MANMOHAN TECHNICAL UNIVERSITY

SCHOOL OF ENGINEERING

MODEL Questions (2081)

ELECTROMAGNETICS (EG551EX)

BEEE (II/II)

FM: 50

PM: 20

MCQ (10×1=10) Attempt **All** the Questions.

1) Which of the following is not a vector quantity?
   a) Electric Field Intensity b) Potential Gradient c) Potential Field d) Electric Flux Density
2) Find the unit vector along PQ if the coordinates of P and Q are (2, -3, -1) and (3,0, 2) respectively.
   a) $5\,\widehat{a_x} - 3\,\widehat{a_y} + 2\,\widehat{a_z}$ b) $-\widehat{a_x} - 3\,\widehat{a_y} - 3\,\widehat{a_z}$ c) $\widehat{a_x} + 3\,\widehat{a_y} + 3\,\widehat{a_z}$
   d) $0.229\,\widehat{a_x} + 0.688\,\widehat{a_y} + 0.688\,\widehat{a_z}$
3) Electric Flux Density ($\vec{D}$) at a point P at a distance (ρ) due to an infinite line charge with line charge density (ρ_L) is given by:
   a) $\frac{\rho_L}{2\pi\varepsilon_0\rho}\,\widehat{a_\rho}$ b) $\frac{\rho_L}{2\varepsilon_0\rho}\,\widehat{a_\rho}$ c) $\frac{\rho_L}{2\pi\rho}\,\widehat{a_\rho}$ d) $\frac{\rho_L}{2\rho}\,\widehat{a_\rho}$
4) Divergence of Electric Flux Density gives:
   a) Potential Field b) Total Charge c) Volume Charge Density d) Current Density
5) Energy Storage Capacity of a capacitor (C) when applied to a potential difference of V_0 can be expressed as:
   a) CV_0 b) CV_0^2 c) $0.5\,CV_0^2$ d) $0.5\,CV_0$
6) The ratio of intensity of magnetization to the magnetization force is known as
   a) Flux density b)Susceptibility c) Relative permeability d) None
7) The Biot-savart's law is a general modification of
   a) Kirchoff's law b) Ampere's law c) Lenz's law d)Faraday's law
8) Maxwell's first equation in free space is
   a) $\nabla\times H = D+J$ b) $\nabla\times H = D$ c) $\nabla\times H = 0$ d) $\nabla\times H = J$
9) The time varying electric field is
   a) $E = -\nabla V$ b) $E = -\nabla V - A$ c) $E = -\nabla V - B$ d) $E = -\nabla V - D$
10) Poynting Vector and Wave Power
   a) Power density b)Energy c)Power density d)Energy

SQ (8×2=16) Attempt any **Eight** from Nine.

1. Find the distance between two points C (ρ = 5, $\emptyset$ = 75^0, z = 2) and D (r = 3, θ = 20^0, $\emptyset$ = 125^0).
2. Compute the Electric Field Intensity at P (1, 3, -1) due to two identical charges of +4 nC at M_1 (0, -2, 3) and M_2 (-2, 1, -1).
3. State Gauss's Law and Divergence Theorem.
4. Derive the expression for Capacitance of a parallel plate capacitor with Surface Area (S) and separation distance (d).
5. Describe polarization and its effect on Electric Flux Density ($\vec{D}$) on a dielectric material.
6. Differentiate between scalar and vecior magnetic potential.
7. Explain how Ampere's law conflict with continuity equation and how it is corrected?
8. State Faraday's law and correct the equation $\nabla \times \vec{E} = 0$ for time varying field with necessary derivation
9. Elaborate the significance of a curl of a vector field.

Sample Question

LQ (6×4=24) Attempt any **Six** from Seven.

10. Derive the expression for the Electric Field Intensity ($\vec{E}$) due to an infinite sheet of charge with surface charge density (ρ_s).
11. In a free space, Electric Flux Density $\vec{D} = 8xyz^4\ \widehat{a_x} + 4x^2z^4\ \widehat{a_y} + 16x^2yz^3\ \widehat{a_z}$ pC/m^2.
    a) Find the total electric flux passing through a rectangular surface represented by $z = 2,\ 0 < x < 2, 1 < y < 3$.
    b) Find $\vec{E}$ at P (2, -1, 3).
12. Verify Divergence Theorem for $\vec{D} = 2xy\ \widehat{a_x} + x^2\ \widehat{a_y}$ c/m^2 and a rectangular parallelopiped formed between the planes $x = 0$ & $x = 1, y = 0$ & $y = 2, z = 0$ & $z = 3$.
13. Derive the expressions for the Boundary Conditions of Electric Fields on the boundary between a conductor and a free space.
14. Derive an expression for input intrinsic impendence using the concept of reflection of waveform plane wave
15. Write all the Maxwell equations for the time varying field point form as well as integral form
16. A rectangular waveguide has dimension a=4 cm and b=2 cm. Determine the cut off frequency and range of frequencies over the guide will operate single mode.

ALL THE BEST