PHYS3038 HW5 Solution

4.10 The solution is trivial.

4.40 $r_\perp = -0.235$, $r_\parallel = 0.198$, hence $E_{R\parallel} = 1.98V/m$, $E_{R\perp} = 4.7V/m$.

4.46 Since $\sin x = x - \frac{x^3}{3!} + \cdots$, so $\sin(\alpha \pm \beta) = (\alpha \pm \beta)[1 - (\alpha \pm \beta)^2/6]$. With Snell's law, one can find $\theta_t \pm \theta_i = \theta_i[1 \pm \frac{1}{n}\left(1 - \frac{n^2-1}{6n^2}\theta_i{}^2\right)]$. Put this into Eq.(4.42), the result can be proved.

4.68 $R = \left(\frac{E_{or}}{E_{oi}}\right)^2 = \frac{E_{or\perp}{}^2 + E_{or\parallel}{}^2}{E_{oi\perp}{}^2 + E_{oi\parallel}{}^2}$

$$= \frac{r_\perp{}^2}{1 + (E_{oi\parallel}/E_{oi\perp})^2} + \frac{r_\parallel{}^2}{1 + (E_{oi\perp}/E_{oi\parallel})^2}$$

$$= r_\perp{}^2 sin^2(\gamma_i) + r_\parallel{}^2 cos^2(\gamma_i)$$

$$T_{\perp,\parallel} = \left(\frac{n_t cos\theta_t}{n_i cos\theta_i}\right) t_{\perp,\parallel}{}^2 = T_\perp sin^2(\gamma_i) + T_\parallel cos^2(\gamma_i).$$

7.9 $E = -2E_0 sinkxsin\omega t$. It's a standing wave with the period of λ, and the nodes at $x = m\lambda$.

7.18 The bandwidth should be 40 KHz to cover the audible range.

7.24 The prove is trivial.