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Seat No. _____

Sardar Patel University **No. of Printed Pages : 02**

B.Sc. Semester : VI Examination

Subject : Physics **Course Title : Electrodynamics and Plasma Physics**

Course Code : US06CPHY24

Date : 07/04/2022 **Time : 03:00 P.M. to 05:00 P.M.** **Total Marks : 70**

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. (Attempt All)** **[10]**

(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_2 (c) NaCl (d) H_2O

(4) The electric displacement D is given as _____.
(a) $\mathbf{D} = \epsilon_0\mathbf{E}+\mathbf{P}$ (b) $\mathbf{D} = -\nabla\times\mathbf{E}$ (c) $\mathbf{D} = (\nabla\times\mathbf{E}) - V$ (d) $\mathbf{D} = (\nabla.\mathbf{E}) - V$

(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) $V_g = \frac{m}{q}\frac{g\times B}{B^2}$ (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)** **[08]**
Fill in the blanks.

(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 $P = C\rho^{\gamma}, \gamma =$ _____.

(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 $\Delta m = -\frac{e^2R^2}{4m_e}B$.

(5) Explain Debye Shielding in detail and derive the formula for Debye length λ_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 $v_D = -\frac{\nabla p \times B}{qnB^2}$ when fluid drift perpendicular to **B**.

—X—