(b) Differentiate between magnetic vector potential and magnetic scalar potential. Derive expressions for the magnetic vector potential and magnetic induction due to a small element of a current carrying circuit at a large distance.

27. (a) Deduce Maxwell's equation of electromagnetic field and discuss their basis.

Or

(b) What do you understand by Lorentz gauge and Coulomb's gauge? Show that coupled inhomogeneous Maxwell's equations are uncoupled by a gauge transformation.

28. (a) Discuss the propagation of plane monochromatic electromagnetic waves in conducting media. Derive the dispersion equation and determine

(i) phase velocity

(ii) refractive index.

Or

(b) Discuss the phenomenon of total internal reflection on the basis of electromagnetic theory.

29. (a) Deriving expression for Thomson-Cross section in terms of 'classical electromagnetic radius' of the charge defined as

$$r_0 = \frac{q^2}{4\pi \epsilon_0 mc^2}.$$

Or

(b) What are normal and anamolous dispersion? Derive Sellmeier's equation for the refractive index of a dielectric medium.

30. (a) Expressing the electromagnetic potentials A and ϕ in terms of 4-vector, obtain their transformation laws.

Or

(b) Writing Maxwell equations in 4-vector form, prove that they are invariant under Lorentz transformation.

———————