Corso di Laurea in
SCIENZA E TECNOLOGIA DEI MATERIALI

Triennale – L30

General information			
Academic subject	***CONDENSED MATTER PHYSICS***		
Degree course	*MATERIALS SCIENCE AND TECHNOLOGY*		
Academic Year	*3rd*		
European Credit Transfer and Accumulation System (ECTS)		8	
Language	*ITALIAN*		
Academic calendar (starting and ending date)		*1ST October 2021 – 8TH January 2022*	
Attendance	*HIGHLY RECOMMENDED*		

Professor/ Lecturer	
Name and Surname	Antonio Ancona Annalisa Volpe
E-mail	antonio.ancona@uniba.it annalisa.volpe@uniba.it
Telephone	0805442371
Department and address	Dipartimento Interateneo di Fisica "M. Merlin" stanza 236
Virtual headquarters	*Codice Teams: zx8dhz1*
Tutoring (time and day)	Tue-Thu 9.30-11.30

Syllabus	
Learning Objectives	*- fundamental knowledge of classical physics and quantum physics* *- basic knowledge of the structure of matter, physics and chemistry of condensed states, with operational and laboratory skills;*
Course prerequisites	*Basic concepts of Classical Physics and Mathematics*
Contents	*Introduction to the course. Black body emission. Photoelectric effect. Compton effect. Production, absorption and diffusion of X-rays. Wave-particle dualism. Uncertainty principle. Wave function and probability density. Bohr's model of the atom. Electronic structure of atoms. The hydrogen atom. The many-electron atom. Zeeman effect. Spin of the electron. Spin-orbit interaction. Introduction to solids. Band theory in solids (outline). Free electron model. Fermi level. Motion of electrons in periodic structures. Brillouin areas. Effective mass. Fermi-Dirac statistics. Applications to electrons in metal. Bose-Einstein statistics. Banded model. P-n diode. Notes on the physics of elementary particles. Numerical exercises on the contents of the course*
Books and bibliography	- Alonso-Finn Vol III – Quantum and Statistical Physics - Eisberg-Resnick – Quantum Physics of Atoms, Molecules, solids, Nuclei and Partcles
Additional materials	

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
200	*48*	*30*	*122*

ECTS			
8	*6*	*2*	

Teaching strategy	*Lectures, group exercises on topics of the course.* *The teaching is preferably delivered in frontal teaching but if necessary it can also be delivered remotely*
Expected learning outcomes	
Knowledge and understanding on:	○ Knowledge of the ideas and experiments that led to the transition from a classical to a quantum approach in physics. ○ Knowing how to describe the evolution of the electron's behaviour from the atom through its modelling to the concept of energy bands in solids. ○ Knowing how to combine the results of classical physics with those of quantum physics to describe some properties of solids.
Applying knowledge and understanding on:	○ Knowing the energy band structure in solids ○ To know the effects that some products of nuclear processes have in order to understand their possible benefits and how to reduce or eliminate the possible damage they can generate.
Soft skills	• *Making informed judgments and choices* ○ Critically evaluate possible experiments and extractable models • *Communicating* knowledge and understanding ○ communication skills in Italian language; ○ ability to express oneself in the presentation and dissemination of one's knowledge with appropriate scientific language, • *Capacities to continue learning* ○ Through the ability to transfer knowledge of the topics learned.

Assessment and feedback	
Methods of assessment	*Oral examination*
Evaluation criteria	*Learn about the evolution of classical physics and the experiments that led to a quantum-type approach. Knowing how to understand how experiments and theoretical evaluations led to the definition of the model of the atom. Knowing and being able to describe the behavior of the electron within a solid both in equilibrium conditions and in the presence of electric fields. Starting from the band model of semiconductor materials, knowing how to reconstruct the bands of a p-n diode and understand their operating principle. Have some basic knowledge about elementary particles and nuclear processes that involve them with particular attention to the damage or benefits that can be derived from them*
Criteria for assessment and attribution of the final mark	*The final grade is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18*
Additional information	