



UNIVERSIDADE da MADEIRA
Electromagnetism

Series of problems 9

1. A current of 0.100 A is charging a 5.00 cm squared plate capacitor. The separation between plates is 4.00 mm. Find:
 - (a) The rate of time change (i.e. the time-derived) of the electrical flux between the plates.
 - (b) The displacement current between the plates.
2. A 0.200 A current is charging a 10.0 cm radius circular-plate capacitor. If the separation between plates is 4.00 mm,
 - (a) What is the rate of change in time (i.e. the time-derived) of the electric field between plates?
 - (b) What is the magnetic field between plates 5.00 cm from the center?
3. The electric field vector of an electromagnetic wave is given by

$$\mathbf{E}(x, t) = E_0 \sin(kx - \omega t) \mathbf{j} + E_0 \cos(kx - \omega t) \mathbf{k}.$$
 - (a) Find the corresponding magnetic field.
 - (b) Calculate $\mathbf{E} \cdot \mathbf{B}$ e $\mathbf{E} \times \mathbf{B}$.

Solutions:

- 1a) $\frac{d\Phi_E}{dt} = \frac{I}{\epsilon_0} = 11,3 \times 10^9 \text{ V m s}^{-1}$; 1b) $I_d = I = 0,100 \text{ A}$; 2a) $\frac{dE}{dt} = \frac{I}{\epsilon_0 A} = 7,19 \times 10^{11} \text{ V m}^{-1} \text{ s}^{-1}$; 2b) $B = 2,00 \times 10^{-7} \text{ T}$; 3a) $\mathbf{B} = \frac{E_0 k}{\omega} (0; -\cos(kx - \omega t); \sin(kx - \omega t))$; 3b) $\mathbf{E} \cdot \mathbf{B} = 0$; $\mathbf{E} \times \mathbf{B} = \left(\frac{E_0^2 k}{\omega}; 0; 0 \right)$.