UNIVERSITÀ DI PAVIA

Anno Accademico 2014/2015

SEMICONDUCTOR NANOSTRUCTURES

Enrollment year	2013/2014
Academic year	2014/2015
Regulations	DM270
Academic discipline	FIS/03 (MATERIAL PHYSICS)
Department	DEPARTMENT OF PHYSICS
Course	
Curriculum	FISICA TEORICA
Year of study	2°
Period	2nd semester (02/03/2015 - 12/06/2015)
ECTS	6
Lesson hours	48 lesson hours
Language	ITALIAN
Activity type	ORAL TEST
Teacher	GERACE DARIO (titolare) - 4 ECTS GERACE DARIO (titolare) - 2 ECTS
Prerequisites	Basic notions of quantum physics, electromagnetism, optics, solid-state physics. The course is held in the second semester, with attendance of 'Solid State Physics I' as a valuable prerequisite.
Learning outcomes	Learning of basic concepts and physical phenomena related to semiconductor nanostructures.
Course contents	The course deals with semiconductor nanostructures, i.e., low-dimensional systems giving rise to quantum confinement effects for electrons and holes in one, two or three dimensions. The following subjects will be treated: First-principles calculations, band discontinuities. Heterostructures, envelope-function method. Two-dimensional systems: quantum wells, superlattices, hetero-interfaces. Absorption and emission, interband and intersubband transitions in quantum wells, semiconductor laser. Confined excitons

	and polaritons. Tunnelling and negative differential resistance, tunnelling diode, resonant tunnelling in double-barrier structures. Effects of electric and magnetic fields. Quantum Hall effect, integer and fractional. One- and zero-dimensional systems: quantum wires and quantum dots, electronic levels, transport and optical properties, correlation effects. Photonic confinement (semiconductor microcavities and photonic crystals, short mention).
Teaching methods	=
Reccomended or required readings	L.C. Andreani, Lecture notes (1998/1999). P.Y. Yu, M. Cardona, Fundamentals of Semiconductors: Physics and Material Properties, 3rd edition (Springer, 2005).). J.H. Davies, The Physics of Low-dimensional Semiconductors: An Introduction (Cambridge University Press, 1998).
Assessment methods	Oral examination. For the examination it is recommended to focus on physical aspects (qualitative trends, figures, methods for measuring various physical properties) rather than on a detailed study of mathematical derivations.
Further information	Oral examination. For the examination it is recommended to focus on physical aspects (qualitative trends, figures, methods for measuring various physical properties) rather than on a detailed study of mathematical derivations.
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile