25-7. (a) $\delta_{\mathrm{Al}} = \left(\frac{2}{\sigma\,\mu_0\,\omega}\right)^{1/2} = \left(\frac{2}{3.54\times 10^7\,(4\,\pi\times 10^{-7})\,2\,\pi\times 6\times 10^4}\right)^{1/2}\mathrm{m} = 0.345\,\mathrm{mm}$

(b) $\delta_{\mathrm{s.w.}} = \left(\frac{3.54\times 10^7}{4.3}\right)\times\delta_{\mathrm{Al}} = 0.991\,\mathrm{m}\approx 1\,\mathrm{m}$

25-8. $\delta_{\mathrm{Ag}} = \left(\frac{\lambda}{\sigma\,\mu_0\,\pi\,c}\right)^{1/2} = \left(\frac{0.1}{3\times 10^7(4\,\pi\times 10^{-7})\,\pi\,(3\times 10^8)}\right)^{1/2}\mathrm{m} = 1.68\times 10^{-6}\,\mathrm{m} = 1.68\,\mu\mathrm{m}$

As long as the silver coating is thicker than this the silver-plated brass component would work.

25-9. (a) $I = I_0\,e^{-\alpha x}\Rightarrow (I/I_0) = (1/4) = e^{-\alpha x} = e^{-\alpha(3.42\,\mathrm{m})}\Rightarrow 3.42\,\alpha = \ln(4)\Rightarrow \alpha = 0.405\,\mathrm{m}^{-1}$

(b) $(I/I_0) = (1/100) = e^{-(0.405\,\mathrm{m}^{-1})x}\Rightarrow (0.405\,\mathrm{m}^{-1}) = \ln(100)\Rightarrow x = 11.37\,\mathrm{m}$

14-2. In general $\tilde{\boldsymbol{E}} = \left[E_{0x}e^{i\varphi_x}\hat{x}\hat{\boldsymbol{x}} + E_{0y}\,e^{i\varphi_y}\,\hat{\boldsymbol{y}}\right]e^{i(kz-\omega t)} = \begin{bmatrix}E_{0x}e^{i\varphi_x}\\ E_{0y}\,e^{i\varphi_y}\end{bmatrix}e^{i(kz-\omega t)} = \tilde{\boldsymbol{E}}_0$

(a) $\tilde{\boldsymbol{E}} = [E_0\hat{\boldsymbol{x}} - E_0\hat{\boldsymbol{y}}]e^{i(kz-\omega t)}\Rightarrow \tilde{\boldsymbol{E}}_0 = E_0\begin{bmatrix}1\\ -1\end{bmatrix}\Rightarrow \frac{1}{\sqrt{2}}\begin{bmatrix}1\\ -1\end{bmatrix}$. Linearly polarized at $-45°$.

(b) $\tilde{\boldsymbol{E}} = [E_0\hat{\boldsymbol{x}} + E_0\hat{\boldsymbol{y}}]e^{i(kz-\omega t)}\Rightarrow \tilde{\boldsymbol{E}}_0 = E_0\begin{bmatrix}1\\ 1\end{bmatrix}\Rightarrow \frac{1}{\sqrt{2}}\begin{bmatrix}1\\ 1\end{bmatrix}$. Linearly polarized at $45°$.

(c) $\tilde{\boldsymbol{E}} = \left[E_0\hat{\boldsymbol{x}} + E_0e^{-i\pi/4}\hat{\boldsymbol{y}}\right]e^{i(kz-\omega t)}\Rightarrow \tilde{\boldsymbol{E}}_0 = E_0\begin{bmatrix}1\\ e^{-i\pi/4}\end{bmatrix}\Rightarrow \frac{1}{\sqrt{2}}\begin{bmatrix}1\\ \frac{1}{\sqrt{2}}(1-i)\end{bmatrix}$. Then,

$$\tan 2\alpha = \frac{2E_{0x}E_{0y}\cos\varepsilon}{E_{0x}^2 - E_{0y}^2}\to\infty\Rightarrow 2\,\alpha = 90°,\,\alpha = 45°$$

Right elliptically polarized at 45°.

