B.Tech Ist Year II Mid-Term (I Semester) Examination, 2015-16

Engineering Physics (AHP-1001)

Time: 90Minutes **M.M. 20**

Section A

Note: Attempt all questions. **(1 × 5 = 5)**

I. State the Gauss's law of electrostatics.
II. Write down the equation of continuity.
III. Express the Poynting vector in terms of electromagnetic fields.
IV. If the skin-depth of EM wave in sea water is 0.005m, calculate the attenuation constant.
V. Write the relation between E, D and P applicable in dielectric medium.

Section B

Note: Attempt any three questions. **(2 × 3 = 6)**

I. Determine the conduction and displacement current densities in a material having conductivity 10^{-4} S/m and ε_r = 2.25. The electric field in the material is $5x10^{-6}$ sin ($9x10^9$ t) V/m.

II. The permeability, permittivity and conductivity of aluminum are μ_r =1, ε_r =1 and $\sigma = 3.50x10^7$ mho/m. Find the skin depth and wave velocity, if the wave enters into the conductor with frequency 100 MHz

(P.T.O)

III. If earth receives 5 cal min^{-1} cm^{-2} solar energy, what are the amplitudes of electric and magnetic fields of radiation?

IV. A 0.3 cm thick insulator of dielectric constant 10 is filled inside the plates, separated by 1 cm and area of plates 100 cm^2 of a parallel plate capacitor, the potential difference between the plates is 100V. Find the value of D and P.

Section C

Note: Attempt any three questions. **(3 × 3 = 9)**

I. Find the expression for electric field due to a non-conducting charged sphere of radius R at the points considered (i) inside the sphere (ii) at the surface of sphere and (iii) outside the sphere.

II. State and prove the Poynting theorem.

III. Show that the electromagnetic waves travel in free space with the speed of light.

IV. Derive the expression for local field in a dielectric and hence obtain the Clausius-Mossotti relation.

Physical Constants

Permeability of free space $\mu_0 = 4\pi x10^{-7}$ N/A^2

Permittivity of free space $\varepsilon_0 = 8.85X10^{-12}$ $C^2/N\text{-}m^2$