

GUJARAT TECHNOLOGICAL UNIVERSITY**BE-VIth SEMESTER–EXAMINATION – MAY- 2012****Subject code: 160906****Date: 22/05/2012****Subject Name: Theory of Electromagnetics****Time: 10:30 am – 01:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 (a) State and explain gauss's law. Obtain electric field intensity of line charge using gauss's law **07**

(b) Obtain the spherical co-ordinates of $10 \bar{a}_x$ at the point $P(x = -3, y = 2, z = 4)$ **07**

Q.2 (a) A dielectric-free space interface has the equation $3x + 2y + z = 12$ m. The origin side of the interface has $\epsilon_{r1} = 3$ and $E_1 = 2\bar{a}_x + 5\bar{a}_z$ (V/m). Find E_2 . **07**

(b) Derive continuity equation of current also explain relaxation time. **07**

OR

(b) Explain boundary condition for dielectric material. **07**

Q.3 (a) State and explain Biot-Savart's law. **07**

(b) Find $\bar{E}$ at the origin if the following charge distributions are present in free space : 1) point charge 12 nC at $P(2, 0, 6)$, 2) uniform line charge density 3 nC/m at $x = -2, y = 3$, 3) uniform surface charge density 0.2 nC/m² at $x = 2$. **07**

OR

Q.3 (a) Write short note: Electrostatic boundary conditions between perfect dielectrics. **07**

(b) The finite sheet $0 \leq x \leq 1, 0 \leq y \leq 1$ on the $z = 0$ plane has a charge density $\rho_s = xy(x^2 + y^2 + 25)^{3/2}$ nC/m². Find: **07**

1) The total charge on the sheet, 2) The electric field at $(0, 0, 5)$

3) The force experienced by a -1 mC charge located at $(0, 0, 5)$.

Q.4 (a) State and Explain Ampere circuital law. **07**

(b) Find the magnetic flux density at the centre 'O' of a square of sides equal to 5 m and carrying 10 amperes of current. **07**

OR

Q.4 (a) Write a note on ferrite core. Also list out various properties of ferrites. **07**

(b) A circular loop located on $x^2 + y^2 = 9, z = 0$ carries a direct current of 10 A along $\bar{a}_\phi$. Determine H at $(0, 0, 4)$ and $(0, 0, -4)$. **07**

Q.5 (a) Explain briefly finite element method. Also state the advantages and disadvantages of finite element method. **07**

(b) A rectangular conducting loop with a resistance of 0.2Ω rotates at 500 rpm. The vertical conductor at $r_1 = 0.03$ m is in the field $B_1 = 0.25 \bar{a}_r$ T and other conductor is at $r_2 = 0.05$ m and in the field $B_2 = 0.8 \bar{a}_r$ T. Find current flowing in the loop. **07**

OR

Q.5 (a) State Maxwell's equations in point form and explain physical significance of the equations. **07**

(b) What values of A and β are required of two fields $E = 120\pi \cos(10^6 \pi t - \beta x) \bar{a}_y$ (V/m) and $H = A \cos(10^6 \pi t - \beta x) \bar{a}_z$ (A/m). Satisfy Maxwell's in a medium where $\epsilon_r = 4$ and $\sigma = 0$. **07**
