



Thursday

- Note : (A) All the notations have their usual meaning.  
 (B) **Bold letter** in equation denotes **vector quantity**.  
 (C) Figures in the parenthesis at the right side of the questions indicate the marks.

Que.1 Choose the most correct option for the following multiple choice questions. [10]  
 (Attempt All)

- (1) The resultant field inside the conductor is \_\_\_\_\_.  
 (a) infinite (b) finite (c) zero (d) one
- (2) When the dielectric is placed in the electric field, all its atoms become \_\_\_\_\_.  
 (a) induced (b) Polarized (c) non-polarized (d) None
- (3) \_\_\_\_\_ is non-polar molecule.  
 (a) Co (b) CO<sub>2</sub> (c) NaCl (d) H<sub>2</sub>O
- (4) The electric displacement D is given as \_\_\_\_\_.  
 (a)  $D = \epsilon_0 E + P$  (b)  $D = -\nabla \times E$  (c)  $D = (\nabla \times E) - V$  (d)  $D = (\nabla \cdot E) - V$
- (5) The \_\_\_\_\_ plays a role in magnetostatics analogous to electric displacement in electrostatics.  
 (a) magnetic field (b) magnetization (c) Susceptibility (d) magnetic field intensity
- (6) Plasma has ability to Shield Out electric potential that applied to it this process is called \_\_\_\_\_.  
 (a) EMI shielding (b) Debye Shielding (c) Charge Shielding (d) Electric Shielding
- (7) The trajectory of a charged particle space is in general, a \_\_\_\_\_.  
 (a) helix (b) circular (c) linear (d) elliptical
- (8) The Larmor radius \_\_\_\_\_ with increase in magnetic field.  
 (a) increases (b) decreases (c) remains constant (d) diverges
- (9) The drift caused by the force of gravity is \_\_\_\_\_.  
 (a)  $V_g = \frac{m g \times B}{q B^2}$  (b)  $V_g = \frac{1}{m} \frac{F \times B}{B^2}$  (c)  $V_g = n(M + m) \frac{g \times B}{B^2}$  (d)  $V_g = \frac{E \times B}{B^2}$
- (10) For ion waves, the group velocity is \_\_\_\_\_ the phase velocity.  
 (a) greater than (b) less than (c) equal (d) none of these

Que.2 Do as directed. (Attempt all)

Fill in the blanks.

[08]

- (1) The charge density inside the conductor is \_\_\_\_\_.
- (2) A magnetization parallel to B is \_\_\_\_\_.
- (3) Any ionized gas cannot be called a \_\_\_\_\_.
- (4) In Thermodynamic relation  $P = C\rho^\gamma$ ,  $\gamma =$  \_\_\_\_\_.



①

(P.T.O.)

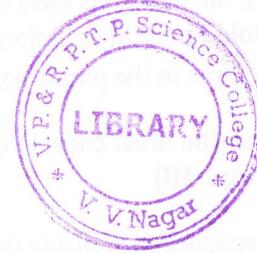
**State whether True or False**

- (5) In real life there are no perfect conductors.
- (6) In a uniform magnetic field, the net force on a current loop is infinite.
- (7) Earth's magnetosphere shields from the solar radiation carried by solar wind.
- (8) Plasma frequency depends only on the plasma density.

**Que.3 Give short answer of the following questions. (Any Ten)**

[20]

- (1) Write Laplace's equation in spherical polar coordinates.
- (2) Briefly explain basic properties of conductors.
- (3) Explain: dielectric.
- (4) What is polarization? Explain.
- (5) Define: (1) Diamagnets (2) Paramagnets (3) Ferromagnets.
- (6) Deduce Faraday's law
- (7) What is plasma? Explain.
- (8) Discuss the loss cone for magnetic mirror.
- (9) Define: Plasma frequency
- (10) Briefly explain Langmuir's paradox.
- (11) Write a note on equation of continuity.
- (12) Differentiate between plasma oscillation and ion waves.



**Que.4 Answer in detail the following long questions. (Any four)**

[32]

- (1) Solve the Laplace 's equation using the method of separation of variable with spherical polar coordinates.
- (2) Define conductor, dielectric and discuss basic properties of conductor in detail.
- (3) Calculate the torque and force on a rectangular current loop in uniform field **B**.
- (4) Explain the effect of magnetic field on atomic orbits and prove that change in the dipole moment is  $\Delta m = -\frac{e^2 R^2}{4m_e} \mathbf{B}$ .
- (5) Explain Debye Shielding in detail and derive the formula for Debye length  $\lambda_D$ .
- (6) Derive expression of polarization drift based on concept of time varying **E** field.
- (7) For ion waves derive equation for the velocity  $C_s$  of sound waves in neutral gas.
- (8) Obtain expression for Diamagnetic drift  $\mathbf{v}_D = -\frac{\nabla p \times \mathbf{B}}{qnB^2}$  when fluid drift perpendicular to **B**.

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(2)