorials.

EVALUATION

The evaluation of the subject will be done taking into account the work done during the course (continuous evaluation CE) and the final exam (FE).

The final exam will consist of a written test, which may consist of a part with questions of a more theoretical nature, and another part of problems.

The continuous evaluation may take into account the work and participation in class of the student or the student throughout the course, as well as the results obtained in possible tests carried out before the final exam.

In the event that the grade of one of the parts of the final exam is less than 3.5 out of 10, it will not be averaged with the continuous evaluation, and the final grade for the course (FG) will be given by the formula FG = Min [3.5, FE]. Therefore the rating will be "Suspense".

If the scores in both parts of the final exam are both equal to or greater than 3.5 out of 10, the final exam grade may be averaged with the continuous evaluation, and the final marks for the course will be obtained as follows *:

- Final grade = 0.7 * FE + 0.3 * CE (Group A)

- Final grade = max (0.7 * FE + 0.3 * CE, FE) (Group B)

where EC is the mark of the continuous evaluation out of 10.

Also:

The grade of this subject can be averaged with that of Mathematical Methods I so that both are considered to have been passed if the average is equal to or greater than 5 points out of 10 and the grade in both is equal to or greater than 4 points out of 10.

* The difference between the procedures for obtaining the final grade between the two groups is due to the different methodologies used.

REFERENCES

Basic

- J. Peñarrocha, A. Santamaría, J. Vidal, Mètodes Matemàtics: Variable Complexa. Universitat de València.
  - K.F. Riley, M.P. Hobson, S.J. Bence, Mathematical methods for physics and engineering: A comprehensive guide, Cambridge University Press
  - J.E. Marsden, ``Basic Complex Analysis''. W. H. Freeman and Company.

Additional

- Ruel V. Churchill, James W. Brown, ``Variable Compleja y Aplicaciones''. MacGraw-Hill.
  - William R. Derrick, ``Complex Analysis and Applications''. Wadsworth International Group.

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

English version is not available

METODOLOGÍA DOCENTE

Durante el mes de febrero 2021, la docencia de teorías y seminarios-trabajos tutelados, pasan a modalidad de videoconferencia síncrona impartida en el horario fijado por la asignatura y el grupo.
A partir del 1 de marzo, se seguirá la modalidad docente indicada en la Guía Docente y en las modalidades docentes aprobadas en las Comisiones Académicas de Título de los meses de julio 2020 y noviembre de 2020, respectivamente, a menos que las autoridades sanitarias y Rectorado indiquen una nueva reducción de presencialidad, en este caso se volvería a la modalidad de videoconferencia síncrona.