C 5130

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FOURTH SEMESTER B.Sc. DEGREE (SUPPLEMENTARY/IMPROVEMENT) EXAMINATION, MAY 2016

Core Course—Physics

PH 4B 07—ELECTRODYNAMICS—I

Time : Three Hours   Maximum : 30 Weightage

The symbols used in this question paper have their usual meanings.

Section A

I. Objective type questions. Each question carries a weightage of ¼.

Choose the correct alternative from the given list :

1 div Curl $\mathbf{E}$ = —————.

     (a) Zero.   (b) $\nabla^2 \mathbf{B}$.

     (c) Infinity.   (d) None above.

2 The Displacement vector $\mathbf{D}$ =

     (a) $\varepsilon_0 \mathbf{E} + \mathbf{P}$.   (b) $\varepsilon_0 \chi_e \mathbf{E}$.

     (c) $\varepsilon_0 \, \partial \mathbf{E}/\partial t$.   (d) $1 + \chi_e$.

3 $\mathbf{V.B} = 0$ implies.

     (a) $\mathbf{B}$ is always zero.   (b) $\mathbf{B}$ is a constant.

     (c) $\mathbf{B}$ is irrotational.   (d) $\mathbf{B}$ is solenoidal.

4 The magnetic susceptibility of a diamagnetic material is :

     (a) Zero.   (b) Less than zero.

     (c) Greater than zero.   (d) Complex.

Fill in the blanks :

5 The value of permittivity of air is —————.

6 The general solution of one dimensional Laplace's equation is a —————.

7 The equation connecting Polarization and susceptibility is —————.

8 The field outside a current carrying solenoid is —————.

Turn over

Give very brief answers :

9   Write down the expression for flux of a vector.

10   Give differential form of Ampere's law.

11   Name the force experienced by a moving charge due to a magnetic field.

12   Give an example for a ferromagnetic material.

$(12 \times \frac{1}{4} = 3$ weightage)

Section B

II.   Answer all *nine* questions. Each question carries a weightage of 1 :

13   What is a Gaussian surface ?

14   Show that electric potential obeys superposition principle.

15   State 2nd Uniqueness theorem.

16   Define a linear Dielectric. Give an example.

17   What are the boundary conditions for **D**.

18   When a bar magnet is broken into 2 equal parts each part becomes a new magnet. Explain it on the basis of vanishing divergence of B.

19   What is Physical significance of the equation $\nabla x \mathbf{E} = 0$.

20   Define magnetization .What is its unit ?

21   How is Magnetic susceptibility related to permeability ?

$(9 \times 1 = 9$ weightage)

Section C

III.   Answer any *five* questions. Each question carries a weightage of 2 :

22   Find the electric field due to a uniformly charged solid cylinder both inside and outside the Cylinder.

23   Derive the equation for the capacitance of a Spherical capacitor.

24   A point charge q is situated at a distance r from the centre of a grounded conducting sphere of radius R. Find the potential inside and outside the sphere using the method of images

25   Find the minimum kinetic energy of a proton which would encircle the earth along the equator. Assume the radius of earth = 6,400 km and $B_H = 4 \times 10^{-5}$ Tesla. Mp = 1.7×10^{-27}kg.

26   Find the magnetic flux density of a square wire loop of side 10 cm, carrying 1 Amp at its centre

27   Explain how the concept of vector potential is introduced in magnetostatics. What is its advantage ?

28   Derive the equation of field due to a magnetised object.

$(5 \times 2 = 10$ weightage)

Section D

IV. Answer any *two* questions. Each question carries a weightage of 4 :

29 Derivean expression for energy of a charged capacitor. Show that the dielectric in between the plates of a parallel plate capacitor experiences a force and derive an equation for it.

30 Definethe terms 'boundary condition'. Derive boundary conditions in magneto statics and compare them with electrostatic boundary conditions.

31 Derive Clausius-Mossotti equation.

(2 × 4 = 8 weightage)