EE 434 Electromagnetic Waves, Spring 2010
Exam 3 May 3, 2010
Equations

$$\epsilon_0 = 8.854 \times 10^{-12}\,\frac{\mathrm{F}}{\mathrm{m}} \qquad \mu = 4\pi \times 10^{-7}\,\frac{\mathrm{H}}{\mathrm{m}}$$

$$\vec{H} = \frac{I\,dl}{4\pi}\sin\theta\left(\frac{j\beta}{r} + \frac{1}{r^2}\right)e^{-j\beta r}\hat{\phi}$$

$$\vec{E} = \frac{j\eta I dl}{2\pi\beta}\left[\cos\theta\left(\frac{j\beta}{r^2} + \frac{1}{r^3}\right)\hat{r} - \frac{1}{2}\sin\theta\left(-\frac{\beta^2}{r} + \frac{j\beta}{r^2} + \frac{1}{r^3}\right)\hat{\theta}\right]e^{-j\beta r}$$

$$\vec{P}_{\mathrm{avg}} = \frac{1}{2}Re\left[\vec{E}_0 \times \vec{H}_0^*\right] \qquad \vec{P}_{\mathrm{avg}} = \frac{\eta}{2}\left(\frac{\beta I\,dl\sin\theta}{4\pi r}\right)^2\hat{r} \qquad P_{\mathrm{tot}} = \frac{\eta\beta^2 I^2\,dl^2}{12\pi}$$

$$\vec{H} = \frac{jI_0}{2\pi\sin\beta_0 l}\frac{e^{-j\beta_0 r}}{r}F(\theta)\,\hat{\phi} \qquad \vec{E} = \frac{j\eta_0 I_0}{2\pi\sin\beta_0 l}\frac{e^{-j\beta_0 r}}{r}F(\theta)\,\hat{\theta}$$

$$F(\theta) = \frac{\cos(\beta_0 l\cos\theta) - \cos(\beta_0 l)}{\sin\theta}$$

$$E = V_0 F(\theta,\phi)\sum_{i=0}^{N-1}\frac{e^{-j(\beta r_i + \psi_i)}}{r_i} \qquad AF = \frac{1}{N}\frac{\sin\left(N\frac{\chi}{2}\right)}{\sin\left(\frac{\chi}{2}\right)} \qquad \chi = \beta d\cos\phi - \psi$$

$$D = \frac{4\pi\,I}{P_{\mathrm{tot}}} \qquad D_0 = \frac{4\pi\,I_{\mathrm{max}}}{P_{\mathrm{tot}}}$$