

**F.Y.B.SC. SEM – II (CBCS - 2016 Course) : WINTER - 2018**

**SUBJECT: PHYSICS: ELECTRICITY & MAGNETISM**

Day : Monday  
Date : 15/10/2018

**W-2018-0697**

Time: 03.00 P.M. To 06.00 P.M  
Max. Marks: 60

**N. B. :**

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Neat diagrams must be drawn **WHEREVER** necessary.
- 4) Use of logarithmic table/**CALCULATOR** is allowed.
- 5) All symbols have their usual meaning unless otherwise stated.

**Q.1 A)** Select and write the most appropriate answer from the given alternatives for (06) each sub question.

- a) Magnetic dipole moment per unit volume is called \_\_\_\_\_
  - i) magnetization
  - ii) magnetic susceptibility
  - iii) magnetic permeability
  - iv) magnetic intensity
- b) SI unit of surface charge density is \_\_\_\_\_
  - i) C/m
  - ii) C-m
  - iii) C/m<sup>2</sup>
  - iv) C-m<sup>2</sup>
- c) Iron, nickel, cobalt and their alloys are examples of \_\_\_\_\_ substance.
  - i) diamagnetic substance
  - ii) paramagnetic substance
  - iii) ferromagnetic substance
  - iv) non-magnetic substance
- d) Dipole moment of non-polar molecule is \_\_\_\_\_
  - i) zero
  - ii) 1
  - iii) -1
  - iv) infinity
- e) 1 Tesla = \_\_\_\_\_ gauss
  - i) 1
  - ii) 10<sup>4</sup>
  - iii) 10
  - iv) 10<sup>5</sup>
- f) A wire of length 1 meter carrying a current I amperes is bent in the form of a circle, what is magnitude of the magnetic moment of circular loop?
  - i)  $\frac{I^2}{4\pi}$
  - ii)  $\frac{4\pi}{I^2}$
  - iii)  $4\pi \cdot I^2$
  - iv) zero

**B)** Attempt all the following questions. (06)

- a) State the relation between three vectors  $\vec{E}$ ,  $\vec{D}$ ,  $\vec{P}$
- b) Give the limitations of Coulomb's law.
- c) What does area of hysteresis loop indicate?
- d) What is electric intensity at any point in the interior of the spherical conductor?
- e) Find absolute permeability of iron in SI unit, if its relative permeability is 2000.
- f) Define electric dipole moment. State its SI unit.

**P.T.O.**

**Q.2** Attempt **ANY THREE** of the following: (12)

- a) What is Gauss's law in electrostatics? Deduce Coulomb's law from Gauss's law.
- b) What is solenoid? Obtain an expression for magnetic induction at a point within a solenoid?
- c) The parallel plate capacitor of plate area  $0.01 \text{ m}^2$  is filled with dielectric of dielectric constant 5. Its capacitance is  $2 \times 10^{-10}$  Farad and it has been charged to 50 volts, find electric intensity in dielectric?  
[ $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 / \text{Nm}^2$ ]
- d) Distinguish between diamagnetic substance and paramagnetic substance.

**Q.3** Attempt **ANY FOUR** of the following: (12)

- a) Obtain an expression for torque on dipole placed in a uniform electric field.
- b) Using Ampere's law, derive an expression for magnetic induction at a point due to straight conductor carrying current I.
- c) A metal sphere of radius 10 cm is charged with  $6.28 \mu\text{C}$ . Find the surface density of charge on sphere?
- d) A toroidal coil has 300 turns. The inner and outer diameters are 22 cm and 26 cm respectively. Calculate magnetic field inside the coil when it carries current of 5 ampere.
- e) Define:  
i) Magnetic intensity    ii) Magnetization    iii) Magnetic Permeability

**Q.4** Attempt **ANY TWO** of the following: (12)

- a) Derive an expression for electric intensity at a point due to electric dipole.
- b) Explain effect of electric field on:  
i) polar molecule                      ii) non-polar molecule
- c) A coil of 20 cm radius has 15 turns and carries a current of 3 ampere. Find the magnetic induction at the centre of the coil.  
[ $\mu_0 = 4\pi \times 10^{-7} \text{ Wb} / \text{Am}$ ]

**Q.5** Attempt **ANY TWO** of the following: (12)

- a) Using loop model for electron orbit, obtain an expression for Bohr magneton.
- b) Obtain an expression for electric potential at any point due to electric dipole; hence determine electric potential at an equatorial point.
- c) Two parallel plates have equal and opposite charges, when the space between two plates is Vacuum, electric intensity is  $3 \times 10^6 \text{ V/m}$ . When the space is filled with dielectric, electric intensity becomes  $1.5 \times 10^6 \text{ V/m}$ . Find induced charge density on the surface of dielectric.

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