# PC2232: Physics for Electrical Engineers

**Tutorial 1 Answers**

1. (a) $f = 5.45 \times 10^{14}$ s$^{-1}$

   (b) $\omega = 3.42 \times 10^{15}$ rad s$^{-1}$
   $k = 1.14 \times 10^{7}$ rad m$^{-1}$

   (c) $B_0 = 2 \times 10^{-6}$ T

   (d) $\vec{E}(t, y) = 600 \sin(3.42 \times 10^{15} t - 1.14 \times 10^{7} y)\hat{k}$
   $\vec{B}(t, y) = (2 \times 10^{-6}) \sin(3.42 \times 10^{15} t - 1.14 \times 10^{7} y)\hat{i}$
   We assumed it was traveling in the positive $y$ direction

2. (a) $\lambda_g = 3.81 \times 10^{-7}$m

   (b) $\lambda_a = 5.26 \times 10^{-7}$m

   (c) $n = 1.38$

   (d) $K = 1.91$

3. (a) $P_{\text{rad}} = 1.34 \times 10^{-11}$Pa

   (b) $E_0 = 1.23$ Vm$^{-1}$
   $B_0 = 4.10 \times 10^{-9}$ T

   (c) $u = 6.69 \times 10^{-12}$ Jm$^{-3}$

   (d) $50 - 50\%$

5. (c) $\Delta = \pi + 2\theta_a^A - 4 \sin^{-1}\left[\dfrac{\sin\theta_a^A}{n}\right]$

6. (a) $\hat{E} = -\dfrac{2}{3}\hat{i} + \dfrac{\sqrt{5}}{3}\hat{j}$

   (b) $E_0 = 9 \times 10^{4}$ Vm$^{-1}$

   (c) Direction: $\dfrac{\sqrt{5}}{3}\hat{i} + \dfrac{2}{3}\hat{j}$

   (d) $|k| = \pi \times 10^{7}$m$^{-1}$

   (e) $\lambda = 2 \times 10^{-7}$ m

   (f) $f = 1.5 \times 10^{15}$ s$^{-1}$

   (g) $v \approx 3 \times 10^{8}$ ms$^{-1}$