4E4133

Roll No. _____ Total No. of Pages : 6

4E4133

B. Tech. IV-Sem. (Main / Back) Exam; April-May 2017

Electronics & Communication Engg.

4EC4A Electromagnetic Field Theory

Time : 3 Hours

Maximum Marks : 80
Min. Passing Marks : 24

Instructions to Candidates :-

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*
Units of quantities used / calculated must be stated clearly.
Use of following supporting materials is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

UNIT - I

1 If the electric field intensity is given by $\vec{E} = 30i + 2xy^2\hat{j} + 5xz^2\hat{k}$ then find

(i) The work done in moving $20\mu c$ from origin to (1,2,0) in this field.

(ii) The work done in a circular path of radius 2 meter in xy plane for unit positive charge

(iii) The electric field in cylindrical co-ordinate system.

4+4+8=16

OR

1 (a) If the charge density is given by $p(x,y,z) = \frac{20}{x} + y^2 z$ then find the total charge in a cube placed in first quardant as shown in fig-1.

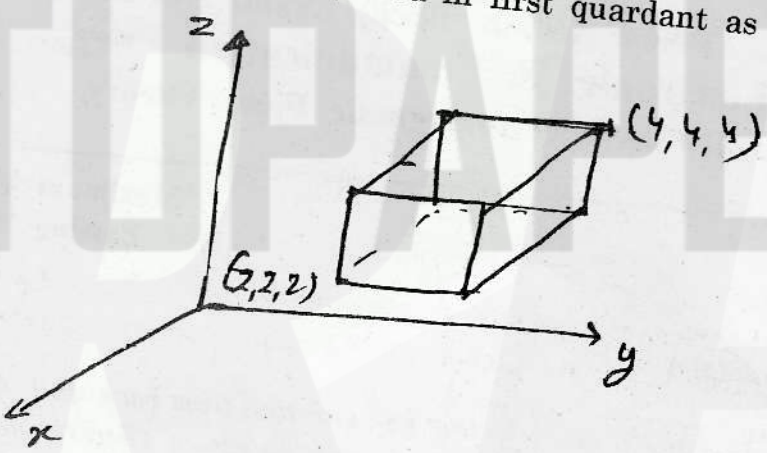

Fig. 1

(b) Explain the use of following w.r. to field theory. **10**

(i) Curl

(ii) Divergence

(iii) Stokes theorem

(iv) Divergence theorem.

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UNIT - II

2 Prove that :

(i) Equipotential surface is normal to electric field intensity.

(ii) Normal component of electric flux density passes without any change at the interface when charge density at interface is zero.

(iii) $\nabla \cdot D = \rho_v$

(iv) $\nabla \times E = 0$ in static field.

4×4=16

OR

2 (a) Find the electric field intensity at any point due to a charge density

$\rho(x, y, z) = 20x^2y^2z\ c/m^s$

Also find the electric field at

(i) Origin and

(ii) (0, 0, 2)

Assume the medium has relative permittivity $E_r = 4$

(b) Find the electrical energy stored in a sphere of radius = 2 meter around a point charge of 10 μc placed at the centre of this sphere. Assume the relative permittivity is $E_r = 2$. 10

