

# VP & RPTP Science College

Vallabh Vidyanagar

BSc Examination [Semester: VI] 2019

Subject: Physics Course: US06CPHY04

Physics

Saturday, Date 09-03-2019

Time: 10.00 am to 12.00 pm

Total Marks: 50



## INSTRUCTIONS:

- 1 Attempt all questions.
- 2 The symbols have their usual meaning.
- 3 Figures to the right indicate full marks.

### Q-1 Multiple Choice Questions: [Attempt all]

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- (i) The charge density inside a conductor is \_\_\_\_\_.
- (a) Negative (b) positive  
(c) Zero (d) imaginary
- (ii) The electric displacement is given as \_\_\_\_\_.
- (a)  $D = \epsilon_0 E + P$  (b)  $D = -\nabla \times E + V$   
(c)  $D = P - \epsilon_0 V$  (d)  $D = -\nabla \times E$
- (iii) The torque on a magnetic dipole is given by \_\_\_\_\_.
- (a)  $N = m \cdot B$  (b)  $N = m \times B$   
(c)  $N = m \cdot H$  (d)  $N = m \times H$
- (iv) In diamagnetic materials the induced dipole moments point \_\_\_\_\_ to the magnetic field.
- (a) opposite (b) same  
(c) Perpendicular (d) None of these
- (v) The magnetic moment of the gyrating particle to be \_\_\_\_\_.
- (a)  $\mu = -\frac{1}{2} m v_{\perp}^2 / B$  (b)  $\mu = -m v_{\perp}^2 / B$   
(c)  $\mu = \frac{1}{2} m v_{\perp}^2 / B$  (d)  $\mu = m v_{\perp}^2 / B$
- (vi) The Larmor radius is given by \_\_\_\_\_.
- (a)  $r_L = \frac{v_{\perp}}{\omega_c}$  (b)  $r_L = \frac{\omega_c}{v_{\perp}}$   
(c)  $r_L = \frac{v_{\parallel}}{\omega_c}$  (d)  $r_L = \frac{v_{\parallel}}{\omega_c}$
- (vii) The current density for plasma is given by \_\_\_\_\_.
- (a)  $j = n_i q_i v_i - n_e q_e v_e$  (b)  $j = n_i q_i v_i \times n_e q_e v_e$   
(c)  $j = n_i q_i v_i + n_e q_e v_e$  (d)  $j = n_i q_i v_i \div (n_e q_e v_e)$
- (viii) The neutral fluid will interact with the ions and electrons only through \_\_\_\_\_.
- (a) Pressure (b) Reaction  
(c) Collision (d) Mixing

**Q-2 Answer the following questions in short. (Attempt any Five) 10**

- (1) Write any two basic properties of conductors. (No detail description is required)
- (2) Define polarization. Give name of one polar molecule.
- (3) Define types of magnets.
- (4) Explain Ohm's law.
- (5) Define plasma.
- (6) Enlist any two applications of plasma.
- (7) Write equation of convective derivative.
- (8) Write the generalized fluid equation of motion for plasma.



**Q-3 Discuss bound charges and show that total potential 8**

$$V(r) = \frac{1}{4\pi\epsilon_0} \oint \frac{\sigma_b}{r} da' + \frac{1}{4\pi\epsilon_0} \oint \frac{\rho_b}{r} d\tau'$$

**OR**

**Q-3 Write a note on a capacitor. Show that total work to charge capacitor from  $q = 0$  to  $q = Q$  is  $W = \frac{1}{2} CV^2$ . Find the capacitance of two concentric spherical metal shells, with radii  $a$  and  $b$ . 8**

**Q-4 Discuss effect of a magnetic field on atomic orbits and define magnetization. 8**

**OR**

**Q-4 Derive Ampere's law in magnetized materials. Discuss Auxiliary field  $H$  in detail. Why  $H$  is more useful quantity than electric displacement  $D$ . 8**

**Q-5 Define and discuss Debye shielding and derive expression for Debye's length. 8**

**OR**

**Q-5 Write a note on (i) Gravitational drift and (ii) Grad-B drift. 8**

**Q-6 Discuss fluid drift parallel to  $\mathbf{B}$  in detail. Discuss graphically when there is a local density clump in plasma. 8**

**OR**

**Q-6 Discuss plasma oscillations and derive expression for plasma frequency  $\omega_p$ . 8**