AE-747

M.Sc. (Previous)
Term End Examination, 2016-17

PHYSICS

Paper - III

Electrodynamics, Plasma Physics and
Statistical Mechanics

Time : Three Hours]   [*Maximum Marks* : 100
                              [*Minimum Pass Marks* : 36

Note : Answer any **five** questions. All questions carry
equal marks.

1. (*a*) Write down the Maxwell's field equations
        in differential and integral forms and
        explain their physical meaning.

    (*b*) State and prove Poynting's theorem for
        the conservation of energy for a system
        of particles and field. Discuss the
        significance of Poynting's vector.

2. (*a*) Derive expressions for inhomogeneous
        wave equations for scalar and vector
        quantities using gauge transformation.

305_BSP_(3)   (*Turn Over*)

(*b*) Show that under Coulomb gauge, the electromagnetic scalar potential is exactly the electrostatic potential while vector potential is described in terms of transverse current.

3. Define Electromagnetic field tensor and write its components explicity. Show how it can be used to write the Maxwell's equations in covariant form.

4. What are 'Lienard-Wiechert' potentials ? Calculate the electric and magnetic field vectors for uniformly moving charges using Lienard-Wiechert potentials and discuss the results obtained.

5. Derive Larmors formulae for power radiated by a low-velocity accelerated charged particle and discuss its angular distribution.

6. Define Plasma State. What are different plasma parameters ? Explain the phenomenon of plasma oscillations. How is plasma produced in laboratory ?

7. (*a*) Explain the MHD description of plasma using the one-fluid and two-fluid models.

(*b*) Describe the Langmuir probe for measuring properties of low-temperature plasma.

(Continued)

(3)

8. (*a*) Explain the concept of phase and how is it divided into phase cells for a classical and quantum system.

   (*b*) Calculate the number of phase cells in a phase space for a particle confined is a box of volume and having energy between O and E. Also calculate the number of phase cells available in the energy range E to $E + dE$.

9. (*a*) What are the consequences of indistinguishability of particle ?

   (*b*) Distinguish between Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics.

   (*c*) Under what conditions do the Fermi-Dirac and Bose-Einstein distribution laws reduce to Maxwell-Boltzmann distribution law.

10. Write notes on any **two** of the following :

    (*a*) Townsend theory of ionization

    (*b*) Gibbs paradox

    (*c*) Concept of four vectors

    (*d*) Bremsstrahlung radiation

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