

SECTION B — (5 × 6 = 30 marks)

Answer ALL questions, choosing either (a) or (b).

21. (a) If in a certain region of space the electric field vector E is given by

$$E = \frac{1}{4\pi\epsilon_0} \int \frac{r}{r^3} \rho d\tau$$

Calculate the curl of the field.

Or

(b) Derive an expression for electric intensity.

22. (a) Deduce the equation of continuity.

Or

(b) Find the power radiated by an oscillating electric dipole.

23. (a) Show that in case of plasma and superconductors

$$\sigma = i \frac{\wedge}{\omega} \text{ and } \text{curl } J = -\wedge^3 \text{ with } \wedge = \frac{Ne^2}{m}$$

Or

(b) A hollow rectangular wave guide has $a = 6$ cm and $b = 4$ cm. The frequency of the impressed signal is 3 Gz. Compute for TE_{10} mode.

(i) Cut off wavelength

(ii) Guide wavelength.

24. (a) Explain the parameters of scattering.

Or

(b) What is meant by resonance scattering?

25. (a) Prove that the space interval $x^2 + y^2 + z^2$ is not invariant under Lorentz transformation while the space-time interval $x^2 + y^2 + z^2 - c^2t^2$ is invariant.

Or

(b) Mention the properties of 4-vectors and compare it with that of 3-vectors.

SECTION C — (5 × 10 = 50 marks)

Answer ALL questions, choosing either (a) or (b).

26. (a) Writing Maxwell's equations in 4-vector form and prove that they are invariant under Lorentz transformation.

Or