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SF-8343

B. E. - III (Sem. - VI) (Electrical) Examination

May/June – 2011

Theory of Electromagnetic

(New Syllabus)

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

Instructions :

(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. - 6) (ELECTRICAL)

Name of the Subject :

☛ THEORY OF ELECTROMAGNETIC (NEW SYLLABUS)

☛Subject Code No. : 8 3 4 3 ☛Section No. (1, 2,.....) : 1&2

Seat No. :

Student's Signature

(2) Attempt all question.
(3) Figure to the right indicates full marks.
(4) Assume necessary data wherever required.
(5) Scientific calculator up to Casio-100D, 100MS series is permitted.

SECTION - I

Q-1 (a) **(06)**

1) Define Unit Normal Vector

2) What is a (range) limit of θ in case of Spherical Coordinate system (r, θ, Φ).

3) Explain in brief the term "Gradient".

4) Define Scalar Magnetic Potential

5) State Coulomb's Law

6) A Point is represented in Cartesian coordinate as P (2, 3,6) , the radial component r in cylindrical coordinate will be _____ r in spherical coordinates.
Less than (b) greater than (c) equal to (d) not related to

(b) 1) State Gauss's law **(08)**

2) Give relation between spherical coordinate and Cartesian coordinate.

3) Find vector A directed from P (2, -4, 1) to Q (0 , -2, 0) in Cartesian coordinate.

4) If two vectors $\mathbf{a} = 2i + \lambda j + k$ and $\mathbf{b} = 4i - 2j - 2k$ are perpendicular to each other then determine the value of λ .

(c) Vertices of triangle is given as A(6, -2, 1) , B(-2, 4, -3) and C (-2, 1, 5) find (1) Area of the triangle (b) θ_{bac} at A (3) Vector projection of R_{ab} on R_{ac}. **(06)**

Q-2 (a) Transform following vectors to spherical coordinates at specified point **(06)**
1) $6a_x + 2a_y$ at P (r=4 , $\theta = 25^0$, $\varphi = 120^0$)
$4a_x - 2a_y - 3a_z$ at Q (x= -2, y = -3, z = 4)

(b) A sheet of charge $\rho s = 2\ nC/m^2$ is present at the plane x=3 in freee space and a line charge of having density $\rho l = 20\ nC/m$ is located at x=1 and z=1 . Find the E at (1) origin (2) at P(4,5,1) **(07)**

(c) A charge is distributed uniformly over the plane z = 10cm with a density of $\rho s = (1 / 3\pi)\ nC/m^2$. find E. **(02)**

OR

Q-2 (a) An in finitely long uniform line charge of having density $\rho_l = 30\ nC/m$, find the E at (1) origin (2) at P(0,6,1) (3) at Q(5,6,1) **(08)**

(b) Define stream line **(02)**

(c) Write divergence theorem with necessary expression. **(05)**

Q-3 Attempt any Three **(15)**

(1) Derive the integral and point form of continuity equation.

(2) Explain the concept of potential gradient and derive the relationship between E and V.

(3) Derive the boundary conditions at a conductor free space boundary.

(4) Point charges of 1 μc and -1 μc are located at (0,0,0.5) and (0,0,-0.5) respectively. Treating these two charges as a dipole at the origin. calculate (1) V at point P(3,0,4) (2) $E_{magnitude}$ at point P

(5) A parallel plate capacitor, for which $C = \epsilon E/d$, has a constant voltage V applied across the plates. Find the stored energy in the electric fields.

SECTION - II

Q-4 (a) Fill in the following blanks. **(05)**

1. Two potential functions V_1 & V_2 satisfy Laplace's equation within a closed region and assume the same values on its surface, V_1 must be equal to V_2. **(True or False)** **01**
2. The relationship between flux density B, magnetic field intensity H and magnetization M is given by _____. **01**
3. Define vector magnetic potential. **01**
4. In a time varying magnetic field $\nabla.H$ = _____ and $\nabla \times H$ = _____. **01**
5. Integral form of Gauss's law is _____. **01**

(b) **Match the Following:** (05)

A	B
1. Reluctance	a. Tesla
2. Magnetic Field Intensity	b. AT / Wb
3. M.M.F.	c. Webber
4. Flux	d. AT
5. Flux Density	e. A / m

(c) State and explain Maxwell's expression for time varying field in point and integral forms. (08)

(d) Explain Lorentz force equation. (02)

Q-5 (a) State Ampere's Circuital Law and derive the point form of Ampere's Circuital Law. (08)

(b) A current element, $I_1\Delta L_1 = 10^{-5} a_z A.m$ is located at $P_1(1,0,0)$, while a second element $I_2\Delta L_2 = 10^{-5}(0.6a_x - 2a_y + 3a_z)A.m$ is at $P_2(-1,0,0)$, both in free space. (07)

(a) Find the vector force exerted on $I_2\Delta L_2$ by $I_1\Delta L_1$.

(b) Find the vector force exerted on $I_1\Delta L_1$ by $I_2\Delta L_2$.

OR

Q-5 (a) A current sheet, $K = 40a_z A/m$, is located in free space at $x = 0.25m$, and a second sheet, $K = -40a_z A/m$, is at $x = -0.25m$. (08)

(a) Let $V_m = 0$ at P(0.1,0.2,0.3) and find $V_m(x,y,z)$ for $-0.25 < x,y,z < 0.25$.

(b) Let $A = 0$ at P and determine $A(x,y,z)$ for $-0.25 < x,y,z < 0.25$.

(b) A differential current lop lies in the x-y plane in a magnetic field $\overline{B}$. Find the total torque on the loop in terms of its differential area & also write it in terms of magnetic dipole moment. (07)

Q-6 **Attempt any three** (15)

(1) Write short note on skin & proximity effects and its application.

(2) What do you mean by polarization? Give its relation with electric field intensity E and electric flux density D. also give the relation between bound charge density and polarization.

(3) Derive expression of potential using Laplace's solution where potential varies with respect to r only.

(4) Define magnetic Boundary condition.

(5) Derive expression for H(Magnetic field intensity) due to current sheet carrying current density $K = k_y a_y$ in entire x-y plane