(d) $\tilde{\boldsymbol{E}} = \left[E_0\hat{\boldsymbol{x}} + E_0e^{i\pi/2}\hat{\boldsymbol{y}}\right]e^{i(kz-\omega t)}\Rightarrow \tilde{\boldsymbol{E}}_0 = E_0\begin{bmatrix}1\\ e^{i\pi/2}\end{bmatrix}\Rightarrow \frac{1}{\sqrt{2}}\begin{bmatrix}1\\ i\end{bmatrix}$. Left-circularly polarized.

14-3. In general $\tilde{\boldsymbol{E}} = \left[E_{0x}e^{i\varphi_x}\hat{\boldsymbol{x}} + E_{0y}\,e^{i\varphi_y}\,\hat{y}\hat{\boldsymbol{y}}\right]e^{i(kz-\omega t)} = \begin{bmatrix}E_{0x}e^{i\varphi_x}\\ E_{0y}\,e^{i\varphi_y}\end{bmatrix}e^{i(kz-\omega t)} = \tilde{\boldsymbol{E}}_0e^{i(kz-\omega t)}$

(a) $\tilde{\boldsymbol{E}} = (2\,E_0\hat{\boldsymbol{x}} + 0\hat{\boldsymbol{y}})e^{i(kz-\omega t)}\Rightarrow \tilde{\boldsymbol{E}}_0 = 2\,E_0\begin{bmatrix}1\\ 0\end{bmatrix}$. Linearly polarized along the x-direction. Velocity is in the $+z$-direction. The amplitude is $A = 2\,E_0\sqrt{1^2+0^2} = 2\,E_0$.

(b) $\tilde{\boldsymbol{E}} = (3E_0\hat{\boldsymbol{x}} + 4E_0\hat{\boldsymbol{y}})e^{i(kz-\omega t)}\Rightarrow \tilde{\boldsymbol{E}}_0 = E_0\begin{bmatrix}3\\ 4\end{bmatrix}$. The polarization direction makes the angle α with the x-axis where,

$$\alpha = \tan^{-1}(4/3) = 53°$$

The wave is traveling in the $+z$-direction with amplitude $A = \sqrt{3^2+4^2}\,E_0 = 5\,E_0$.

(c) $\tilde{\boldsymbol{E}} = 5\,E_0(\hat{\boldsymbol{x}} - i\hat{\boldsymbol{y}})e^{i(kz+\omega t)}\Rightarrow \tilde{\boldsymbol{E}}_0 = 5E_0\begin{bmatrix}1\\ -i\end{bmatrix}$. The propagation is in the $+z$-direction. The wave is right-circularly polarized with amplitude. The electric field vector traces out a circle of radius $5\,E_0$.

14-4. (a) $\tilde{\boldsymbol{E}}_1 = E_{01}(\hat{\boldsymbol{x}} - \hat{\boldsymbol{y}})e^{i(kz-\omega t)} \Rightarrow \tilde{\boldsymbol{E}}_{01} = 2\,E_{01}\begin{bmatrix} 1 \\ -1 \end{bmatrix}$. This is linearly polarized along $-45°$

$\tilde{\boldsymbol{E}}_2 = E_{02}\left(\sqrt{3}\hat{\boldsymbol{x}} + \hat{\boldsymbol{y}}\right)e^{i(kz-\omega t)} \Rightarrow \tilde{\boldsymbol{E}}_{02} = E_{02}\begin{bmatrix} \sqrt{3} \\ 1 \end{bmatrix}$. This is linearly polarized along $\alpha = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right) = 30°$

The angle between the two is 75°.

(b) $\tilde{\boldsymbol{E}}_{01} \cdot \tilde{\boldsymbol{E}}_{02} = E_{01}\,E_{02}(\sqrt{3} - 1) = (\sqrt{2}\,E_{01}\,)\,(\sqrt{3 + 1^2}\,E_{02})\cos(\theta_{12}) \Rightarrow \cos\theta_{12} = \frac{\sqrt{3} - 1}{2\,\sqrt{2}} \Rightarrow \theta_{12} = 75°$