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RM-6509

B. E. II (Sem. IV) (Electrical) Examination

May / June – 2010

Engineering Electromagnetics

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

Instruction :

(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. 2 (Sem. 4) (Electrical)**

Name of the Subject :

☛ **Engineering Electromagnetics**

☛Subject Code No. : **6 5 0 9** ☛Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Attempt all questions.

(3) Figures to the **right** indicate full marks.

(4) Assume **necessary** data wherever required.

(5) Scientific calculator up to Casio-100D, 100MS series is permitted.

SECTION -I

1 (a) 1) 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. **(06)**

(a) Less than (b) greater than (c) equal to (d) not related to

2) Electric flux density D is _____ to the Electric equipotential lines.

(a) Normal (b) Tangential (c) Opposite (d) not related to

3) Temperature distribution in room is a _____ field

4) μ_0 is called _____

5) Work done in moving a point charge about a closed path is _____

6) Divergence theorem is given as _____

(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)**

2 (a) Explain the concept of Point charge, line charge and surface charge with necessary equations. **(06)**

(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

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)**

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

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. Two identical coaxial circular coils carry the same current I amp in opposite directions. What is the magnitude of the magnetic field B at a point on the axis midway between the coils? 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. M.M.F.	a. Tesla
2. Magnetic Field Intensity	b. AT / Wb
3. Flux Density	c. Webber
4. Flux	d. AT
5. Reluctance	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)

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

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)

6 **Attempt any three** (15)

(1) Write short note on Vector Helmholz equation and its application

(2) Prove that solution of Laplace's equation is unique.

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

(4) Discuss main properties of diamagnetic, paramagnetic & ferromagnetic materials.

(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