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M 9931

V Semester B.Sc. Degree (CCSS-Reg./Supple./Imp.)

Examination, November 2015

Core Course in Physics

5B06 PHY: ELECTRODYNAMICS - I

Time: 3 Hours

Max. Weightage: 30

## SECTION-A

(Choose the correct answer. Each bunch carries a weightage of 1).

- 1. i) In the equation  $p = \alpha E$ ,  $\alpha$  is
  - a) Dipole moment

b) Polarization

c) Susceptibility

- d) Atomic Polarizability
- ii) Two metal spheres of radii R, and R, are charged to the same potential. The ratio of charges on the spheres
  - a)  $\sqrt{R_1}$ :  $\sqrt{R_2}$
- b) R<sup>2</sup><sub>1</sub>: R<sup>2</sup><sub>2</sub>
- c) R,: R2
- d) R31: R32

- iii) Volume current density is
  - a) Current per unit Volume
- b) Current per unit Area
- c) Current per unit length

- d) Charge per unit length
- iv) A soap bubble is negatively charged. Its radius
  - a) Decreases

b) Increases

c) Remains uncharged

- d) Cannot be predicted (W = 1)
- A current carrying loop is placed in a uniform magnetic field. The torque acting on it doesnot depend on
  - a) Shape of the loop

b) Area of the loop

c) Value of current

- d) Magnetic field
- ii) Domain formation is the necessary feature of
  - a) Diamagnetism

b) Paramagnetism

c) Ferromagnetism

d) All of the above

P.T.O.

- iii) The radius of curvature of the path of a charged particle in uniform magnetic field is directly proportional to
  - a) Charge

b) Momentum of the particle

c) Energy of the particle

- d) Intensity of the field
- iv) If a medium of dielectric constant K > 1 is introduced in a region, electric field E.
  - a) Increased K times

b) Reduced by a factor K

c) Not affected

d) None of the given (

(W = 1)

## SECTION-B

(Answer any six questions. Each question carries a weightage of 1).

- 3. What is physical definition of divergence of a vector field?
- 4. What is meant by irrotational field?
- Write down the advantage of potential formulation in electrostatics.
- 6. Write down Poisson's equation.
- 7. Give Clausius-Mossoti formula.
- 8. What is meant by polarization of a dielectric?
- 9. What is Lorentz force ?
- 10. State Biot-Savart law in vector form.

(6×1=6)

## SECTION - C

(Answer any nine questions. Each question carries a weightage of 2).

- 11. Show that  $(A \times B) \times C$  is not equal to  $A \times (B \times C)$ .
- 12. Find the area of a parallelogram formed by  $A = 2\hat{i} + 3\hat{j}$  and  $B = 4\hat{j} 2\hat{k}$ .
- 13. Find the potential inside a spherical shell of radius 0.1 m, uniformly charged with  $100\mu C$  .
- 14. Two charges  $4\mu C$  and  $5\mu C$  are at the corners of an equilateral triangle of side 30 cm. Find the electric field at the third corner.
- 15. A charge of 10μC is 0.5 m above a large block of a linear dielectric material of susceptibility 6. Find the force on the charge and its direction.

A part of long wire carrying a current of 1A is bent into a semicircle of radius 1 cm.
 Find the field at the centre of the semicircle.

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17. Derive Gauss's law in differential form.

- 18. A sphere of linear dielectric material is placed on an originally uniform electric field E<sub>o</sub>. Find the new field inside the sphere, if the dielectric constant is K.
- 19. Calculate the work done by the force  $F = 2\hat{i} + 2\hat{j} + 10\hat{k}$  N in moving an object through a displacement of  $4\hat{i} + 5\hat{j} \hat{k}$  m. Also find the component of the force acting along the direction of displacement.
- Prove that the normal component of electric field is discontinuous at any boundary of a charged surface.
- Two identical drops are charged to the same potential V. Find the new potential if they coalesce into one drop.
- A solenoid of length 20 cm and radius 1 cm and containing 200 turns carries a current of 2A. Calculate the magnetic induction at the center. Also calculate the magnetic moment of the solenoid. (9x2=18)

## SECTION - D

(Answer any one question. Carries a weightage of 4).

- 23. Derive an expression for the magnetic field intensity of on the axis of a circular coil carrying current i. Plot the field against distance.
- Show that electric field is negative gradient of electric potential and obtain Poisson's and Laplace's equations. (1x4=4)