

Lecture course type: Seminars - Academic Year 2019/20

Period: I Semester

Title: Integrated Photonics – PIXAPP Advanced Integrated Photonic Education Program

Teacher: Dr. Francesco Floris (email: francesco.floris@tyndall.ie)

Level: Master Degree and Ph.D.

Credits: 3

Contents:

- PART 1 – Optics: [6h] {H}
 - Geometrical Optics: diottro, critical angle
 - Physical Optics: polarization, interference and coherence effects, diffraction, Fermat principle, Huygens-Fresnel principle
 - Electromagnetic Optics: Bloch-Floquet theorem, introduction to Fourier optics, convolution
- PART 2 - Guided Propagation: [10h]
 - Electromagnetism in solid state systems: continuous and discrete translational symmetry, photonic band structure, rotational symmetry, mirror symmetry and TE and TM mode separation, time-reversal invariance {J}
 - Optical fibers based on total internal reflection confinement: total internal reflection confinement mechanism, coherence, propagation and attenuation {Y}, {S}
 - Photo-physical properties of stratified media {D}
 - Symmetric and asymmetric slab waveguide: guided and leaky modes {Y}
- PART 3 – Confinement: Optical Resonators and Photonic Crystals: [8h]
 - Optical resonators based on total internal reflection confinement:
 - * 1D - Fabry-Pérot resonator {Y}, {S}
 - * 2D - Optical ring resonator {Y}
 - * 3D - Optical whispering gallery modes resonator {H}
 - Photonic Crystals: {J}
 - * 1D - Bragg Reflector: stop band and stop band confinement, nanotechnology applications
 - * 2D - Planar cavity and slab waveguide: photonic band gap and stop band confinement, nanotechnology applications
 - * 3D – Tri-dimensional cavity: photonic band gap and stop band confinement, nanotechnology applications

Texts and supporting material: {H} Hecht - Theory and Problems of Optics (Schaum); {J} Joannopoulos - Photonic Crystals: Molding the Flow of Light; {Y} Yariv e Yeh - Photonics: optical electronics in modern communications (Oxford University Press); {S} Saleh e Teich - Fundamentals of Photonics (Wiley); {D} Class notes provided by the teacher

Teaching style: Front lectures

Exam: oral examination. It is suggested to focus mainly on the physical aspects of the contents rather than on the detailed memorization of the mathematical passages

Language: English