ECE 476/576

HW #3

6.11

$\tau_p = \frac{3/c}{1 - T_2R_1R_2R_3} = 78.7$ ns;

$\therefore \Delta\omega_{1/2} = 1/\tau_p = 12.7\times10^{+6}$ r/s; $\omega_0 = 2.98^{+15}$ r/sec; Q= $2.43\times10^{+8}$

6.20

Round–trip time = 5 nsec = $\frac{2d}{c}$; $\therefore$ d = 75 cm; $\nu_0 = 5.37\times10^{+14}$ Hz

Using the slope at t = 0, τ_p = 75 nsec (by extrapolating) = $\frac{2d/c}{1 - R_1R_2}$; $\therefore$ $R_1R_2 = 0.933$

$\Delta\nu_{1/2} = \frac{1}{2\pi\tau_p} = 2.12\times10^{+6}$ Hz; $\therefore$ $Q_0 = 2.53\times10^{+8}$ and $F = \frac{c/2d}{\Delta\nu_{1/2}} = \frac{200\times10^{+6}}{2.12\times10^{+6}} = 94.2$

With pumping, the photon lifetime increases to: τ_p = 125 nsec = $\frac{2d/c}{1 - G^2R_1R_2}$

$\therefore$ $G^2R_1R_2 = 0.960$; Using the value of R_1R_2 found above leads to: $G^2 = 1.0286$ or G = 1.0142 = $\exp[\gamma_0 l_g]$; $\therefore$ $\gamma_0 = 1.878\times10^{-4}$ cm^{-1}

6.29

(a) At A, $(\omega/c)n_1d = q\pi$; at B $(\omega/c)n_2d = (q+1)\pi$; subtract: $n_2 - n_1 = \lambda_0/2d = 3.16\times10^{-5}$.

(b) The FSR = c/2d = 30 GHz which corresponds to the spacing between the peaks of 32divisions; The FWHM is ~2.2 divisions;

Thus F = 32/2.2 = 14.5. $\Delta\nu_{1/2}$ = 30 GHz÷F = 2.06 GHz; $\nu = 4.74\times10^{14}$ Hz;

$Q = \nu/\Delta\nu_{1/2} = 2.3\times10^5$.