Reg. No. : | | | | | | | | | | |

Question Paper Code: 31333

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2016

Third Semester

Electrical and Electronics Engineering

01UEE303 - FIELD THEORY

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Determine the gradient of the scalar field $U = x^2y + xyz$.
2. Mention the sources of electromagnetic fields.
3. Define electrical potential
4. Write Poisson's and Laplace's equations.
5. State Biot-Savart's law.
6. Define magnetization.
7. Differentiate transformer emf and motional emf.
8. Find the force experienced by electron when it moves at a velocity of 200 *m/s* at right angles to uniform magnetic field of 1 *Tesla*?
9. Define skin depth.
10. What is standing wave ratio?

PART - B (5 x 16 = 80 Marks)

11. (a) (i) Determine the divergence of the vector fields:

(1) $P = x^2yza_x + xza_z$ (2)

(2) $Q = \rho\ sin\Phi\ a_\rho + \rho^2za_\Phi + zcos\Phi a_z$ (3)

(3) $T = (1/r^2)\ cos\theta\ a_r + rsin\theta cos\Phi\ a_\theta + cos\theta\ a_\Phi$ (3)

(ii) State and prove divergence theorem. (8)

Or

(b) (i) Given point P(-2, 6, 3) and , $\vec{A} = y\,\vec{\imath} + (x + z)\vec{\jmath}$, express P and $\vec{A}$ in cylindrical coordinates. (8)

(ii) State and prove divergence theorem. (8)

12. (a) (i) Point charges 1 *mC* and -2 *mC* are located at (3, 2, -1) and (-1, -1, 4) respectively. Calculate the electric force on a 10 *nC* charge located at (0, 3, 1) and the electric field intensity at that point. (10)

(ii) Derive the expression for electric field intensity due to a surface charge by applying Gauss law. (6)

Or

(b) (i) A dielectric slap of flat surface with relative permittivity 4 is disposed with its surface normal to a uniform field with flux density 1.5 C/m^2. Determine polarization in a slap. (4)

(ii) Derive the expressions for boundary conditions between conductor and dielectric in electric field. (12)

13. (a) (i) Derive the expression for magnetic field intensity due to a straight current carrying conductor. (8)

(ii) Derive the expression for torque on a current carrying loop placed in a magnetic field. (8)

Or

(b) (i) A small current loop L_1 with magnetic moment $5a_z\ A.m^2$ is located at the origin while another small loop current L_2 with magnetic moment $3a_y\ A.m^2$ is located at (4, –1, 7). Determine the torque on L_2. (10)

(ii) Write short notes about classification of magnetic materials. (6)

14. (a) With necessary explanation, derive the Maxwell's equations for time varying fields, for good conductor and for time harmonic fields. (16)

Or

(b) (i) Compare the field theory and circuit theory. (8)

(ii) Two parallel circular loops of radii *'a'* and *'b' (a >>b)* are coaxially located and carry currents I_1 and I_2 respectively. The axial distance between the centers of loops is *z*. Find approximately the force between the loops. (8)

15. (a) (i) Derive wave equations in phasor form. (8)

(ii) A transmission line operating at $\omega = 10^6$ *rad/sec*, has $\alpha = 8$ *db/m*, $\beta = 1$ *rad/m* and $Z_0 = (60 + j40)\Omega$ and is $2m$ long. If the line is connected to a source of v_g volts and terminated by a load of$(20 + j50)\Omega$, determine the input impedance. (8)

Or

(b) A plane wave propagating through a medium with $\varepsilon_r = 6$, $\mu_r = 3$ has $E = 0.5\ e^{-z/3}\ sin\ (10^8\ t - \beta\ z)\ a_x\ V/m$. Determine β, wave velocity, the loss tangent, *H* field and intrinsic impedance. (16)

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