UCLouvain

lphys2303

2021

Cryophysics and vacuum physics

5.00 credits	30.0 h + 15.0 h	Q1

Teacher(s)	Bayot Vincent ;Hackens Benoît ;Melinte Sorin ;
Language :	English
Place of the course	Louvain-la-Neuve
Prerequisites	Introductory course to condensed matter physics (like LPHY1345 or MAPR1492).
Main themes	This teaching unit aims at giving students the tools to understand physical phenomena at play in high and ultra-high vacuum conditions, as well as at cryogenic temperature. It also allows them to directly experience technical aspects related to these disciplines. Applications of vacuum physics and cryophysics will be illustrated through different visits in research laboratories, and hands-on exercices, realized in the laboratory, will help them to visualize direct applications of the theory and to get used to the operation of low temperature and high vacuum production and control equipments.
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)** AA1: AA1.2, AA1.3, AA1.4 AA2: AA2.2, AA2.3 AA5: AA5.2, AA5.3 AA6: AA6.2, AA6.3 AA7: AA7.1, AA7.2 AA8 : AA8.1 **b. Specific learning outcomes of the teaching unit** 1 At the end of this teaching unit, the student will be able to: 1. properly choose high vacuum and/or cryogenic production and control system, adapted to a given set of requirements ; 2. describe the evolution of the properties of different classes of materials and of different cryogenic fluids as a function of temperature and pressure ; 3. describe the principles, and fully design an experimental setup operating at high and ultra-high vacuum and/or low temperature, fulfilling a set of constraints ; 4. describe and simulate the evolution of pressure inside a vacuum chamber as it is vacuum-pumped ; 5. manipulate the main elements of an experimental setup operating at low temperature and/or high vacuum.
Evaluation methods	Written report on the project and its oral presentation during the exam. Lab reports. Knowledge of the theory is tested during the exam.
Teaching methods	Lectures, hands-on sessions in the laboratory, project
Content	• Cryogenic fluids • Cryogenic systems • Thermometry • Kinetic theory of gases, Boltzmann distribution, perfect and real gas • Molecular flow, conductance, pumping speed • Phase changes, vapour pressure, phenomena on the surface • Instruments for the production and control of high/ultra-high vacuum
Inline resources	Moodle site
Bibliography	M. Guisset, Technique du vide, Louvain-la-Neuve, 1992. Transparents de l'unité d'enseignement, réalisés par les enseignant.e.s.
Faculty or entity in charge	PHYS

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Physical Engineering	FYAP2M	5		
Master [120] in Electrical Engineering	ELEC2M	5		
Master [120] in Physics	PHYS2M	5		