



Bachelor in Physics (Academic Year 2022-23)

Mathematical Methods II			Code	800505	Year	2nd	Sem.	2nd
Module	General Core	Topic	Mathematical Methods in Physics		Character	Obligatory		

	Total	Theory	Exercises
ECTS Credits	6	3.5	2.5
Semester hours	55	30	25

Learning Objectives (according to the Degree's Verification Document)
<ul style="list-style-type: none"> To use basic partial differential equations in Physics, to know their scope and to dominate fundamental techniques to obtain solutions. To learn Fourier analysis methods and its applications to differential equations. To get knowledge of most of the special functions used in Physics and their physical properties.
Brief description of contents
Partial differential equations. Fourier series and transformations. Boundary problem resolution. Special functions.
Prerequisites
Calculus on one and various variables functions. Linear ordinary differential equations.

Coordinator	José I. Aranda Iriarte			Dept.	FT
	Room	18, 2ª pl. oeste	e-mail	pparanda@ucm.es	

Theory/Exercises – Schedule and Teaching Staff								
Group	Lecture Room	Day	Time	Professor	Period/ Dates	Hours	T/E	Dept.
B	4ª	Mo Th	12:00-14:00	Manuel Mañas Baena	Full semester	42	T/E	FT
			10:00-12:00	Alexey Vladimirov	Full semester	13	E	

T: Theory, E: Exercises

Office hours				
Group	Professor	Schedule	E-mail	Location
B	Manuel Mañas Baena	1er. sem: L 10:30-13:30 (+ 3 hours online) 2º sem: Tu, We, Fr: 12:00 - 13:00 (+ 3 hours online)	manuel.manas@ucm.es	Office 02.0318.0
	Alexey Vladimirov	M: 14:30-16:00 + 1 hora y media online	alexeyvl@ucm.es	Office 03.0306.A

Syllabus

1. Introduction to partial differential equations (PDEs). First order PDEs. Second order linear PDEs. Boundary and initial value problems. The equations of Mathematical-Physics. The wave equation.
2. Series solutions for second order linear ODEs and special functions. Regular point and regular singular points. Hermite, Legendre and Bessel equations.
3. Boundary value problems for ODE. Fourier series and Fourier transform. Eigenvalues and eigenfunctions. Sets of orthogonal functions. Eigenfunction series expansions. Fourier trigonometric series. Convergence. Inhomogeneous problems. Fourier transforms.
4. EDP: method of separation of variables and eigenfunction expansion method. Homogeneous and non-homogeneous problems for the equations of Mathematical Physics (heat, wave, Laplace, Schrödinger, ...). Cartesian, polar, cylindrical and spherical coordinate problems.

Bibliography

Basic:

- Partial Differential Equations: An Introduction, Walter A. Strauss. John Wiley & Sons
- Introduction to Partial Differential Equations, Peter Olver. Springer 2016.
- *Applied Partial Differential Equations with Fourier Series and Boundary Value Problems*. Richard Haberman. Pearson Education Limited (2013).
- *Boyce's Elementary Differential Equations and Boundary Value*. William E. Boyce, Richard C. DiPrima, Douglas B. Meade. John Wiley & Sons Inc (2017).

Complementary:

- *Partial Differential Equations*, Peter J. Olver, Springer
- *Fourier Series*. Georgi Tolstov. Dover
- *Ecuaciones Diferenciales II*. Manuel Mañas Baena y Luis Martínez Alonso. (<http://eprints.ucm.es/31464/1/Manuel.pdf>)

Online Resources

We will use the UCM's Moodle facility (Campus Virtual)

Methodology

We will follow the material uploaded to the Moodle platform. In particular, The professor lecture notes. The classes will be divided in theoretical and practical, solving in these last ones' exercises from the professor lecture notes.

Evaluation Criteria		
Exams	Weight:	65%
<p>The final exam (ordinary or extraordinary) consists in the resolution of a number or practical problems that the student must solve using the knowledge learned throughout the course. The mark of the exam, say E, will vary from 0 to 10. A score E bigger than 5 means that the student has passed the subject.</p> <p>In other to apply the marks obtained in other activities the mark E must be bigger than 3.5.</p>		
Other Activities	Weight:	35%
<p>Continuous evaluation activities of any of these types will be carried out:</p> <ul style="list-style-type: none"> • Delivery of problems throughout the course individually or in groups. • Individual realization of evaluable problems during class hours. <p>The final grade A of other activities will be a number between 0 and 3.5 points. This note will be considered in the extraordinary call.</p>		
Final Mark		
<p>If E is the score of the final exam and A the final grade of other activities, the final grade C_F will be given (if $E \geq 3.5$) by the following formula</p> $C_F = \text{Max} (A + 0.65 * E, E)$		