UCLouvain

lphys2112

2024

Mathematical physics

5.00 credits	30.0 h	Q1

Teacher(s)	Ringeval Christophe ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	Having followed LPHYS1202 is an asset.
Main themes	This teaching unit aims at presenting and deepening the mathematical structures supporting the construction of modern physics theories. These structures will be presented according to the logical flow in which they can be constructed. Various practical examples taken from actual physics will be used as an illustration of their importance.
Learning outcomes	**At the end of this learning unit, the student is able to :** **a. Contribution of the teaching unit to the learning outcomes of the programme (PHYS2M and PHYS2M1)** 1.2, 2.1, 2.5, 3.1, 3.2, 3.3, 3.4 1 **b. Specific learning outcomes of the teaching unit** At the end of this teaching unit, the student will be able to : 1. express the axioms supporting the mathematical structures seen in the lectures ; 2. express and demonstrate the main theorems used in physics ; 3. generalize and apply the techniques seen in the lectures to new problem in physics.
Evaluation methods	Evaluation is performed with a 2-hours long written exam dealing with the subjects and methods addressed during the lectures, but also with their application to new problems which have not been explicitly solved in the course.
Teaching methods	The teaching methods is traditional lecturing on the black board alternated with inquiry-based methods during collective discussions.
Content	The lectures follow the following tree : - Concepts of topology * Euclidian * Connected space, topological group - Measure theory and Lebesgue integral * Measurable space and functions * Lebesgue's integral * Applications to probabilities - Distributions et Green's functions * Tests functions and distributions * Operations and Fourier transforms * Green's functions - Spectral theory in Hilbert's spaces * Elementary properties of Hilbert's spaces * Linear functional and operators * Spectra of bounded operators * Unbounded operators, self-adjoint, symmetric * Spectral theorem - Concepts of differential geometry * Manifolds and differential forms * Flow, Lie derivatives and commutators * Exterior derivative
Bibliography	- Geometry, Topology and Physics, Nakahara. - Méthodes mathématiques pour les sciences physiques, Schwartz. - Lebesgue Measure and Integral, Craven.

Faculty or entity in charge	PHYS

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [60] in Physics	PHYS2M1	5		🔍
Master [120] in Physics	PHYS2M	5		🔍