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Question Paper Code: 41333

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

Third Semester

Electrical and Electronics Engineering

14UEE303 – FIELD THEORY

(Regulation 2014)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- Find the curl of the gradient of scalar field defined by $V = 2x^2y + 3y^2 + 4z^2x$
(a) $4xy\mathbf{a}_x + 6yza_y + 8yxa_z$ (b) $4\mathbf{a}_x + 6\mathbf{a}_y + 8\mathbf{a}_z$
(c) $(4xy + 4z^2)\mathbf{a}_x + (2x^2 + 6yz)\mathbf{a}_y + (3y^2 + 8zx)\mathbf{a}_z$ (d) 0
- A dielectric slab with 500mm X 500mm cross-section is 0.4m long. The slab is subjected to a uniform electric field of $E = 6\mathbf{a}_y + 8\mathbf{a}_z$ kv/mm. The relative permittivity of the dielectric materials is equal to 2. The value of constant ϵ_0 is 8.85×10^{-12} F/m. What is the energy stored in the dielectric?
(a) 8.85×10^{-12} F/m (b) 8.85×10^{-5} (c) 8.85 (d) None of these
- The flux density at a point in space is given by $B = 4x\mathbf{a}_x + 2Ky\mathbf{a}_y + 8\mathbf{a}_z$ wb/m². Find the value of constant k must be equal to
(a) -2 (b) -0.5 (c) +0.5 (d) +2
- The direction of vector A is radially outward from origin, with $A = kr^n$ where $r^2 = X^2 + Y^2 + Z^2$ and K is constant. The value of n for which $\Delta \cdot A = 0$ is
(a) -2 (b) 2 (c) 1 (d) 0
- Which of the following is the unit of magnetic flux density
(a) Weber (b) Lumens (c) Tesla (d) None of these

6. Given a vector field $F = y^2 x a_x - y z a_y = x^2 a_z$, the line integral $F \cdot dl$ evaluated along a segment on the X-axis from $x=1$ to $x=2$ is
- (a) -2.33 (b) 0 (c) 2.33 (d) 7
7. Substance which have the permeability less than the permeability of free space are known as
- (a) ferromagnetic (b) paramagnetic (c) diamagnetic (d) bipolar
8. Field due to infinitely long line charge along Z-axis varies with
- (a) ρ (b) Φ (c) Z (d) None of these
9. Electromagnetic waves can travel through space, they do not need this to travel through
- (a) electric energy (b) charge (c) medium (d) magnetic field
10. The intrinsic impedance of free space is
- (a) 75 ohm (b) 73 ohm (c) 120π (d) 77 ohm

PART - B (5 x 2 = 10 Marks)

11. Write the conditions of vector A to be Solenoidal and irrotational.
12. A parallel plate capacitor has a charge of $10^{-3}C$ on each plate while the Potential difference.
13. Define Lorentz law of force.
14. Write down the integral and point form of Maxwell's equation using Faraday's law.
15. Define skin depth.

PART - C (5 x 16 = 80 Marks)

16. (a) Derive the expression interms of Cartesian, cylindrical and spherical co-ordinate systems (16)

Or

(b) State and prove

(i) Divergence theorem (8)

(ii) Stokes theorem (8)

17. (a) Circular disc of radius 'a' m is charged uniformly with a charge density of $\rho_s C/m^2$. (16)

Or

(b) State and derive electric boundary condition for a dielectric to dielectric medium and a conductor to dielectric medium. (16)

18. (a) State and explain Ampere's circuit law and show that the field strength at the end of a long solenoid is one half of that at the centre. (16)

Or

(b) Obtain the expression for energy stored in the magnetic field and also derive the expression for magnetic energy density. (16)

19. (a) State and derive the Maxwell's equations for free space in integral form and point form for time varying field. (16)

Or

(b) Derive the Maxwell's equation in phasor integral form. (16)

20. (a) Derive wave equations for a conducting medium. (16)

Or

(b) Define Brewster angle and derive its expression. (16)
