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SE-8282

B. E. III (Sem. - V) (ECC) Examination

May/June – 2011

Engineering Electromagnetics

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

Intructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. 3 (Sem. - 5) (ECC)**

Name of the Subject :

☛ **Engineering Electromagnetics**

☛ Subject Code No. : **8 2 8 2** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Attempt all questions.
(3) Assume suitable data wherever necessary.
(4) Figures to the right indicate full marks.

SECTION - I

1 (a) Answer the following : **10**

(i) At every point in space $a\phi . a\theta = 1$. True/false.

(ii) Define : the gredient of a scalar.

(iii) Which of the following is zero ?

(a) Grad div
(b) Div grad
(c) Curl grad
(d) Curl curl

(iv) Express $P\left(2, 30^\circ, 5\right)$ in cartesian co-ordinates.

(v) Define potential and potential difference.

(b) Explain corss product of vector. **4**

(c) Determine gradient of following scalar field. **6**

(i) $U = x^2 y + xy^2$

(ii) $v = \rho z \sin\theta + z^2 \cos^2\theta + \rho^2$

(iii) $f = \cos\theta \ \sin\theta \ln r + r^2\theta$

2 (a) State Coloumb's law and Derive expression for electric field intensity due to point charge. 8

(b) Evaluate both sides of divergence theorm for the field $D = 2xyax + x^2 ay \; {}^{c}/_{m^2}$ and the rectangular parallel piped formed by the planes $x = 0$ and $x = 1$, $y = 0$ and 2, and $z = 0$ and 3. 7

OR

(a) Derive the potential field of a system of point charges. 8

(b) Three field quantities are given by 7

$\vec{P} = 2a_x - a_z$

$\vec{Q} = 2a_x - a_y + 2a_z$

$\vec{R} = 2a_x - 3a_y + a_z$

Determine

(i) $\left(\vec{P} + \vec{Q}\right) \times \left(\vec{P} - \vec{Q}\right)$

(ii) $\vec{Q} \bullet \vec{R} \bullet \times \vec{P}$

(iii) $\vec{P} \bullet \vec{Q} \times \vec{R}$

3 Attempt any **three :** 15

(i) Gauss law for differential valume elements.

(ii) Uniqueness theorm.

(iii) Poison's and laplace equations and their significance.

(iv) Maxwell's eq^{n} in point form and integral form.

(v) Derivations of boundarg conditions for perfect dielectric materials.

SECTION - II

4 (a) Fill in the blank from the given options : 5

(i) _____law is used to find current enclosed within a circuit.

(A) Biot - Savart's law

(B) Amperes' circuital law

(C) Divergence theorem

(D) Gauss law

(ii) The magnetic field out of the parallel plate capacitor is_____

(A) Unity

(B) Zero

(C) Maximum

(D) Minimum

(iii) Total electromagnetic force can be obtained from_____

(A) $Q\vec{E}$

(B) $Q\vec{B}$

(C) $Q\vec{E}+Q\left(\vec{u}\times\vec{B}\right)$

(D) $Q\left(\vec{u}\times\vec{B}\right)$

(iv) Stoke's theorem can be written as

(A) $\nabla\bullet D=\rho_v$

(B) $\nabla\bullet B=0$

(C) $\oint D\bullet ds=\int \nabla\bullet D\,dv$

(D) $\oint A\bullet dl=\int_S (\nabla\times A)dS$

(v) Gauss law for magnetic field is $\int B\bullet ds=$____

(A) $\nabla\bullet B$

(B) Zero

(C) $\int D\bullet ds$

(D) ρ_v

4 (b) Define the following : **5**

(i) Homogeneous dielectric material.

(ii) Magnetic dipole moment.

(iii) Torque

(iv) Magnetic field B

(v) Magnetization.

(c) Match the following : **5**

(Analogy between electric and magnetic circuits)

A	B
1) Current $I=\int J\bullet ds$	1) Flux $\phi=\int B\bullet ds$
2) Resistance R	2) Field intensity H
3) Field intensity E	3) Reluctance R
4) Electromotive force (emf)	4) Flux density $B=\frac{\psi}{S}$
5) Current density J=I/S	5) Magnetomotive force (mmf)

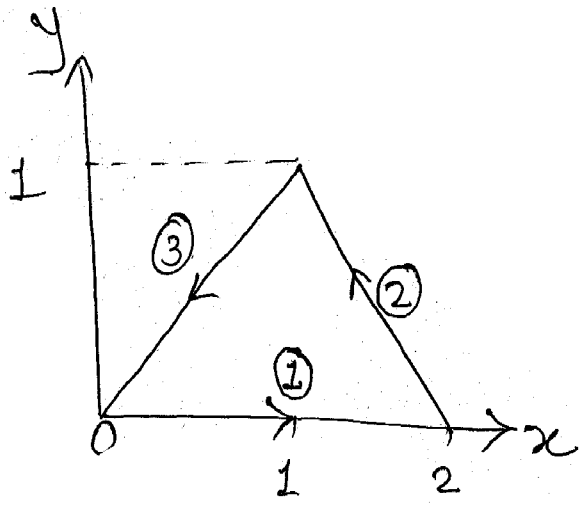
(d) Determine curl of each of following vector : **5**

(i) $\vec{P} = x^2 yz\ \vec{a}_x + xz\ \vec{a}_z$

(ii) $Q = \rho \sin\phi\ \vec{a}_\rho + \rho^2 z\ \vec{a}_\phi + Z\cos\phi\ \vec{a}_z$

5 (a) Derive the boundary conditions that H and / or B satisfy at the interface between two diff. media. **8**

(b) The conducting triangular loop in figure given below carries a current of 10A. Find H at (0,0,5) due to side - 1 of the loop. **7**



OR

(a) For any straight filamentary conductor of finite length, derive Biot-Savart's law. **8**

(b) Determine H at (0.4, 0.3, 0) in the field of an 8A filamentary current directed inward from infinite to the origin on the positive x-axis and then outward to infinity along the y axis. **7**

6 Attempt any **three** : **15**

(i) Poison's and Lapace equations and their significance.

(ii) Continuity equation.

(iii) Ampere's circuital law.

(iv) Wave motion in free space.

(v) Conductor dielectric boundary conditioins.
