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Question Paper Code: 44403

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

Fourth Semester

Electronics and Communication Engineering

14UEC403 - ELECTROMAGNETIC FIELDS

(Regulation 2014)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- A field F is said to be SOLENOIDAL if
 - CURL $F=0$
 - DIV $F=0$
 - $\nabla^2 F = 0$
 - $\int F \cdot dl = 0$
- Two Positive charges Q Coulomb each are placed at points $(0, 0, 0)$ and $(2, 2, 0)$, while two negative charges Q Coulomb each in magnitude are placed at points $(0, 2, 0)$ and $(2, 0, 0)$. The electric field at point $(1, 1, 0)$ is
 - Zero
 - $\frac{Q}{8\pi\epsilon_0}$
 - $\frac{Q}{4\pi\epsilon_0}$
 - $\frac{Q}{16\pi\epsilon_0}$
- The Magnetic field at any point on the axis of a current carrying circular coil will be
 - Perpendicular to the axis
 - Parallel to the axis
 - At an angle of 45 degree with the axis
 - Zero
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- Point form of Ohm's law is
 - $\vec{E} = \sigma \vec{J}$
 - $\vec{J} = \sigma \vec{E}$
 - $\vec{E} = \vec{J}$
 - $\vec{E} = \frac{\sigma}{J}$

6. In a dielectric-conductor boundary, the tangential component of electric field is
 (a) E_i (b) $2E_i$ (c) 0 (d) Infinity
7. The Coefficient of coupling between two coils
 (a) Orientation of the coils (b) Current
 (c) Number of turns on the two coils current (d) Self-inductance of the two coils
8. Give the equation of power flow in coaxial cable
 (a) Poynting Vector (b) Scalar Vector
 (c) Radial Vector (d) none of these
9. In a good conductor E/H ratio is
 (a) Real
 (b) Imaginary
 (c) Has a phase of 45 degree
 (d) Has no relevance,(i.e) E is independent of H
10. Skin depth is proportional to
 (a) Frequency (b) permeability (c) $\sqrt{\sigma}$ (d) $1/\sqrt{\sigma}$

PART - B (5 x 2 = 10 Marks)

11. List the principles of superposition.
12. Define Biot-Savart Law.
13. Define mutual inductance.
14. State Poynting theorem.
15. Mention the properties of uniform plane wave.

PART - C (5 x 16 = 80 Marks)

16. (a) Determine the electric field intensity of an infinitely long, straight, line charge of a uniform density ρ_L in air. (16)

Or

- (b) State and prove Gauss law with applications. (16)

17. (a) Find the magnetic flux density around infinitely long straight conductor using Bio-Savart law. (16)

Or

- (b) Prove Ampere's circuital law. Derive an expression for vector magnetic potential. (16)

18. (a) A cylindrical capacitor consists of an inner conductor of radius ' a ' and an outer conductor whose inner radius is ' b '. The space between the conductor is filled with a dielectric of permittivity ϵ , and the length of the capacitor is L . Determine the capacitance of this capacitor. (16)

Or

- (b) (i) Obtain an expression for capacitance of a parallel plate capacitor. (8)
(ii) Explain the following (a) magnetization (b) permeability. (8)

19. (a) Derive the Poynting vector from Maxwell's equations and explain power of flow. (16)

Or

- (b) (i) Explain about power flow in a coaxial cable. (10)
(ii) Find the displacement current at $t = 0$ passing in an aluminium conductor of circular cross section having a total resistance of 0.15Ω and voltage of $100 \sin(10^6 \pi t)$ volts across it. Given $\sigma = 3.5 \times 10^7 \text{ } \Omega/m$ and $\epsilon_r = 1$. (6)

20. (a) Define Brewster angle. Derive the wave equation in free space condition. (16)

Or

- (b) Derive the transmission and reflection coefficient for the electromagnetic waves when incident normally on perfect dielectric. (16)

