SARDAR PATEL UNIVERSITY
6th Semester B.Sc. EXAMINATION (Under CBCS)
Monday, 02nd April 2018
Time 10:00 am to 1:00 pm
Subject Code: PHYSICS [USO6CPHY04]
(Electrodynamics and Plasma physics)

N.B: (i) All the symbols have their usual meanings.   Total Marks: 70

(ii) Figures at the right side of questions indicate full marks.

Q-1 Choose the correct option for the following questions.   [10]

(1) The resultant field inside the conductor is _____.
     (a) one   (b) infinite   (c) zero   (d) none of above

(2) When a sample is placed in a region of non-uniform magnetic field, the diamagnet is _____ away.
     (a) repelled (b) attract (c) steady (d) none

(3) The current density J is proportional to the _____ per unit charge.
     (a) pressure (b) force (c) work (d) energy

(4) Conductivity decreases with increasing _____.
     (a) force (b) work (c) energy (d) temperature

(5) A changing magnetic field induces _____ field.
     (a) electric (b) magnetic (c) electromagnetic (d) none

(6) The magnetic flux through the Larmor orbit is _____.
     (a) decreases (b) increases (c) constant (d) none

(7) Magnetic moment of the gyrating particle is _____.
     (a) $\mu = \frac{\frac{1}{2}mv_\perp{}^2}{B}$ (b) $\mu = \frac{mv_\perp{}^2}{B}$ (c) $\mu = \frac{-\frac{1}{2}mv_\perp{}^2}{B}$ (d) none of these

(8) The Magnetic moment is invariant in slowly varying _____ fields.
     (a) electric magnetic (b) magnetic (c) electric (d) gravitational

(9) $P = C_p\gamma$, where $\gamma = $ _____.
     (a) $\frac{c_p}{c_v}$ (b) $\frac{c_v}{c_p}$ (c) $c_p \cdot c_v$ (d) $c_p + c_v$

(10) In particular, ω does not depend on K, so the group velocity $\frac{d\omega}{dk}$ is _____.
     (a) zero (b) greater than zero   (c) less than zero   (d) none

Q-2 Answer any ten questions in brief.   [20]

(1) Show that total work done to go from q=0 to q=Q is $w = \frac{1}{2}cv^2$.

(2) Explain : Dielectric.

(3) Give boundary conditions for electric displacement.

(4) Define: Electromotive force.

(5) Deduce: Faraday's Law.

(P.T.O)

(6) Write four equations of electrodynamics before Maxwell's.

(7) Write three conditions that an ionized gas must satisfy to be called plasma.

(8) Explain: Loss cone.

(9) What is drift instability?

(10) Define: Plasma frequency.

(11) Explain: ion acoustic waves.

(12) Which phenomenon is called "Langmuir's paradox"?

Q-3 (A) What happens to a neutral atom when it placed in an electric field E? [04]

(B) Give interpretation of bound changes and show that [06]
(i) If polarization is uniform $\sigma_b = \hat{p}.\hat{n}$ and
(ii) If polarization is non-uniform $\rho_b = -\vec{\nabla}.\vec{p}$

OR

Q-3 (A) Solve Laplace's equation using the method of separation of variable with spherical polar co-ordinates. [06]

(B) Give the solution of Laplace's equation in three dimensions and show that if a single point charge q is located outside the sphere $V_{arc} = V_{centre}$. [04]

Q-4 (A) Calculate the torque and force on a rectangular current loop in an uniform field B. [10]

OR

Q-4 (A) Explain bound currents and give physical interpretation of bound currents. [10]

Q-5 (A) What is Maxwellian velocity distribution? Deduce E_{av} in one and three dimension. [06]

(B) Write and explain Saha equation. [04]

OR

Q-5 (A) Derive expression for polarization drift based on concept of time varying field. [05]

(B) Prove that the magnetic flux through a Larmor orbit is constant in time-varying B field. [05]

Q-6 (A) Derive equation of,(i) continuity and (ii) state [06]

(B) Compare ordinary fluids with ordinary hydrodynamics. [04]

OR

Q-6 (A) For an Ion waves derive the velocity of sound in plasma. [06]

(B) Obtain an expression for the velocity C_s of sound waves in neutral gas. [04]

---

②