Total No. of Questions :8]

SEAT No. :

PB3832

[Total No. of Pages : 3

[6262]-94

T.E.(Electronics & Telecommunication)
ELECTROMAGNETIC FIELD THEORY
(2019 Pattern)(Semester -I)(304182)

Time : 2½ Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Solve Q.No.1or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No8.***
2) ***Figures to the right side indicate full marks.***
3) ***Assume suitable data, if necessary.***

Q1) a) Derive the boundary condition between Conductor and Free space for static electric field. **[8]**

b) Derive an expression for energy stored and energy density in electrostatic field. **[9]**

OR

Q2) a) For a parallel plate capacitor area of plate A=12 cm^2 spacing between plates d=5 mm, separated by dielectric of $\varepsilon_r = 12$, connected to a 40 V battery find: Capacitance, Electric field intensity E, flux density D and an energy stored in the capacitor. **[8]**

b) Region-1 is semi-infinite space in which $2x - 5y > 0$, while for region-2, $2x - 5y < 0$. Let $\mu r_1 = 3, \mu r_2 = 4$, H_1=30 a_x' A/m. Find B_1,H_{t2},$H_{N2}$and H_2. (Magnetic flux density in region 1-B_1, Tangential component of Magnetic field intensity in region 2 - H_{t2}, Normal component of Magnetic field intensity in region 2-H_{N2} and Magnetic field intensity in region 2-H_2). **[9]**

Q3) a) State and explain Maxwell's equations for time varying field in detail. **[10]**

b) State and explain the Faradays ' law and Lenz's law with suitable example. **[8]**

OR

Q4) a) At frequency of 3000 MHz, the dielectric constant of ice made from pure water has values of 3.20, while the loss tangent is 0.0009. If a uniform plane wave with a amplitude of 100 V/m at $z = 0$ is propagating through such ice, find the time-average power density at $z = 0$ and $z = 10$ m for the given frequency. **[8]**

P.T.O.

b) Let $\mu = 10^{-5}$ H/m = 4 × 10^{-9}F/m, $\sigma = 0$, and $\rho v = 0$. Find k (including units) so that each of the following pairs of fields satisfies Maxwell's equations:

(i) D = $6a_x - 2y\, a_y + 2z\, a_z$ nC/m^2, H = $kx\, a_x + 10y\, a_y - 25z\, a_z$ A/m;

(ii) E = $(20y - kt)a_x$ V/m, H = $(y + 2\times10^6 t)a_z$ A/m. **[10]**

Q5) a) Derive the Helmholtz Wave Equation in terms of electric field intensity and magnetic field intensity for the charge free region. **[8]**

b) A 9.375-GHz unifrom plane wave is propagating in polyethylene with $\varepsilon_r = 2.26$, $\mu_r = 1$. If the amplitude of the electric field intensity is 500 V/m and the material is assumed to be lossless, find: **[10]**

i) The phase constant

ii) The wavelength in the polyethlene

iii) The velocity of propagation

iv) The intrinsic impedance

v) The amplitude of the magic field intensity.

OR

Q6) a) Define the terms: Phase velocity ,Group Velocity, propagation constant, wavelength and intrinsic impedance. **[8]**

b) Derive the expression for reflection coefficient and transmission coefficient for normal incidence of uniform plane wave. **[10]**

Q7) a) A lossless transmission line with $Z_0 = 75\,\Omega$ is 30m long and operates at 2MHz. The line is terminated with a load $Z_L = 90 + j60\,\Omega$. If velocity u=0.6c on the line, where C is velocity of light using Smith chart **[10]**

i) Reflection coefficient

ii) Standing wave ratio

iii) Input impedance

iv) Load admittance

b) State and explain primary and secondary constants of transmission line. **[7]**

OR

Q8) a) A generator of 1v, 1 KHz supplies power to a 100 Km open wire transmission line terminated in Z0. The line parameters are, $R=10.4\,\Omega$/ Km, L=0.00367 H/Km, $G=0.8\times10^{-6}$ mho/Km,

$C=0.00835\times10^{-6}$ F/Km.

Calculate Z_0 α, β, λ, and velocity (v). **[9]**

b) Derive general, soution of transmission line. Also explain its physical significance. **[8]**