UCLouvain

lphys1112

2018

Mechanics 2 and thermodynamics

10 credits	52.5 h + 45.0 h	Q2

Teacher(s)	Fichefet Thierry ;Goosse Hugues (compensates Fichefet Thierry) ;Lemaitre Vincent ;
Language :	French
Place of the course	Louvain-la-Neuve
Main themes	In continuation of the topics addressed in the LPHYS1111 Mechanics 1 teaching unit, wave phenomena such as mechanical waves (coupled springs and pendulums, vibrating string), sound waves and waves on water are studied. The concepts of normal modes of vibration, dispersion, reflection and transmission relationships, wave packets, phase velocity and group velocity, and two- and three-dimensional waves are discussed. Then we talk about the statics and the dynamics of the fluids by insisting on the concepts of pressure and waves on the water. The concept of viscosity and some simple flow examples are presented for incompressible viscous fluids. The basic notions of thermodynamics are then introduced. The concepts of thermodynamic state, pressure and temperature are defined. Internal energy and the first principle of thermodynamics as well as entropy and the second principle of thermodynamics are then presented. Equilibrium conditions and applications (including cycles and thermal machines) are studied. Finally, we describe the kinetic theory of gases, the macroscopic properties of perfect gases and the phase changes of pure bodies. In addition, during the semester and opening up to modern physics, two conferences
Aims	**a. Contribution of the teaching unit to the learning outcomes of the programme** **AA1 :** 1.1, 1.3, 1.4, 1.5 **AA2 :** 2.1, 2.2, 2.4 **AA3 :** 3.1, 3.2, 3.3, 3.4, 3.5, 3.6 **AA4 :** 4.3 **AA6 :** 6.3, 6.4 **b. Specific learning outcomes of the teaching unit** At the end of this teaching unit, the student will be able to: 1. mathematically describe the mechanical systems with several degrees of freedom and associated wave phenomena; 2. recognize the essential concepts associated with mechanical waves and the relationships they maintain; 3. recognize the power of some mathematical tools to describe physical phenomena; 4. describe and interpret basic notions of incompressible fluids; 5. describe and interpret the basic concepts of thermodynamics, in particular the first and second principles of thermodynamics; 6. apply the basic principles of thermodynamics to simple cases, standard thermodynamic machines and examples of everyday life; 7. interpret transformations involving exchanges of mass and energy through the principles of thermodynamics; 8. link the concepts developed in the field of thermodynamics with those discussed in other teaching units, especially mechanics and chemistry. 9. discuss the main processes associated with phase changes of pure bodies; 10. describe and apply the kinetic theory of gases; 11. manipulate experimental devices, perform measurements and interpret them physically. 1 - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	' These methods are to be specified by the teachers who will be in charge of this teaching (with the exception of the mention of the two compulsory conferences). ' Written exam: resolution of exercises, demonstrations of theoretical reasoning. ' Correction of laboratory reports. ' Participation in the two compulsory conferences organized as part of this teaching unit.

Teaching methods	**The teaching of both parts of this teaching unit is at the appreciation and availability of the course holder e(s). If necessary, sections 9 to 15 may be given before sections 1 to 8.** Demonstration on the blackboard, slide showings, projection of animations, realization of experiments during the lectures, realization of laboratories, exercises sessions. Laboratory work is done in teams of two or three students. They must perform a delicate measure involving concepts that have been (or will be) introduced as part of the teaching units LPHYS1111 and LPHYS1112. In particular, a great autonomy is required for the realization of these laboratories. The results are then presented in the form of a written report. The waves are present everywhere, whether in mechanical systems, sound, or in fluids (or of course in electromagnetism, as seen in the teaching unit LPHYS1221). The focus is therefore on the common mathematical description of all these wave phenomena. In the same way, thermodynamics makes it possible to make links between different disciplines, in particular mechanics, chemistry and electromagnetism.
Content	The table of contents includes the following points: Part 1 1) Free oscillations of simple systems. 2) Free oscillations of systems with a large number of degrees of freedom. 3) Forced oscillation. 4) Progressive waves. 5) Reflection, transmission and interference. 6) Modulation, pulse and wave packets. 7) Two- and three-dimensional waves, polarization. 8) Introduction to statics and dynamics of fluids. Part 2 9) Thermodynamic system, transformations and state variables. 10) Internal energy and first principle of thermodynamics. 11) Entropy and second principle of thermodynamics. 12) Kinetic theory of gas - perfect gas. 13) Transformations and thermal machines. 14) Phase transitions of pure bodies.
Bibliography	Cours de physique de Berkeley. Volume 3 : ondes. Ansermet J.P. et S. Bréchet, 2016. Thermodynamique. Presses polytechniques et universitaires romandes. Gonczi G., 2005. Comprendre la thermodynamique. Ellipses, 260 pp., ISBN 2-7298-2363-8. Bocquet L., J.-P. Faroux, J. Renault, 2002. Toute la thermodynamique, la mécanique des fluides et les ondes mécaniques. Dunod, 519 pp., ISBN 2-10-005568-2.
Faculty or entity in charge	PHYS

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Bachelor in Physics	PHYS1BA	10		🔍
Minor in Physics	LPHYS100I	10		🔍