

Electromagnetics for Photonics (RP 4.1.7)

Electrodynamics: Ohm's law, Electromotive force, Faraday's law, Lenz's law; Maxwell's equations; Boundary conditions; Scalar and vector potentials. Poynting vector. 3

Electromagnetic Waves: Wave equations; Polarization; Boundary conditions: reflection and transmission; EM waves in non conducting media; Reflection and transmission; Snell's law; Brewster angle; EM waves in conductors: Reflection and transmission; Dispersion; Free electrons in conductors and plasmas; Plasma frequency. 5

Guided Waves: Rectangular metallic waveguides; Coaxial lines; Modes; Dielectric Waveguides: planar and cylindrical. EM wave propagation and modes in step and graded index fibres. Dispersion: chromatic and polarization mode 7

Wave propagation in Anisotropic Media: Birefringence; Optical activity; Index ellipsoid; Electro-optic effect; applications 4

Wave propagation in periodic media: Bloch waves; Bragg reflectors; Periodic waveguides; Spectral Filters and Bragg gratings; 2D and 3D periodic media: concept of EM band gap materials and Photonic crystals. 5

Optical Properties of Materials; Refractive index; phase and group velocity, Complex refractive index and light absorption, Kramers-Kronig relation; Resonance absorption; Lattice absorption; Band-to-band absorption; Free carrier absorption; Light scattering : Rayleigh, Mie 5

EM wave propagation in gain media: Absorption, spontaneous and stimulated emission; Einstein coefficients; Population inversion and gain; Amplification of EM waves 3