Physics 471 Exam 4

Winter 2009 Bret Hess 422-2108

Closed book. No time limit. Student graphing calculators OK

CID _____

$$r_s = \frac{\sin\theta_t\cos\theta_i - \sin\theta_i\cos\theta_t}{\sin\theta_t\cos\theta_i + \sin\theta_i\cos\theta_t} = -\frac{\sin(\theta_i-\theta_t)}{\sin(\theta_i+\theta_t)} = \frac{n_i\cos\theta_i - n_t\cos\theta_t}{n_i\cos\theta_i + n_t\cos\theta_t}$$

$$t_s = \frac{2\sin\theta_t\cos\theta_i}{\sin\theta_t\cos\theta_i + \sin\theta_i\cos\theta_t} = \frac{2\sin\theta_t\cos\theta_i}{\sin(\theta_i+\theta_t)} = \frac{2n_i\cos\theta_i}{n_i\cos\theta_i + n_t\cos\theta_t}$$

$$r_p = \frac{\cos\theta_i\sin\theta_i - \cos\theta_t\sin\theta_t}{\cos\theta_t\sin\theta_t + \cos\theta_i\sin\theta_i} = \frac{\tan(\theta_i-\theta_t)}{\tan(\theta_i+\theta_t)} = \frac{n_t\cos\theta_i - n_i\cos\theta_t}{n_i\cos\theta_t + n_t\cos\theta_i}$$

$$t_p = \frac{2\cos\theta_i\sin\theta_t}{\cos\theta_t\sin\theta_t + \cos\theta_i\sin\theta_i} = \frac{2\cos\theta_i\sin\theta_t}{\sin(\theta_i+\theta_t)\cos(\theta_i-\theta_t)} = \frac{2n_i\cos\theta_i}{n_i\cos\theta_t + n_t\cos\theta_i}$$

$$T = \frac{n_t\cos\theta_t}{n_i\cos\theta_i}|t|^2$$

$$|E_{\text{eff}}| = \sqrt{{E_{0x}}^2 + {E_{0y}}^2}$$

$$\alpha = \frac{1}{2}\tan^{-1}\left[\frac{2E_{0x}E_{0y}\cos\varepsilon}{{E_{0y}}^2 - {E_{0y}}^2}\right]$$

$$E_\alpha = |E_{\text{eff}}|\sqrt{{E_{0x}}^2\cos^2\alpha + {E_{0y}}^2\sin^2\alpha + E_{0x}E_{0y}\cos\varepsilon\sin 2\alpha}$$

$$E_{\alpha\pm\pi/2} = |E_{\text{eff}}|\sqrt{{E_{0x}}^2\sin^2\alpha + {E_{0y}}^2\cos^2\alpha - E_{0x}E_{0y}\cos\varepsilon\sin 2\alpha}$$

$$n = \frac{n_o n_e}{\sqrt{n_o^2\sin^2\phi + n_e^2\cos^2\phi}} \qquad \tan\phi' \equiv \frac{S_y}{S_z} = \frac{n_o^2}{n_e^2}\tan\phi$$

$$\begin{bmatrix}\cos^2\theta & \sin\theta\cos\theta\\ \sin\theta\cos\theta & \sin^2\theta\end{bmatrix}\begin{bmatrix}\cos 2\theta & \sin 2\theta\\ \sin 2\theta & -\cos 2\theta\end{bmatrix}$$

$$\begin{bmatrix}\cos^2\theta + i\sin^2\theta & \sin\theta\cos\theta - i\sin\theta\cos\theta\\ \sin\theta\cos\theta - i\sin\theta\cos\theta & \sin^2\theta + i\cos^2\theta\end{bmatrix}$$

$$\begin{bmatrix}E_{\text{I}}\\ H_{\text{I}}\end{bmatrix} = \begin{bmatrix}\cos k_0 h & (i\sin k_0 h)/\Upsilon_1\\ \Upsilon_1 i\sin k_0 h & \cos k_0 h\end{bmatrix}\begin{bmatrix}E_{\text{II}}\\ H_{\text{II}}\end{bmatrix} \qquad h \equiv nd\cos\theta$$

$$\Upsilon_1 \equiv \sqrt{\frac{\epsilon_0}{\mu_0}}\, n_1\cos\theta_{i\text{II}}$$

$$r = \frac{\Upsilon_0 m_{11} + \Upsilon_0\Upsilon_s m_{12} - m_{21} - \Upsilon_s m_{22}}{\Upsilon_0 m_{11} + \Upsilon_0\Upsilon_s m_{12} + m_{21} + \Upsilon_s m_{22}}$$

$$t = \frac{2\Upsilon_0}{\Upsilon_0 m_{11} + \Upsilon_0\Upsilon_s m_{12} + m_{21} + \Upsilon_s m_{22}}$$

$\varepsilon_o = 8.854\times10^{-12}\ \text{C}^2/\text{N}\cdot\text{m}^2$

$\mu_o = 4\pi\times10^{-7}\ \text{T}\cdot\text{m/A}$

$c = 2.9979\times10^{8}\ \text{m/s}$

$q_e = 1.602\times10^{-19}\text{C}$

$m_e = 9.108\times10^{-31}\text{kg}$

$k_B = 1.380\times10^{-23}\ \text{J/K}$

$h = 6.626\times10^{-34}\ \text{J}\cdot\text{s}$

$\hbar = h/2\pi = 1.054\times10^{-34}\ \text{J}\cdot\text{s}$

$\sigma = 5.670\times10^{-8}\ \text{W/m}^2\cdot\text{K}^4$

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