Reg. No					



MANIPAL UNIVERSITY, MANIPAL

THIRD SEMESTER M. Sc. (PHYSICS) End Semester Examination, Nov/December,2015.

SUBJECT: ELECTRODYNAMICS, (PHY 703)

Time: 3 Hrs

Max. Marks: 50

Note: (i) Answer any FIVE full questions. (ii) Any missing data may suitably be assumed.

- (A) Starting from Maxwell's equations prove (i) Coulomb's Law (ii) Continuity equation. (B)What are 'Electromagnetic potentials'? Derive Maxwell's equations in terms of Electromagnetic potentials. =10)
- 2. (A) What are magnetic scalar and vector potentials? What are their importance?

(B) Derive the equation of continuity $div \vec{J} + \frac{\partial \rho}{\partial t} = 0$, where the symbols have their usual meanings. (6+4=10)

3. State and prove the law of conservation of linear momentum in an electromagnetic field.

(10)

4. (A).Using Maxwell's electromagnetic equations derive the equation for plane electromagnetic waves in free space

(B) Deduce an expression for the velocity of propagation of a plane electromagnetic wave in a medium of permeability ' μ ' and permittivity ' ϵ '. (6+4=10)

5. Determine the boundary conditions satisfied by electromagnetic fields at the interface

between two media of different permeabilities and permittivities. Derive these boundary conditions. (10)

6. State Maxwell's equations for a system of charges and currents. Show that the energy density $u = \frac{1}{2} \left[\varepsilon_0 E^2 + \mu_0 H^2 \right]$ and Poynting's vector $\mathbf{S} = (\mathbf{E} \times \mathbf{H})$ (10)

Physical Constants: Permittivity of Free space (ε_0) = 8.854 x 10⁻¹² F.m⁻¹. Permeability of free space (μ_0) = 4 π x 10⁻⁷ N A⁻² [or H m⁻¹⁻],Speed of light in vacuum (c) = 3 x 10⁸ ms⁻¹. Planck's constant (h) = 6.626 x 10⁻³⁴ Js..Avogadro's No.= 6.02 x 10²⁶/ kg mol, Boltzmann's Constant (k) = 1.381 x 10⁻²³ J K⁻¹ Electron charge (e) = 1.60 × 10⁻¹⁹ C

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