

ENGLISH VERSION

- 1 (A) Attempt any two : 12
- (1) Derive an equation of the grand canonical distribution function through alternative method.
 - (2) Write down notes on μ -space and τ -space.
 - (3) Find out fluctuations in the number of particles of a system in a grand canonical ensemble.
- (B) Attempt any four : 4
- (1) Position and momentum co-ordinates can be known as _____ canonical equation.
(Hamiltonian, Lagrangian, Newtonian)
 - (2) Define phase space.
 - (3) Write down an equation of expansion function, P_α for grand canonical ensemble.
 - (4) $d\tau = \frac{\quad}{(h\omega^3, h\omega, h\omega^{3N})}$ in τ -space.
 - (5) Number of states in τ -space having $d\tau$ volume element is given by
$$g_\alpha = \frac{\quad}{\left(\frac{d\tau}{h^3}, \frac{d\tau}{h^2}, \frac{d\tau}{h}\right)}$$
- (C) Attempt any one : 4
- (1) Short notes on Barometric formula.
 - (2) Explain Mean Value Fluctuation (M.V.F.) for canonical ensemble.

- 2 (A) Attempt any two : 12
- (1) Define heat capacity and derive its equation. Draw its graph.
 - (2) Explain information of electromagnetic wave with optical modes and indicate phonon, photon curve in $\omega \rightarrow k$ graph.
 - (3) Explain Fermi Dirac distribution function at different temperature.
- (B) Attempt any four : 4
- (1) Show that metal is a proper illustration for Plasma.
 - (2) Write down an equation of heat current in terms of temperature gradient.
 - (3) Give a definition of density of states.
 - (4) Write down an equation of Fermi velocity for free electron gas at absolute temperature.
 - (5) Write down an equation of Debye length λ_D .
- (C) Attempt any one : 4
- (1) Derive an equation of average kinetic energy for free electron gas at 0 K temperature.
 - (2) Derive an equation of density of states as

$$\frac{D(\epsilon)}{V} = \frac{1}{2\pi^2} \left(\frac{2m}{\hbar^2}\right)^{3/2} \epsilon^{1/2}$$

3 (A) Attempt any two : 12

- (1) Derive Maxwell's equations in Homogeneous plasma.
- (2) Explain properties of plasma in magnetic field.
- (3) Explain magneto hydro dynamic (MHD) conversion of energy.

(B) Attempt any four : 4

- (1) In dispersion principle, if $w > w_p$ then wave vector $K =$ _____
(imaginary, real, hybrid)
- (2) V_{ph} _____ C . for any value of w .
($>$, $<$, $=$)
- (3) Write down a full name of TFTR.
- (4) _____ is known as "Father of plasma physics".
(Langmuir, Lorentz, Einstein)
- (5) When does a quasi neutrality of plasma is destroyed ? https://www.hnguonline.com

(C) Attempt any one : 4

- (1) Prove that $V_{ph} V_g = C^2$ where V_{ph} = phase velocity, V_g = group velocity, C = light velocity.
- (2) Explain controlled thermonuclear reactions.

Attempt any five : 10

- (1) $f(\epsilon) =$ _____ for $T = 0 K$ and $\epsilon < \epsilon_f$.
(1, 0, ∞)
- (2) A motion of plasma particles around magnetic force lines in _____ shape, so plasma do not attach to the wall of chamber.
(Helix, Circular, Ellipse)
- (3) Write down an equation of Hall co-efficient R_H .
- (4) When $\omega = \omega_p$ then Dielectric constant $\epsilon(\omega) =$ _____ (Zero, One, Infinite)
- (5) Write down a relation between C , μ_o and ϵ_o .
- (6) Draw a track of charged particles motion of fully ionized plasma in the absence of magnetic field.
- (7) Nuclear fusion condition is _____
 $\left(n\tau \geq \frac{1}{\alpha v}, n\tau < \frac{1}{\alpha v}, n\tau = \frac{1}{\alpha v} \right)$
- (8) Write down two types of confinement of a plasma.

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