UNIT - III

3 (a) Find the magnetic field intensity in medium-2 (fig.2) 6

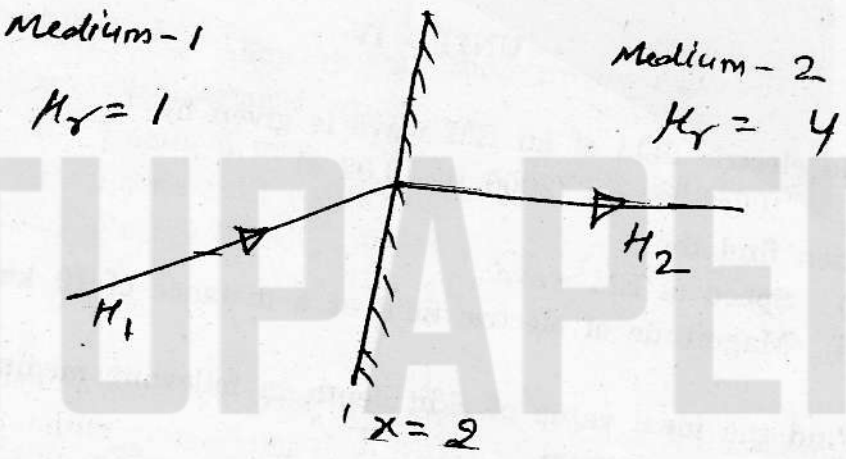

Fig. 2

Assume $\mu_1 = 20i + yj + a\hat{k}$ and current density at interface is zero.

(b) Prove that

(i) $\nabla \cdot B = 0$

(ii) $\vec{B} = \nabla \times \vec{A}$.

4+4=8

OR

3 (a) Find the analogous relation of following in magnetic field.

(i) $V(x,y,z) = \frac{1}{4\pi t_0} \int \frac{p(x,y,z)dv}{r}$

(ii) $\nabla^2 V = \frac{P}{\in}$

4+4=8

(b) A current loop (2×4) cm^2, carrying 2 ampere current is placed in yz plane. Find torque on it if the magnetic field at that region is given $\vec{B} = 200\hat{j} + 10\hat{k}$

8

UNIT - IV

4 (a) The electric field of an EM wave is given by
$E_x = 100e^{-0.02z} \sin(2000\ t - 0.02\ z)$
Then find the
(i) Speed of EM wave
(ii) Magnitude of electric field at a distance of 10 km

4×2=8

(b) Find the ideal value of skin depth in following medium
(i) Perfect vacuum
(ii) Perfect conductor at DC
(iii) Perfect conductor at f = 10 GHz
(iv) Conductor with conductivity $\sigma = 10^6$ SΩ at f = 10^9 Hz

4×2=8

OR

4 (a) A wave is incident from medium 1 to medium 2 then find its (fig 3)

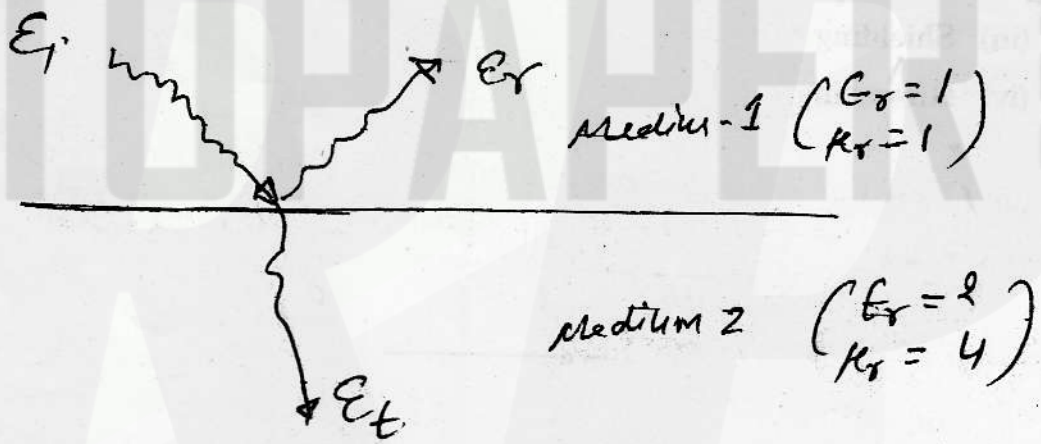

Fig. 3

(i) reflected power
(ii) transmitted power.

(b) Define the following with their proper expressions : 4+4=8

(i) Displacement vector
(ii) Depth of penetration
(iii) Phase shift coefficient
(iv) Energy density of EM wave. 4×2=8

UNIT - V

5 Find the radiation resistance of dipole antenna. 16

OR

5 Write short notes on any two :

(i) EMI testing

(ii) EMC

(iii) Shielding

(iv) Grounding.

8×2=16