



Bachelor in Physics

(Academic Year 2025-26)

Mathematics		Code	800492	Year	1st	Sem.	1st
Module	Basic Core	Topic	Mathematics		Character	Obligatory	

	Total	Theory	Exercises
ECTS Credits	9	4	5
Semester hours	84	34	50

Learning Objectives (according to the Degree's Verification Document)
<ul style="list-style-type: none"> • Reinforce previous elementary mathematical concepts. • Acquire the ability to analyze and calculate limits and derivatives. • Know how to study real functions of a real variable and find their extrema. • Know how to calculate definite and indefinite integrals of functions of a real variable.
Brief description of contents
Review of basic mathematical concepts, differential and integral calculus of functions of a real variable.
Prerequisites
High-school Mathematics.

Coordinator	V́ctor Mart́n Mayor			Dept.	FT
	Room	03.323.3	e-mail	vicmarti@ucm.es	

Theory/Problems – Schedule and Teaching Staff								
Group	Lecture Room	Day	Time	Professor	Period/ Dates	Hours	T/E	Dept.
B	7	W,Th,Fr	9:00 – 11:00	María Jesús Rodríguez Plaza	Full term	84	T/E	FT

T: Theory, E: Exercises

Office hours					
Group	Professor			E-mail	Location
B	María	Jesús	Rodríguez Plaza	mjrplaza@fis.ucm.es	03.309.0

Syllabus
<p>1.- Review. Sets. Mathematical language. Newton's binomial theorem. Real numbers. Inequalities.</p> <p>2.- Real functions. One-one and onto functions. Review of the elementary functions: polynomial, exponential, logarithmic and trigonometric.</p> <p>3.- Infinite numerical sequences. The concept of limit. Calculation of limits.</p> <p>4.- Limits and continuity of functions. Theorems on continuous functions defined on intervals.</p> <p>5.- Definition and calculation of derivatives. Differentiability of the elementary functions. The chain rule. Theorems on differentiable functions.</p> <p>6.- Applications of the derivative. Extrema. Graph of a function.</p> <p>7.- Infinite numerical series. The geometric series and its sum. Convergence tests: the comparison test, the limit test, the Leibniz test, the ratio test, the radical test.</p> <p>8.- Power series. The radius of convergence, operations with power series, differentiation. Taylor polynomials and Taylor series.</p> <p>9.- Calculation of limits. Use of L'Hopital's rule and Taylor polynomials.</p> <p>10.- The concept of integral. Definition. The fundamental theorem of Calculus.</p> <p>11.- Calculation of antiderivatives. Partial integration. Antiderivatives of rational functions. Change of variables. Antiderivatives of trigonometric functions.</p> <p>12.- Improper integrals. Unbounded integration interval or unbounded function. Convergence tests.</p>

Bibliography
<p>Basic:</p> <ul style="list-style-type: none"> – Stewart, J, <i>Calculus: Early Transcendentals</i>, Brooks/Cole Pub Co, 1995. – Boas, Mary L., <i>Mathematical Methods in the Physical Sciences</i>, John Wiley & Sons, 2006. <p>Complementary:</p> <ul style="list-style-type: none"> – Spivak, M., <i>Calculus</i>, Publish or Perish, 1980.

Online Resources
Material and announcements related to the course will be posted in the UCM "Campus Virtual".

Methodology
<p>Review lectures will consist essentially of problem-solving sessions. In the ordinary lectures, half of the time will be spent on theoretical explanations (including examples) and the other half on problem solving sessions. The corresponding exercises will be made available to the students in advance.</p> <p>Along the course, additional take-home exercises, quizzes or projects may be assigned. In addition, exercises or tests similar to those discussed in problem-solving sessions may be given during lecture hours and graded.</p> <p>The instructor will answer both theoretical and problem-related questions from the students in his office during tutoring hours.</p> <p>There will be a mid-term exam covering the first half part of the material, and a final exam at the end of the term. Examination questions and exercises will be similar to those explained in the lectures/problem-solving sessions. Older exams will be facilitated in advance to the student</p>

Evaluation Criteria		
Exams	Weight:	70%
A midterm exam (mid-semester) and a final exam will be held. The midterm exam will not eliminate		

any coursework. The content assessed in the midterm exam may also be assessed in the final exam.

The final exam grade, E, will be obtained as follows:

$$E = \max(F, 0.4 \times P + 0.6 \times F).$$

where P is the grade obtained on the midterm exam and F is the grade obtained on the regular final exam, both on a scale of 0 to 10. To pass the course, a grade of F must be greater than or equal to 4.

In the extraordinary session, all students must take the entire course. The grade for the July extraordinary session will be obtained following exactly the same evaluation procedure.

60% of the questions will be common to all groups in both the midterm and final exams.

Other Activities		Weight:	30%
<p>The lecturer of each group decides how to grade these Other Activities. Partial or full credits will be assigned to problems or tests solved individually or in groups in the classroom or as homework; or by regular lecture attendance and supervisions, or by any other academic activity that the professor may find of relevance.</p> <p>The grade of these activities, denoted by A, will be a number between 0 and 10.</p>			
Final Mark			
<p>With E denoting the mark in exams and A denoting the final mark accounted in Other Activities, the final grade C_F of the student will be given provided that $E \geq 4.5$ by the formula</p> $C_F = \max(0.3 \times A + 0.7 \times E, E).$ <p>A student will pass the course if $C_F \geq 5$.</p> <p>If $E < 4.5$ but $C_F \geq 5$, the final mark of the course will be E.</p> <p>Extraordinary exams will follow the same rules.</p>			