

Second Semester M.Sc. Physics Examination, January 2016**Classical Electrodynamics and Optics**

Time: 3 Hours

Max. Marks: 80

Instructions: Answer all questions.

1. (a) Arrive at the multipole expansion of the electrostatic potential due to an arbitrary charge distribution. (10)
- (b) Setup an expression for electric quadrupole moment. (5)

OR

2. (a) Setup an expression for Lienard-Wiechert potentials of a moving point charge. (10)
- (b) Show that charges travelling with uniform speed cannot radiate electromagnetic energy. (5)

3. (a) Deduce the Abraham-Lorentz formula for radiation reaction. Explain its significance. (10)
- (b) Show that acceleration assumes enormous proportion almost instantaneously, in terms of Abraham-Lorentz formula. (5)

OR

4. (a) Discuss the behaviour of plasma in a magnetic field in detail. (10)
- (b) Obtain an expression for Alfvén velocity of a plasma wave. (5)
5. (a) Discuss the propagation of electromagnetic waves through a conducting medium. (10)
- (b) Obtain an expression for plasma frequency of an ionized gas. (5)

OR

6. (a) Derive Clausius-Mossotti equation for electric fields in solids. (10)
- (b) Write a note on crystal polarizers. (5)

7. (a) Obtain an equation for the intensity distribution due to superposition of light waves from two coherent sources. (10)
- (b) Note down the conditions for sustainable interference. (5)

OR

8. (a) Give a detailed description of diffraction at a circular aperture. (10)
- (b) Discuss briefly the Huygens' theory of light and Fresnel's correction to it. (5)

9. Answer **any four** of the following: (4X5=20)
- (a) Obtain an expression for electric dipole moment.
 - (b) Show that when the velocity is zero, the Lienard-Wiechert potentials generate electrostatic potential.
 - (c) Obtain an expression for power radiated by an accelerated charge when its acceleration is collinear to its velocity (bremsstrahlung).
 - (d) Show that ρ and ϕ are the fourth components of \vec{J} and \vec{A} respectively.
 - (e) Write a note on Pinch effect.
 - (f) Starting from Fresnel's equations, obtain Brewster's law.
 - (g) Discuss about resolving power of Fabry-Perot etalon.
 - (h) Write a short note on temporal coherence.