BACHELOR OF SCIENCE (CBCS-2018 COURSE)
T. Y. B. Sc. Sem-VI :SUMMER- 2022
SUBJECT : PHYSICS : CLASSICAL ELECTRODYNAMICS

Day : Saturday

Date : 2/7/2022

S-18462-2022

Time : 11:00 AM-02:00 PM

Max. Marks : 60

N.B.:
1) All questions are **COMPULSORY.**
2) Figures to the **RIGHT** indicate full marks.
3) Draw neat diagrams **WHEREVER** necessary.

Q. 1 Attempt any **Two** of the following. **(12)**
   (a) What is mean by electrical images? Write down the procedural steps for solving electrostatics problems.
   (b) Derive an expression of surface charge density of induced charge in the plane for a point charge +q placed from perpendicular distance 'd' from infinite grounded conducting plane.
   (c) Find the magnitude of polarization (P) in a dielectric material with k = 2.8, If D = 3.5 × 10^{-7} C/m^2 (Assume material is homogeneous and isotropic).

Q. 2 Attempt any **Two** of the following. **(12)**
   (a) What is meant by electric field or electrostatic field? define electric intensity at point in electric field and prove the expression for electric intensity due to point charge at any point $\mu - 1 + \chi_m$,
   (b) Explain concept of electrical potential and hence define electrical potential at a point.
   (c) Show that $\vec{\nabla} \times \vec{E} = - \dfrac{\partial \vec{B}}{\partial t}$

Q. 3 Attempt any **Two** of the following. **(12)**
   (a) Using Biot-Savart's law, derive an expression for magnetic induction due to straight conductor carrying a current I at appoint near the conductor
   (b) A parallel plate capacitor of plate area A=400 cm^2 and separated d=1.5 cm is charged by a potential 80 volt. Then the battery is disconnected and a dielectric slab of thickness b=0.8 cm and dielectric constant k=5 inserted. Calculate the three vectors E, D, E and P in dielectric.
   (c) Show that in a charge free non conducting medium Maxwell's equation leads to
   $$\nabla^2 E - \mu_0 \in_0 \frac{\partial^2 E}{\partial t^2} = 0 \quad \text{and} \quad \nabla^2 H - \mu_0 \in_0 \frac{\partial^2 H}{\partial t^2} = 0$$

Q. 4 Attempt any **Three** of the following. **(12)**
   (a) Obtain the solution of Laplace equation in Cartesian co-ordinate in three dimensions.
   (b) What do mean by Hysteresis? Draw Hysteresis loop and explain the term remanence and coercivity.
   (c) Two spheres of charges +20 C and +80 C are placed 36 cm apart. Find the position of the point between them where intensity is zero.
   (d) Find the electric field intensity and potential between anode and grounded cathode of working vacuum diode.

Q. 5 Attempt any **Four** of the following. **(12)**
   (a) Show that $\vec{\nabla} \cdot \vec{E} = \dfrac{\rho}{\in_0}$
   (b) State and explain coulombs law in electrostatics.
   (c) What do you mean by Diamagnetic, paramagnetic, ferromagnetic substances? Explain with example.
   (d) Three charges q, -2q and 4q are placed at corners of equilateral triangle having length of each side 2 m. Compute the potential energy of the structure.
   (e) What is meant by electric susceptibility? Show that $k = 1 + \chi_e$
   (f) Find the magnetic field associated with $E = E_0 \cos\beta x \cos\omega t \, \hat{z}$

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