Q.P. Code : **10032**

(3 Hours) [Total Marks : 100

N.B. : (1) **All** questions are **compulsory**
(2) **Figures** to the **right** indicate **full** marks
(3) Neat diagrams should be drawn wherever necessary
(4) Use of non-programmable calculators and logarithmic tables is allowed
(5) Symbols have their usual meaning unless otherwise stated

1. Attempt any **Two** of the following :-
   (a) Derive the formula $E = mc^2$ between the relativistic mass and total energy of the moving body. **10**
   (b) Discuss Minkowski's four dimensional space-time diagram give the calibration of the space-time axes relative to the stationary and moving frame of reference. **10**
   (c) Derive Lorentz transformation equations for space-time co-ordinates making use of the postulates of the special theory of relativity. **10**

2. Attempt any **Two** of the following :-
   (a) Derive Lorentz transformation equations for the components of electric field $\bar{E}$. **10**
   (b) Show that the electric field of a uniformly moving charge in an inertial frame of reference loses its spherical symmetry. **10**
   (c) Discuss in detail 'Weyl's postulate' and 'cosmological principle'. **10**

3. Attempt any **Two** of the following :-
   (a) State the uniqueness theorems. For a point charge held at a distance 'd' above an infinite grounded conducting plane obtain the expression for potential above the plane, also obtain the expression for induced charges density on the conducting plane. **10**
   (b) Starting from Biot-Savart's law obtain the expressions for $\overline{\nabla}.\overline{B}$ and $\overline{\nabla} \times \overline{B}$. **10**
   (c) For a polarized dielectric give the physical interpretation of bound charge densities ρ_b and σ_b. **10**

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4. Attempt any **Two** of the following :-

(a) Obtain an expression for energy stored in magnetic field. **10**

(b) State and prove Poynting theorem. Obtain its differential form. **10**

(c) A plane electromagnetic wave is incident normally on the interface of two non-conducting media. Write expressions for the incident, reflected and transmitted fields. Apply suitable boundary conditions and obtain reflection coefficient (R) and transmission coefficient (T). **10**

5. Attempt any **Four** of the following :-

(a) Explain in short Longitudinal and Transverse Doppler effect. **5**

(b) Show that $\vec{E}.\vec{B}$ is invariant under Lorentz transformation's of electric field $\vec{E}$ and magnetic field $\vec{B}$. **5**

(c) Write a note on 'Microwave Background Radiation.' **5**

(d) Obtain Gauss law in polarized dielectrics. **5**

(e) A vector field in vacuum is given by $\vec{B} = yz\hat{i}+xz\hat{j}+xy\hat{k}$. Check if this can represent magnetostatic field. **5**

(f) Obtain Ampere's law in Magnetized material. **5**
