MATERIALS ENGINEERING AND NANOTECHNOLOGY (LM56)

(Lecce - Università degli Studi)

Teaching PHYSICS OF MATTER MOD. II

GenCod A003098

Owner professor Nicola LOVERGINE

Teaching in italian PHYSICS OF MATTER MOD. II

Course year 1

Teaching PHYSICS OF MATTER MOD. II

Language ENGLISH

SSD code FIS/03

Curriculum PERCORSO COMUNE

Reference course MATERIALS ENGINEERING AND

Location Lecce

Course type Laurea Magistrale

Semester First Semester

Credits 6.0

Exam type Oral

Teaching hours Front activity hours: 54.0

Assessment

For enrolled in 2020/2021

Course timetable https://easyroom.unisalento.it/Orario

Taught in 2020/2021

BRIEF COURSE DESCRIPTION

This is the Modulus II of the course named "Physics of Matter". The Mod. II is a graduate level introductory course to the fields of atomic, molecular and condensed matter physics. It aims to present the main properties of atoms, molecules and solids, along with their detailed theoretical description/explanation based on the concepts of quantum mechanics and solid state physics. In particular, the origin and properties of bonds in both molecules and solids are presented, with emphasis - for solids - on metals and metal properties. Special emphasis is placed thoughout this Course modulus on the interaction of atoms and (crystalline) solids with electromagnetic radiation (X-rays) and its use in the physical-chemical and structural characterization of materials. Theoretical concepts introduced during the lectures are complemented by Laboratory classes dealing with practical sessions on X-ray fluorescence and X-ray diffraction measurements on crystalline materials.

REQUIREMENTS

Knowledge and understanding of the concepts tought in PHYSICS OF MATTER MOD. I (LM56)

COURSE AIMS	After the Course the student will be able to describe major physical properties of atoms, molecules and solids using the principles and laws of quantum mechanics. In particular, the student will be able to: ▪ Describe and understand electronic configurations of many-electron atoms, their energy levels and angular momentum states; understand the origin and types of molecular bonds; ▪ Understand and utilize X-ray absorption and fluorescence spectroscopy to identify chemical elements in a given material; ▪ Identify solids according to the type of bonds between atomic constituents; ▪ Describe and understand the origin of the metals electric/thermal properties and their consequences; ▪ Describe and identify major crystal structures and the spatial arrangements of constituent atoms/ions/molecules within them; ▪ Understand the use of X-ray diffraction for the structural characterization of crystalline materials.
TEACHING METHODOLOGY	The Course is carried on through classroom theoretical lectures (about 90% of the total teaching hours) and practical Laboratory sessions (about 10% of the teaching hours) , the latter focussing on the applications of X-ray fluorescence for determining the materials chemical composition and the sue of X-ray diffraction measurements in the study of crystalline materials.
ASSESSMENT TYPE	Physics of Matter – Mod. II is the second modulus of the Course named "Physics of Matter". There a single final exam which includes the contents of Modulus I and Modulus II. The exam consists of two cascaded parts: the first part is a written test (duration: two hours and a half); the student is asked to solve exercises; it is aimed to verify to what extent the student has gained the ability to apply quantum theory to solve simple case studies; the second part is an oral examination/colloquium aimed at determining to what extent the student has gained an overall knowledge of the topics treated within the course.
FULL SYLLABUS	Many-electron atoms, X-ray absorption and fluorescence of atoms, Laboratory I (XRF and microanalysis for analysis of materials chemical compostion), Bonds in molecules, Introduction to Condensed Matter Physics, Chemical bonds in solids, Classical description of electric conduction in metals, Electrons contribution to thermal and thermo-electric properties of metals, Quantum theory of electrons in metals, Elements of crystallography, X-ray diffraction of crystals, Experimental methods of X-ray diffraction on crystals, Laboratory II (Practical X-ray diffraction on crystals).
REFERENCE TEXT BOOKS	1. Fundamental University Physics Vol. 3 – Quantum and Statistical Physics (M. Alonso & E.J. Finn), Addison Wesley (1968). 2. Solid State Physics (N.W. Ashcroft & N.D. Mermin), Holt-Saunders International Editions (1976). 3. Introduction to Solid State Physics (C. Kittel), Thomson Press (2003).