***New York City College of Technology***

***Fall 2013***

***Homework 1***

***Chapter 6***

**1 The voltage between two parallel plates separated by a distance of 5mm is 200V. Determine the electric field intensity.**

$$E=\frac{V}{d}=\frac{200 V}{0.005 m}=40,000 V/m$$

**2 The voltage between two parallel plates separated by a distance for 0.4in is 60V. Determine the electric field intensity.**

1in = 0. 254 m

0.4in = 0.01016

$$E=\frac{V}{d}=\frac{60 V}{0.01016 m}=5,905 V/m$$

**3 The electric field intensity in the region between two parallel plates separated by a distance of 4cm is 2KV/m. Determine the voltage between the plates.**

$$E=\frac{V}{d} = V=E x d=2000 x 0.04=80V$$

**4 The electric field intensity in the region between two parallel plates separated by a distance of 8mm is 200V/mm. Determine the voltage between the plates.**

$$E=\frac{V}{d}= V=E x d=200 x 8=1600V$$

**5 A direct current of 5A is flowing a conductor. Determine the magnetic field intensity at a distance of 3m from the conductor.**

$$H=\frac{I}{2πd}=\frac{5A}{2π.3}=265mA/m$$

**6 A direct current of 4mA is flowing in a conductor. Determine the magnetic field intensity at a distance of 5ft from the conductor.**

1ft = 0.3048m

5ft = 1.524m

$$H=\frac{I}{2πd}=\frac{0.004A}{2π.1.524}=265mA/m$$

**7 For the parallel plates of Problem 6-3 determine the electric flux density if the dielectric is polyethylene (**$ϵ\_{r}=2.25$**).**

$$\in =\in \_{r}x \in \_{°} \in =2.25 x (8.842x10^{-12}F/m)=19.895 x10^{-2}F/m$$

$$D=\in \_{}x E=19.895 x10^{-12}F/m x 2000V/mm =39.79 nC/m^{2}$$

**8 For the parallel plates of Problem 6-4, determine the electric flux density if the dielectric is air.**

$$D=\in \_{}x E=8.84\frac{x10^{-12}F}{m}x (\frac{200V}{m}x\frac{1mm}{0.001})=17.68 μC/m^{2}$$

**9 For the current carrying conductor of Problem 6-5, determine the magnetic flux density at a distance of 3m from the conductor if the medium is air**.

$$B=μ x H=\left(1.2566x10^{-6}\right)X(0.265A/m)=332nC/m^{2} $$

**10 For the current carrying conductor of Problem 6-6, determine the magnetic flux density at a distance of 5ft from the conductor if the medium is air.**

$$B=μ x H=\left(1.2566x10^{-6}\right)X(0.0417/m)=52.4nC/m^{2}$$

**11 The electric flux density normal to a rectangular surface with dimensions 8m x 75cm is 4μC/m2. Determine the value of the electric flux across the area.**

$$ψ=DxA=6m^{2}x 4μC/m^{2}=2.4μC$$

**12 The electric flux density normal to a circular surface with a diameter of 3m is 8μC/m2. Determine the value of the electric flux across the area**.

$$A=π x r^{2}=3.14 x (1.5)^{2}=7.068$$

$$ψ=DxA=7.068m^{2}x 8μC/m^{2}=0.56μC$$

**13 the magnetic flux density normal to a circular surface with a radius of 5m is 4nWb/m2. Determine the value of the magnetic flux across the area.**

$$A=π x r^{2}=3.14 x (5)^{2}=78.54$$

$$ϕ=BxA=4nWb/m^{2}x 78.54m^{2}=0.314μWb$$

**14 The magnetic flux density normal to a rectangular surface with dimensions 30cm x 60cm is 12nWb/m2. Determine the value of the magnetic flux across the area.**

$$a=b x h=30cm x 60cm=1800cm^{2} or 0.18m^{2} $$

$$ϕ=BxA=12nWb/m^{2}x 0.18m^{2}=2.16nWb$$

**15 A current of 8A is uniformly distributed over a rectangular conductor with dimensions 5mm x 4mm. Determine the current density.**

$$a=b x h=5mm x 4mm=20mm^{2} or 2x10^{-5}m^{2} $$

$$J=\frac{I}{a}=\frac{8A}{2x10^{-5}m^{2}}=400000A/m^{2}$$

**16 A current of 4A is uniformly distributed over a circular conductor with a diameter of 3cm. Determine the current density.**

$$A=π x r^{2}=3.14 x (0.15)^{2}=7.06x10^{-4}m^{2}$$

$$J=\frac{I}{a}=\frac{4A}{7.06x10^{-4}m^{2}}=5658.84A/m^{2}$$

**17 Assume that the conductivity for the conductor of Problem 6-15 is 5MS/s. Determine the electric field intensity.**

$$E=\frac{J}{δ}=\frac{400A/m^{2}}{5x10^{6}S/m}=80μV/m$$

**18 Assume that the conductivity for the conductor of Problem 6-16 is 6 x107 S/m. Determine the electric field intensity.**

$$E=\frac{J}{δ}=\frac{142.85A/m^{2}}{6x10^{7}S/m}=2.38μV/m$$

**19 The rms magnitude of the magnetic field of a plane wave in air is** $H\_{y}=200μA/m$**. Assuming the E is in the positive x-direction, determine the following for a circular surface of diameter 50m in the x-y plane over which the field are constant.**

1. Ex

$$\frac{E\_{x}}{H\_{y}}=η E\_{x}=\frac{η }{H\_{y}}=\frac{377Ω}{200μA/m}=1.885MV/m $$

1. Pz

$$℘\_{z}=\frac{E\_{x}}{η}=\frac{1.885MV/m}{377Ω}=9425MW/m^{2}$$

1. **Total power transmitted through area**

$$A=π x r^{2}=3.14 x (25m)^{2}=78.58m^{2}$$

$$P=℘\_{z} x A=9425MW/m^{2} x 78.54m^{2}=740MW$$

**20 The rms magnitude of the electric field of a plane wave in a sea water (**$ϵ\_{r}=2.25$**) is Ex = 3V/m. Assuming that H is in the positive y-direction, determine the following for a square surface with sides of 15m each in the x-y plane over which the fields are constant:**

1. **Hy**

$$\frac{E\_{x}}{H\_{y}}=η H\_{y}=\frac{E\_{x} }{η}=\frac{3V/m}{377Ω}=7.95mA/m$$

1. **Pz**

$$℘\_{z}=\frac{E\_{x}}{η}=\frac{3V/m}{377Ω}=23.8mW/m^{2}$$

1. **Total power transmitted through area**

$$A=L^{2}=(15m)^{2}=225m^{2}$$