Printed Pages : 4 EEC-303

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0324 Roll No. | | | | | | | | | | |

B. Tech.

(Semester-III) Theory Examination, 2011-12

ELECTROMAGNETIC FIELD THEORY

Time : 3 Hours] *[Total Marks : 100*

Note : Attempt questions from each Section as per directions.

Section-A

1. Write short answers : 2×10=20

(a) Given $\overline{A} = 2a_x + 4a_y - 3a_z$ and $\overline{B} = a_x - a_y$, find $A.B$.

(b) Show that :

$\overline{A} = 4a_x - 2a_y - a_z$ and $\overline{B} = a_x + 4a_y - 4a_z$ are perpendicular.

(c) Define line charge.

(d) Define Gauss' law.

(e) Define Ampere's law.

(f) Explain Stoke's theorem.

(g) Define conduction current.

(h) For a given medium the characteristic impedance is $150 < 30° \ \Omega$. The loss tangent of this medium is _____ .

(i) Define reflection coefficient.

(j) Define standing wave ratio.

Section-B

2. Attempt *all* parts : $6 \times 5 = 30$

(a) State and explain the Divergence theorem. Given a vector $\overline{A} = 3xa_x + ya_y + 5za_z$, find the curl of $\overline{A}$.

(b) A charge $Q_1 = -10\text{nC}$ is at the origin in free space. If the x-component of E is to be zero, at the point (3, 1, 1), what charge Q_t should be kept at the point (2, 0, 0)?

(c) State and explain Biot-Savart law.
If the magnetic field $\overline{H} = 100\sin\theta a_\theta$ A/m in spherical coordinates, determine J at $(10, \pi/2, 0)$.

(d) Given $E = 10\sin(\omega t - \beta z)a_y$ V/m in free space, determine $\overline{D}, \overline{B}, \overline{H}$.

(e) A lossless transmission line of length 100 m has an inductance of 28 μH and a capacitance of 20 nF. Find :

(i) Propagation velocity

(ii) Phase constant at an operating frequency of 100 kHz.

(iii) Characteristic impedance of the line.

Section-C

3. Attempt any *five* parts : 10×5=5(

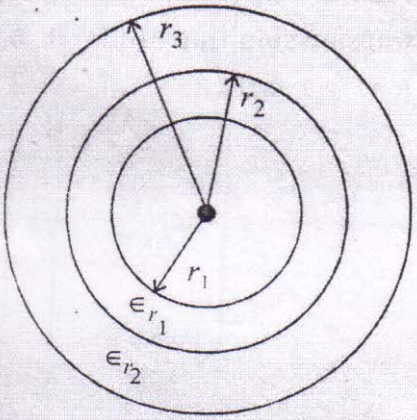
(a) Three equal point charges of 2 μC are i
free space at (0, 0, 0), (2, 0, 0) and (0, 2, 0
respectively. Find net force on $Q_4 = 5\mu C$ a
(2, 2, 0).

(b) Define electric flux density.

A point charge $Q = 10nC$ is at the origin in fre
space. Find the electric field at $\rho(1, 0, 1)$. Als
find the electric flux density at ρ.

(c) Define polarization.

The cable shown in figure below is 10 km
long. If $r_1 = 10$ mm, $r_2 = 15$ mm, $r_3 = 20$ mm
$\epsilon_{r_1} = 2.0$, $\epsilon_{r_2} = 4.0$, find the capacitance o
the cable.



(d) Two homogenous, linear and isotropic media have an interface at $x=0$. $x<0$ describe medium 1 and $x>0$ describe medium 2, $\mu_{r_1}=12$ and $\mu_{r_2}=5$. The magnetic field in medium 1 is $150a_x - 400a_y + 250a_z$ A/m. Determine :

(i) Magnetic field in medium 2.

(ii) Magnetic flux density in medium 1 and 2.

(e) State and explain the Maxwell's equation in differential and integral form.

(f) Derive the relation between E and H in uniform plane wave.

(g) Define different types of looses in transmission line.

(h) Find the input impedance of 75Ω lossless transmission line of length 0.1λ when the load is a short.