JBG-160301010102010400   Seat No. _____

M. Sc. (Sem. I) (CBCS) Examination

December – 2019

Physics : CT-04

(Electrodynamics & Plasma Physics)

(New Course)

Time : $2\frac{1}{2}$ Hours]   [Total Marks : **70**

Instructions :

(1)   All questions are compulsory.

(2)   Figures on right indicate marks.

1   Answer any seven :   14

(a)   Define mechanics. What are the different types of mechanics ?

(b)   Name the four types of forces.

(c)   Show that, velocity of light (c) = $1\big/\left(\mu_o \varepsilon_o\right)^{1/2}$

where μ_o and ε_o are permeability and permitivity of free space.

(d)   Prove that : $\overline{\nabla}\cdot\overline{r}=3$ and $\overline{\nabla}\times\overline{r}=0$.

(e)   Show that $\overline{J}=\sigma\overline{E}$ is an alternate form of Ohm's law.

(f)   What are the different states of matter ?

(g)   List the techniques used for plasma confinement.

(h)   Define phase velocity and group velocity.

(i)   What are the necessary conditions for the existence of plasma ?

(j)   What do you mean by magneto-hydrodynamics ?

2 Attempt any two of the following :

   (a) Briefly discuss contribution of Maxwell in the field of electrodynamics. Why and how he modified Ampere's law ?   **7**

   (b) Discuss how Maxwell's equations get modified for insulting material or vacuum ? Thus, derive wave equations for $\bar{E}$ and $\bar{B}$.   **7**

   (c) Derive necessary boundary conditions for normal and tangential components of $\bar{B}$ and $\bar{H}$ at a boundary between two media.   **7**

3 Answer the following questions :

   (a) Define Scalar and Vector potentials and express Maxwell's equations in terms of V and $\bar{A}$.   **7**

   (b) An electromagnetic wave of angular frequency (w) incident normally at the interface between the two linear media, derive necessary formulae for reflection (R) and transmission (T) coefficients.   **7**

OR

3 Answer the following questions:

   (a) Discuss in detail, magnetic mirror effect.   **7**

   (b) Discuss in detail, applications of plasma in various fields.   **7**

4 Answer any two questions :

   (a) Discuss the motion of charged particle in the presence of uniform magnetic field $\bar{B}$ when electric field is absent $\left[\bar{E}=0\right]$.   **7**

   (b) What are the main and subtypes of plasma instabilities ? Discuss any three in detail.   **7**

   (c) Discuss in detail : Plasma Oscillations and Whistler mode.   **7**

5 Write short notes on any two :   **14**

   (a) Electromagnetic waves in conductor (skin depth).

   (b) Gauge transformation.

   (c) Motion of charged particle under the influence of $\bar{E}$ and $\bar{B}$.

   (d) Phase velocity and Group velocity.