

Topics in mid-term test

1. Photon energy; basic concept of laser operation; wave parameters (η , β or k , average Poynting vector $\langle \vec{S} \rangle$) and Maxwell's equation; reflection & refraction of EM wave (Snell's law, θ_B , θ_C , TE & TM polarization); plane wave; power reflectance and transmittance; time varying field versus phasor; properties of media (linear, homogeneous, dispersive and isotropic).
2. Parameters for material dispersion (group velocity and index, D_ν , D_λ); conversion between parameters ($\Delta\lambda$ and $\Delta\nu$, D_ν and D_λ); Lorentz model; χ' & χ'' versus absorption & refractive index; FWHM width
3. Fermat's Principle; ray matrices; modeling of spherical cavity; stability criteria; ray position
4. Interference effect (constructive, destructive conditions), interference in a FP cavity or etalon; resonant conditions for phase and amplitude; power transmittance of FP cavity; effect of input angle and length variation;

lossless and lossy resonators (free spectral range, finesse, Q factor, linewidth or bandwidth, photon lifetime); similar concepts applied to traveling cavity