DCV-1603010102010400 Seat No. _____

M. Sc. (Sem. I) Examination

August - 2022

Physics : CT - 4

(Electrodynamics & Plasma Physics) (New Course)

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

Instruction : Attempt any five questions.

1 (a) Define mechanics. What are the different types of mechanics? **14**

(b) What do you mean by isotropic medium and homogeneous medium?

(c) Show that velocity of light $(c) = \frac{1}{(\mu_0 \in_0)^{1/2}}$.

(d) Define scalar and vector potentials.

(e) What are the necessary conditions for the production of electromagnetic waves?

(f) Define Grazing angle and Brewster's angle.

(g) Briefly discuss Maxwell's contribution to electrodynamics.

2 (a) Define plasma state of matter. **14**

(b) List the natural sources where plasma occurs.

(c) Define plasma instability.

(d) What is ionosphere?

(e) Define gyro-frequency.

(f) List the applications of plasma.

(g) What do you understand by non-dispersive medium, normal-dispersive medium and anomalous-dispersive medium?

3 (a) Discuss in detail, why and how Maxwell modifies Ampere's law? **14**

(b) How Maxwell's equations get modified for vaccum? Derive wave equations for electric field $(\bar{E})$ and magnetic field $(\bar{B})$.

4 (a) Discuss in detail, skin depth of a conducting material and show that : $d = \frac{1}{k_{-}}$. 14

(b) Write a note on : Gauge transformation.

5 (a) Derive necessary boundary conditions at the interface between two mediums. 14

(b) Write a note on : Retarded potentials.

6 (a) A plane electromagnetic waves of angular frequency 'ω' incident normally at the interface between two linear media. Establish relationship between amplitude of incident wave $\left(\bar{E}_{OI}\right)$, amplitude of reflected wave $\left(\bar{E}_{OR}\right)$ and amplitude of transmitted wave $\left(\bar{E}_{OT}\right)$. 14

(b) Define reflection coefficient (R) and transmission coefficient (T) in terms of refractive indices (η) and thus show that $R + T = 1$. For instance if light passes from air to glass how much percentage of light get reflected and transmitted?

7 (a) Discuss the influence of uniform magnetic field $\left(\bar{B}\right)$ on the motion of charged particles when electric field is absent. 14

(b) Write a note on : Plasma oscillations.

8 (a) Write a note on : Whistler mode. 14

(b) Write a note on : Magnetic mirror effect.

9 (a) What are the different types of plasma instability? Discuss in brief. 14

(b) Write a note on : Applications of plasma.

10 (a) Write a note on : Phase Velocity $\left(V_p\right)$ and Group Velocity $\left(V_g\right)$. 14

(b) Write a note on different criterias required for existence of plasma.
