UNIVERSITÀ DI PAVIA

Anno Accademico 2019/2020

QUANTUM ELECTRONICS	
Anno immatricolazione	2019/2020
Anno offerta	2019/2020
Normativa	DM270
SSD	FIS/03 (FISICA DELLA MATERIA)
Dipartimento	DIPARTIMENTO DI INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE
Corso di studio	ELECTRONIC ENGINEERING
Curriculum	Photonics
Anno di corso	1°
Periodo didattico	Primo Semestre (30/09/2019 - 20/01/2020)
Crediti	6
Ore	48 ore di attività frontale
Lingua insegnamento	English
Tipo esame	SCRITTO E ORALE CONGIUNTI
Docente	PIRZIO FEDERICO (titolare) - 6 CFU
Prerequisiti	The Mathematical and Physical concepts given by the 1st Level Degree (Mechanics and Electromagnetism, Geometry and Algebra, Mathematical Methods courses). The concepts illustrated in the course of “Fotonica” (Photonics) are important but not essential
Obiettivi formativi	The aim of the course is to give a correct quantum-mechanical description of the radiation-matter interaction and provide the physical tool necessary to understand the functioning of LASERs. At the end of the course, the students should possess the basic concepts of Quantum Mechanics, the main aspects of the radiaton-matter interaction and should be able to qualitatively and quantitatively describe the functioning of a LASER oscillator.
Programma e contenuti	Wave-particle duality, experimental facts Quantum Mechanics Postulates, Schrödinger Equation

	Eigenvalue problems, some examples of representative potentials Angular momentum, Hydrogen Atom and Periodic Table of Elements Identical Particles, Spin, Fermions and Bosons Statistics Time Independent Perturbation Theory Time Dependent Potentials, Perturbative method Electric Dipole interaction Fermi Golden Rule Absorption, Spontaneous and Stimulated Emission, Einstein's A and B coefficients Density Matrix, radiation-matter interaction 3- and 4-levels systems, rate equations Optical resonators Free running laser operation Q-Switching and Mode-Locking regimes Some representative example of lasers (Gas lasers, Solid-state lasers, Fiber Lasers, Semiconductor Lasers)
Metodi didattici	Lectures (hours/year in lecture theatre, blackboard + slides): 44 Practical class (hours/year in lecture theatre): 2 Practicals / Workshops (hours/year in lab): 2
Testi di riferimento	There are many wonderful books about the topics we will cover in this Course. A lot of them are available at the Faculty Library. I will not follow a specific textbook, but students can refer to: A. Yariv. Quantum Electronics. Wiley. D. J. Griffiths. Introduction to Quantum Mechanics (2nd Edition). Pearson Prentice Hall. C.L. Tang. Fundamentals of quantum mechanics, for solid state electronics and optics. Cambridge University Press. W. Koechner. Solid.State Laser Engineering (6th Edition). Springer. This book can be considered the "Holy Bible" of solid-state lasers Engineers.
Modalità verifica apprendimento	The final exam will consist of an oral discussion about the topics introduced during the course. The student will select a specific topic to start from among those presented during classes. During the exam, the Teacher will evaluate the general knowledge of the matter and will verify the effective level of understanding of the main topics covered in the course. The final mark will be depending also on the ability of the student present the concepts and to make use of a correct scientific language.
Altre informazioni	The final exam will consist of an oral discussion about the topics introduced during the course. The student will select a specific topic to start from among those presented during classes. During the exam, the Teacher will evaluate the general knowledge of the matter and will verify the effective level of understanding of the main topics covered in the course. The final mark will be depending also on the ability of the student present the concepts and to make use of a correct scientific

	language.
Obiettivi Agenda 2030 per lo sviluppo sostenibile	$lbl_legenda_sviluppo_sostenibile