ÇANKAYA UNIVERSITY

PHYS 132 – PHYSICS II

CHAPTER 32

MAXWELL'S EQUATIONS, MAGNETISM OF MATTER

PROBLEM SET

1) Determine the rate at which the electric field changes between the round plates of a capacitor, 6.0 cm in diameter, if the plates are spaced 1.1 mm apart and the voltage across them is changing at a rate of 120 V/s. **[Answer: $\mathbf{1.1 \times 10^5 \frac{V/m}{s}}$]**

2) *** Calculate the displacement current I_D between the square plates, 5.8 cm on a side, of a capacitor if the electric field is changing at a rate of 2.0×10^6 $\mathrm{V/m \cdot s}$.
[Answer: $\mathbf{6.0 \times 10^{-8}}$ A]

3) At a given instant, a 2.8-A current flows in the wires connected to a parallel-plate capacitor. What is the rate at which the electric field is changing between the plates if the square plates are 1.60 cm on a side? **[Answer: $\mathbf{1.2 \times 10^{15}}$ $\mathbf{V/m \cdot s}$]**

4) *** A 1500-nF capacitor with circular parallel plates 2.0 cm in diameter is accumulating charge at the rate of 38.0 mC/s at some instant in time. What will be the induced magnetic field strength 10.0 cm radially outward from the center of the plates? What will be the value of the field strength after the capacitor is fully charged?
[Answer: $\mathbf{7.60 \times 10^{-8}}$ T; after fully charged,magnetic field will be zero]

5) *** Suppose an air-gap capacitor has circular plates of radius $R = 2.5$ cm and separation $d = 1.6$ mm. A 76.0-Hz emf, $\varepsilon = \varepsilon_0 cos\omega t$, is applied to the capacitor. The maximum displacement current is 35 μA. Determine (*a*) the maximum conduction current *I*, (*b*) the value of ε_0, (*c*) the maximum value of $d\phi_E/dt$ between the plates. Neglect fringing.
[Answer: a) 35 μA, b) 6700 V, c) $\mathbf{4.0 \times 10^6 \frac{V \cdot m}{s}}$]