

Physics (Hons.) Paper-IV

Answer five questions, selecting two each from Group-A and two questions Group-B, in which Q.No. 1 is compulsory.

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1. Choose the correct option in each of the following :

(a) S.I. unit of the quantity is :

- (i) Am^{-1} (ii) Nc^{-2} (iii) ms^{-1} (iv) $\text{Nm}^2 \text{c}^{-2}$

where ϵ_0 = permittivity of free space, μ_0 = permeability of free space.

(b) At a point inside a hollow charged sphere :

- (i) Potential and electric intensity both are zero
(ii) Potential is non-zero constant and electric intensity is zero
(iii) Potential is zero and electric intensity is non-zero constant
(iv) Potential and electric intensity both are non-zero constant

(c) At a point on the perpendicular bisector of an electric dipole :

- (i) Potential and electric intensity both are zero
(ii) Potential is zero but electric intensity is non-zero
(iii) Potential is non-zero but electric intensity is zero
(iv) None of the above is correct

(d) For a paramagnetic material susceptibility is :

- (i) Independent of temperature and applied magnetic field
(ii) Directly proportional to temperature and independent of applied magnetic field
(iii) Inversely proportional to temperature and independent of applied magnetic field
(iv) None of the above is correct

(e) Potential gradient developed along a conductor having a temperature gradient is called :

- (i) Seeback effect (ii) Peltier effect
(iii) Thomson effect (iv) Joule's effect

(f) Kirchhoff's second law is an application of :

- (i) Conservation of charge (ii) Conservation of energy
(iii) Conservation of charge and energy both (iv) None of the above is correct

(g) Moving coil ballistic galvanometer is used to measure :

- (i) Current (ii) Voltage (iii) Charge (iv) Resistance

(h) M is mutual inductance of two coils having self inductances L_1 and L_2 , then :

- (i) $M = \sqrt{L_1 L_2}$ (ii) $M < \sqrt{L_1 L_2}$ (iii) $M > \sqrt{L_1 L_2}$ (iv) $M \leq \sqrt{L_1 L_2}$

(i) The phase difference between current and voltage in a self inductance in an a.c. circuit is :

- (i) π (ii) $\pi/2$ (iii) Zero (iv) None of the above is correct

(j) At resonance a series LCR circuit fed with an alternating voltage behaves as :

- (i) Inductive circuit (ii) Capacitive circuit
(iii) Resistive circuit (iv) None of the above is correct

Group-A

2. Obtain Laplace's equation in cartesian co-ordinates and use it to obtain the capacity of a parallel plate condenser.
3. Explain non-polar and polar dielectrics. Discuss polarization of a non-polar dielectric when it is placed in a uniform electric field. Define electric polarization vector (\vec{P}) and electric displacement vector (\vec{D}) and obtain their relation.
4. What is magnetic circuit ? Explain the terms magnetomotive force and reluctance. Compare electric and magnetic circuits. Discuss the full magnetic circuit of an electro-magnet.
5. Explain the terms : LNMUonline.com
 - (a) Magnetic hysteresis (b) Retentivity
 - (c) Coercive force (d) Cycle of magnetization

6. Explain the physical significance of B-H curve :
 (a) Obtain the expression for electric intensity at a point due to an electric dipole.
 (b) Obtain the expression for force on unit area on the surface of a charged conducting sphere.

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Group-B

7. Explain Peltier and Thomsan Coefficients. Applying thermodynamics in the working of a thermocouple establish the relation $\frac{d}{dT} \left(\frac{\lambda}{T} \right) = \frac{\sigma_a - \sigma_b}{T}$, where the symbols have their usual meaning.
8. A capacitor C is charged and is allowed to discharge through an inductance L and resistance R in series.
 Discuss when the discharge will be oscillatory and obtain the frequency of oscillation.
9. Explain the construction and working of an a.c. wattmeter.
10. Write short notes on any two of the following :
 (a) Kirchoff's laws and their applications (b) A.C. De Sauty bridge
 (c) Use of complex numbers in study of a.c. circuits.
 (d) Self and mutual inductances.

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