



K15P 0306

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (Reg./Sup./Imp.) Examination, November 2015  
(2014 Admn. Onwards)

PHYSICS

PHY 1C03 : 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) Derive the Laplace's equation in cylindrical coordinates. Give the general procedure for solving Laplace's equation.

OR

- b) Explain the concept of electric dipole radiation. Treating electric dipole to be equivalent to an accelerated charge calculate (1) The dipole moment amplitude in terms of charge  $q$  and acceleration ' $a$ ' of the accelerated charge. (2) The instantaneous rate of radiation from the charge. **(2×12=24)**

SECTION – B

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

3. 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.

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4. a) What is Polarization ?  
b) Obtain the condition for the linear polarization.  
c) What is skin depth ? Derive an expression for the skin depth.
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 total internal reflection ?  
b) Explain Brewster's angle and critical angle.  
c) Derive the Hagen-Rubens relation using the concept of reflection from a conducting plane.
7. a) What is a retarded potential ?  
b) Explain the significance of Lienard Wiechert potentials.  
c) Obtain the scalar Lienard-Wiechert potential.
8. a) What is a wave guide ?  
b) Explain the difference between TE & 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  $b = a/2$ . **(4×9=36)**