



K16P 1298

Reg. No. : .....

Name : .....

**First Semester M.Sc. Degree (Reg./Suppl./Imp.)  
Examination, November 2016  
(2014 Admission Onwards)  
PHYSICS  
PHY1C03 : Electrodynamics**

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer both questions (either **a** or **b**). Each question carries **12** marks.

1. a) Explain the concept of the method of images. Apply the image theory to determine the total induced charge in the case of a point charge placed above a grounded conducting plane.

OR

- b) Explain the concept of radiation reaction. Derive the Abraham-Lorentz formula.
2. a) Starting from Maxwell's equations prove Coulomb's law and continuity equation.

Using Maxwell's equations, obtain the relation  $\frac{1}{c} \frac{\partial}{\partial t} \left( \frac{E^2 + B^2}{2} \right) + \nabla \cdot (\vec{E} \times \vec{B}) = 0$ .

OR

- b) Explain the basic concept of Lorentz transformation. Deduce expressions for the Lorentz transformation of coordinates. What is meant by light cone ?

(2x12=24)

SECTION – B

Answer **any four** questions. 1 mark for Part **a**, 3 marks for Part **b**, 5 marks for Part **c**.

3. a) State Biot and Savart law.  
b) Obtain Biot and Savart law mathematically.  
c) Discuss any one application of the Biot and Savart law.

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4. a) What is Poynting's theorem ?  
b) Derive Poynting's vector.  
c) Show how Poynting's theorem can be interpreted for the microscopic fields  $(\vec{E}, \vec{B})$  as a statement of conservation of energy of the combined system of particles and fields.
5. a) What is meant by boundary-value problems ?  
b) Obtain Fresnel coefficients for normal incidence reflections.  
c) Prove that all the incident energy is either reflected or transmitted at the boundary of two non conducting media.
6. a) What is a retarded potential ?  
b) Explain the significance of Lienard Wiechert potentials.  
c) Obtain the scalar Lienard-Wiechert potential.
7. a) Explain what is meant by invariance of electric charge.  
b) Discuss the covariant formulation of Maxwell's equations.  
c) Obtain the electromagnetic field tensor.
8. a) What is a wave guide ?  
b) Explain the difference between TE and TM modes.  
c) A rectangular hollow metal wave guide is designed to propagate a 9375 MHz signal in the  $TE_{10}$  mode. Calculate the breadth of wave guide 'a' if the guide wavelength is equal to the cutoff wavelength. Calculate the cutoff frequency of the next higher order mode if  $b = a/2$ .

(4x9=36)