

ENEL 476
Assignment #1 – 2015
Chapter 9

Due on February 6, 2015
4 pm

Drop boxes on ICT 2nd floor

9.2, 9.6, 9.16, 9.26, 9.42

- 9.2 The circuit in Figure 9.18 exists in a magnetic field $\mathbf{B} = 40 \cos(30\pi t - 3y)\mathbf{a}_z$ mWb/m². Assume that the wires connecting the resistors have negligible resistances. Find the current in the circuit.

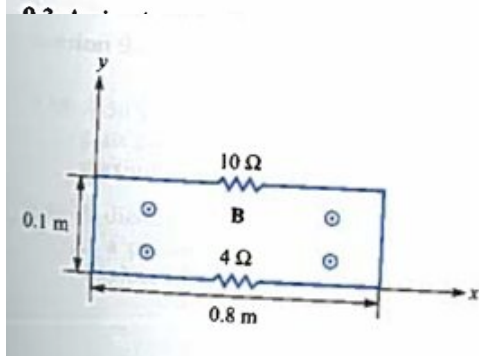
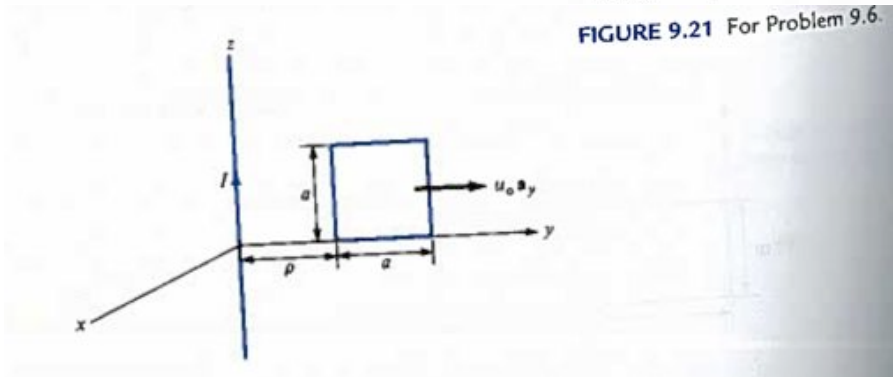


FIGURE 9.18 For Problem 9.2.

- 9.6 A square loop of side a recedes with a uniform velocity $u_0\mathbf{a}_y$ from an infinitely long filament carrying current I along \mathbf{a}_z as shown in Figure 9.21. Assuming that $\rho = \rho_0$ at time $t = 0$, show that the emf induced in the loop at $t > 0$ is

$$V_{\text{emf}} = \frac{u_0 a^2 \mu_0 I}{2\pi \rho(\rho + a)}$$

FIGURE 9.21 For Problem 9.6.



Find the displacement current density and displacement current.

9.16 A dielectric material with $\mu = \mu_0$, $\epsilon = 9\epsilon_0$, $\sigma = 4 \text{ S/m}$ is placed between the plates of a parallel-plate capacitor. Calculate the frequency at which the conduction and displacement currents are equal.

9.25 Given that $\mathbf{E} = E_0 \cos(\omega t - \beta z) \mathbf{a}_x \text{ V/m}$ in free space, determine \mathbf{D} , \mathbf{H} , and \mathbf{B} .

9.26 In a certain material, $\sigma = 0$, $\mu = \mu_0$, and $\epsilon = 81\epsilon_0$. The magnetic field intensity in this material is $\mathbf{H} = 10 \cos(2\pi \times 10^9 t + \beta x) \mathbf{a}_z \text{ A/m}$. Determine \mathbf{E} and β .

9.42 Let $\mathbf{H} = 40 \cos(10^9 t - \beta z) \mathbf{a}_x \text{ A/m}$ in a region for which $\sigma = 0$, $\mu = \mu_0$, $\epsilon = 4\epsilon_0$.
(a) Express \mathbf{H} in phase form. (b) Find \mathbf{J}_d .

9.43 Given that