



B-1603010102010400

Seat No. _____

M. Sc. (Sem. I) Examination

March - 2021

Physics : CT-04

(Electrodynamics & Plasma Physics)

(New Course)

Time : $2\frac{1}{2}$ Hours]

[Total Marks : 70

Instruction : Attempt any five questions.

- 1 (a) Define operator $\bar{\nabla}$. Show that $\bar{\nabla} \cdot \bar{r} = 3$ where $\bar{r} = \hat{i}x + \hat{j}y + \hat{k}z$. 14
(b) Define mechanics. What are the different types of mechanics ?
(c) What are the four different types of forces ?
(d) What are the necessary conditions for the production of electro magnetic waves ?
(e) What are the characteristics of electro magnetic waves ?
(f) What do you mean by linear medium ?
(g) Show that velocity of light $(c) = (\mu_o \cdot \epsilon_o)^{-1/2}$.
- 2 (a) What are the six different states of matter ? 14
(b) List the applications of plasma.
(c) Define plasma-state of matter.
(d) List the techniques used for plasma confinement.
(e) List the types of plasma instability.
(f) List the natural and artificial source of occurrence of plasma.
(g) Define phase velocity and group velocity.
- 3 (a) Discuss in brief, Maxwell's contribution to electrodynamics. 7
Why and how Maxwell modifies Ampere's law ?
(b) Write Maxwell's equations for perfect insulating material and 7
derive the wave equations for electric field (\bar{E}) and magnetic
inductance (\bar{B}).
- 4 (a) Based on the wave equations for \bar{E} and \bar{B} derived modified 7
wave equations.
(b) Discuss in detail, skin-depth of conducting material. 7

- 5 (a) Derive necessary boundary conditions at the interface between two mediums. 7
- (b) Define Scalar potential (V) and Vector potential (\vec{A}). 7
Represent Maxwell's equations in terms of V and \vec{A} .
- 6 (a) Write a note on : Gauge transformation. 7
- (b) Write a note on : Retarded potentials. 7
- 7 (a) A plane electro-magnetic waves of angular frequency ' ω ' incident normally at the interface between two linear media. Establish relationship between amplitude of transmitted waves (\vec{E}_{OT}) and reflected waves (\vec{E}_{OR}) to the amplitude of incident waves (\vec{E}_{OI}). 7
- (b) Define reflection coefficient (R) and transmission coefficient (T) in terms of refractive indices. Show that $R + T = 1$. Prove that when light passes from air ($\eta=1.0$) to glass ($\eta=1.5$), 4% of light get reflected and 96% of light get transmitted. 7
- 8 (a) Discuss in detail, any three applications of plasma in various fields. 7
- (b) Discuss the statement : 'We live in 1% of universe in which plasma does not occur naturally'. Write a note on different criteria required for existence of plasma. 7
- 9 (a) Write a note on : Whistler mode. 7
- (b) Write a note on : Magnetic mirror effect. 7
- 10 (a) Discuss the effect of uniform magnetic field (\vec{B}) on the motion of charge particle. 7
- (b) Write a note on : Plasma instabilities. 7