UNIVERSITÀ DI PAVIA

Anno Accademico 2020/2021

PHOTONICS	
Enrollment year	2019/2020
Academic year	2020/2021
Regulations	DM270
Academic discipline	FIS/03 (MATERIAL PHYSICS)
Department	DEPARTMENT OF PHYSICS
Course	PHYSICAL SCIENCES
Curriculum	Fisica teorica
Year of study	2°
Period	1st semester (05/10/2020 - 20/01/2021)
ECTS	6
Lesson hours	48 lesson hours
Language	Italian
Activity type	ORAL TEST
Teacher	LISCIDINI MARCO (titolare) - 6 ECTS
Prerequisites	This course has no prerequisites other than the knowledge of basic concepts in electromagnetic theory and quantum mechanics. This course is complemental to those dealing with optics, semiconductor, nanostructures, and solid state physics.
Learning outcomes	The student will learn how to deal with classical and quantum electromagnetic phenomena in realistic systems, including micro and nano structures, with particular emphasis on light propagation in waveguides, light confinement in optical resonators, and light generation by various classical and quantum phenomena (e.g. LASER, second harmonic generation, spontaneous parametric down-conversion, spontaneous four-wave mixing, etc ...).
Course contents	The course covers the main concepts in the field of classical and quantum photonics and is divided in 5 building blocks: (1) Elements of classical and quantum optics, including quantization of the

	electromagnetic field in micro and nanostructures; (2) light propagation in dielectric waveguides; (3) Optical resonators and cavities; (4) quantum light-matter interaction (e.g. spontaneous emission and LASERs); (5) Classical and quantum nonlinear optics.
Teaching methods	The teaching activity is in strong interaction with students, trying to stimulate a dialogue. Lessons are mostly held on the chalkboard, with course material accessible to the students through KIRO and the course website. In some cases small experiments are performed along with slides/videos.
Reccomended or required readings	A. Yariv, "Quantum electronics", third edition (Wiley, New York, 1989) A. Yariv and P. Yeh, "Photonics" (Oxford University Press, 2007)) B.E.A. Saleh, M.C. Teich, "Fundamentals of Photonics", second edition (Wiley, 2007)) E. Rosencher, B. Vinter, "Optoelectronics" (Cambridge University Press, 2002)) R. Loudon, “The Qauntum Theory of light” (Oxford University Press 2008)) J.D. Joannopoulos, S. G. Johnson, J. N. Winn, and R. D. Meade "Photonic Crystals: Molding the Flow of Light," second edition (Princeton, 2008))
Assessment methods	The final mark is determined after an oral examination. During the class there will be homework assignments. Each student can decide whether the marks obtained in the assignments should be considered in the final evaluation or not. In the first case (i.e. without home assignment), The oral exam will deal only with three of the five main topics of the course. At least one of the topic has to be either (4) Quantum light-matter interaction or (5) Classical and quantum nonlinear optics. In the second case, the assignments will be considered in the evaluation, and the oral exam will deal only with two of the five main topics of the course. At least one of the topic has to be either (4) Quantum light-matter interaction or (5) Classical and quantum nonlinear optics.
Further information	The final mark is determined after an oral examination. During the class there will be homework assignments. Each student can decide whether the marks obtained in the assignments should be considered in the final evaluation or not. In the first case (i.e. without home assignment), The oral exam will deal only with three of the five main topics of the course. At least one of the topic has to be either (4) Quantum light-matter interaction or (5) Classical and quantum nonlinear optics. In the second case, the assignments will be considered in the evaluation, and the oral exam will deal only with two of the five main topics of the course. At least one of the topic has to be either (4)

	Quantum light-matter interaction or (5) Classical and quantum nonlinear optics.
Sustainable development goals - Agenda 2030	The goals