

5 credits

30.0 h + 22.5 h

Q2

Teacher(s)	Bruno Giacomo ;Delaere Christophe ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	LPHY1251, LMAT1261, LPHY1211, LPHY1322 <i>The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.</i>
Main themes	This course is an introduction to solid state physics. As such, we will deal with the different thermal and electric properties of solids. We will focus upon the application of basic concepts to semi-conductors (micro-electronic and technical applications for detecting charged particles) and to superconductivity.
Aims	a. Course contribution to the LO reference framework (programme LO) LO1: 1.1, 1.4, 1.6 LO2: 2.4. LO3: 3.2, 3.5 LO6: 6.3, 6.4 b. Specific formulation of programme LOs for this course At the end of this course, the student will be able: - to identify the main crystalline structures and their symmetries, both for the spatial and reciprocal networks. - to compare the different types of crystalline bonds. - to apply analytical mechanics to periodic structures to deduce their thermal properties. - to describe the vibrations of a crystal in terms of phonons. - to apply statistical mechanics to a gas of electrons to deduce their thermal and electrical properties. - to establish how a periodic potential produces an energy band structure. - to deduce the properties of semi-conductors in the solids band structure. - to explain the behaviour of a diode and a transistor starting from the properties of semi-conductor crystals. - to discuss the properties of superconductors in the light of different phenomenological and/or microscopic models. ----- <i>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".</i>
Evaluation methods	Oral exams (OE) comprising: * immediate preparation questions, * preparation on a subject chosen by the student, * unprepared discussion on the points above. Laboratory report.
Teaching methods	Lectures. Lectures with short hands-on learning activities (e.g.: supervised questions, citing applications, ') Exercises on moodle Individual exercise sessions which are supervised- Practicals, experiments
Content	- Crystalline structure. Reciprocal network. Crystalline bond and elastic constants. - Phonons: network vibrations and thermal properties. - Fermi's gas of free electrons, quasi-free electrons, energy bands. - Semi-conductor crystals: basic properties and devices (diode and transistor). - Superconductivity: experimental facts and theoretical approaches

Bibliography	Charles Kittel, Physique de l'état solide, EAN13 : 9782100497102 http://www.dunod.com/sciences-techniques/sciences-fondamentales/physique-et-astrophysique/master-et-doctorat-capes-agreg/physique-de-letat-so David L. Sidebottom, Fundamentals of Condensed Matter and Crystalline Physics, ISBN: 9781107017108 http://www.cambridge.org/be/knowledge/isbn/item6687763/?site_locale=nl_BE Neil William Ashcroft et N. David Mermin, Physique des solides, ISBN : 2-86883-577-5 http://www.edition-sciences.com/physique-solides.htm
Faculty or entity in charge	PHYS

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Bachelor in Physics	PHYS1BA	5	LPHY1211 AND LPHYS1241	
Master [60] in Physics	PHYS2M1	5		
Minor in Physics	LPHYS100I	5		