Total No. of Questions : 8]

SEAT No. :

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T.E. (E & TC Engineering)

ELECTROMAGNETIC FIELD THEORY

(2019 Pattern) (Semester - I) (304182)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data if necessary.***
4) ***Use of a calculator is allowed.***
5) ***Neat diagrams must be drawn wherever necessary.***

Q1) a) For a parallel plate capacitor, area of plate A = 120cm^2, spacing between plates d = 5mm, separated by dielectric of ϵr = 12, connected t_0 40V battery. Find **[8]**

i) Capacitance

ii) E

iii) D

iv) Energy stored in Capacitor

b) Derive boundary conditions that exist between two different magnetic materials. **[10]**

OR

Q2) a) Derive an expression for capacitance parallel plate capacitor. **[8]**

b) A boundary exists at Z = 0 between two dielectrics $\epsilon r1$=2.5 in region Z<0 and $\epsilon r2$=4 in region Z>0. The field in the region $\epsilon r1$ is E=30a_x + 50a_y + 70a_z v/m. Find **[10]**

i) Normal Component of E_1

ii) Tangential Component of E_1

iii) Angle α_1 between E_1 and normal to surface

iv) Normal Component of D_2

v) Tangential Component of D_2

vi) Angle α_2 between D_2 and normal to surface

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Q3) a) State and prove Poynting theorem. State significance of Poynting Vector. **[8]**

b) What do you mean by displacement current. Prove that displacement current density is given by $J_d = \partial D/\partial t$. **[10]**

OR

Q4) a) Given $H=H_m e^{j(wt+\beta z)} a_x$ a/m in free space. Find E using Maxwell equation. **[8]**

b) Write Maxwell equation for free space in point form and integral form for static electric field. **[10]**

Q5) a) Find the skin depth of frequency of 1.6MHz in aluminium whose $\sigma = 38.2$ Ms/m and $\mu_r = 1.0$. Also find propagation constant and wave velocity. **[8]**

b) Derive the wave equation for free space in terms of electric field intensity. **[8]**

OR

Q6) a) For uniform plane waves explain Depth of penetration. **[8]**

b) For uniform plane waves explain the term Snell's Law. **[8]**

Q7) a) A generator of 1V, 1KHz supplies power to 100 km long transmission line, terminated in Zo and having following parameters. R = 10.4 Ω/km, L = 0.00367 H/km, G = 0.8×10^{-6} mho/km and C = 0.00835×10^{-6} F/km. Calculate characteristics impedance, propagation constant, reflection coefficient K. **[8]**

b) What is meant by dissipation less line? Derive an expression for input impedance of dissipation less line. **[10]**

OR

Q8) a) A transmission line cable has following primary constants
R = 11 Ω/km G = 0.8μmho/km L = 0.00367H/km C = 8.35nF/km at a signal of 1khz calculate : **[10]**

i) Characteristic Impedance Z_0
ii) Attenuation Constant a Np/km
iii) Phase Constant β radians/km
iv) Wave Length λ in km
v) Velocity of signal in km/sec

b) A transmission line has a characteristic impedance $69\angle -12°\Omega$ is terminated 200Ω resistor. Determine **[8]**

i) VSWR
ii) Reflection coefficient

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