CBCS SCHEME

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15EC36

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Engineering Electromagnetics

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. State and explain Couloumbs law and show its vector form. **(04 Marks)**

b. Define Electric field Intensity and Electric flux density. **(04 Marks)**

c. A 20nc point charge is located at P(2, 4, –3) in free space
i) Find E(r) ii) Find E at A(–3, 2, 0) **(08 Marks)**

OR

2 a. Derive the expression for Electric field Intensity due to Infinite line charge **(08 Marks)**

b. A line charge ρ_L = 50nc/m is located along the line x = 2, y = 5 in free space. i) Find E at P(1, 3, –4) ii) If the surface x = 4 contains a uniform surface charge density $\rho_s = 18nd/m^2$, at which point in the z = 0 plane is E_{total} = ? **(08 Marks)**

Module-2

3 a. State and prove Gauss's law. **(06 Marks)**

b. Define the terms : i) Potential and ii) Potential difference. **(04 Marks)**

c. Calculate the workdone in moving 4c charge from B(1,0,0) to A (0, 2, 0) along the path y = z – 2x, z = 0 in the Field 'E'. 1) 5ax V/m 2) 5x ax V/m 3) 5x ax + 5y ay V/m. **(06 Marks)**

OR

4 a. Derive the Expression for equation of continuity. **(06 Marks)**

b. Explain the potential field of a point charge **(04 Marks)**

c. Let $D = (10r^2 + 5e^{-r})\, a_r\ C/m^2$.
i) Find ρ_v as a function of r
ii) Find the total charge lying within the sphere radius 'a' centered the origin. **(06 Marks)**

Module-3

5 a. Derive Poisson's and Laplace equations. **(04 Marks)**

b. State and prove uni-queness theorem. **(06 Marks)**

c. The potential on the plane x – 2y + 5z = 2 is 50V, point P (2, 3, –7) lies on a parallel conducting plane having a potential of –360V
i) Find V at A (–1, 4 6)
ii) Find E (x, y, z) **(06 Marks)**

OR

6 a. State and explain Biot – Savert's law. **(06 Marks)**

b. State and explain Ampere's Circuital law. **(04 Marks)**

c. The magnetic field intensity is given as $H = (3/\rho)a_\rho + 12\,(z - 5)a_\phi + 2\rho^2 \sin\phi\ a_z$ in free space. Determine the value of surface integral $\int_s (\nabla \times 4) \cdot ds$ over the paraboloidal surface $-z = \rho^2,\ 0 \le z \le 3$. **(06 Marks)**

Module-4

7 a. Derive an equation for the magnetic force between two differential current Elements. **(08 Marks)**

b. An air core toroid has 500turns, mean radius of 15cm cross sectional area of $6cm^2$. The magneto motive force is 2000A.t. Calculate total reluctance, Flux, Flux density, Field intensity. **(08 Marks)**

OR

8 a. Derive the Boundary conditions at the boundary between two magnetic of different permeability's. **(08 Marks)**

b. Find the force per meter length between two parallel wires separated by 10cm in air carrying current of 10A in the same. **(04 Marks)**

c. Write a note on Magnetic circuit. **(04 Marks)**

Module-5

9 a. List point form and integral form of Maxwell's equations for steady and time varying fields. **(06 Marks)**

b. A 300MHz wave propagating through fresh water. Assuming a lossless medium $\mu_2 = 1$, $\epsilon_r = 78$ (at 300MHz). Find the β, v, λ, η if $E_0 = 0.1VM$, also find E_x and H_y. **(10 Marks)**

OR

10 a. State and prove Poynting theorem. **(08 Marks)**

b. Using Maxwell's equation derives an expression for uniform plane wave in free space. **(08 Marks)**

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