

Day: Monday
Date: 30/10/2017

Time: 03.00 PM TO 06.00 PM
Max. Marks: 60

W-2017-0558

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 the symbols have their usual meaning unless otherwise stated.

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

- a) Nm^2/C is SI unit of _____.
i) electric flux
ii) electric intensity
iii) electric potential
iv) electric dipole moment
- b) Product of magnitude of one charge and distance between two charges forming dipole is _____.
i) electric dipole
ii) electric intensity
iii) electric potential
iv) electric dipole moment
- c) Dielectric constant for vacuum is _____.
i) $K=0$
ii) $K=1$
iii) $K<1$
iv) $K>1$
- d) Substances whose molecules possess electric dipole are _____ substances.
i) unipolar
ii) non polar
iii) polar
iv) none
- e) Magnetic moment per unit volume is _____.
i) magnetic susceptibility
ii) magnetization
iii) magnetic permeability
iv) magnetic induction
- f) A solenoid of length 0.5 m has a radius of 1cm and is made of 500 turns. If it carries a current of 3A. Then magnitude of magnetic field inside solenoid is
i) $3.77 \times 10^3 T$
ii) $37.7 \times 10^3 T$
iii) $0.377 \times 10^3 T$
iv) $3.77 \times 10^{-2} T$

B) Attempt all the followings: **(06)**

- a) Define surface charge density. State its SI unit.
- b) Give the physical significance of equation of torque on dipole placed in an electric field.
- c) State Gauss's law for magnetism.
- d) According to Biot-Savart's law. What is expression for magnetic induction at the centre of circular coil carrying current I ?
- e) State characteristics of diamagnetic substance.
- f) Determine electric potential at any point on the perpendicular bisector of the dipole.

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) Obtain an expression for electric intensity at a point due to electric dipole.
- c) State and prove Ampere's circuital law.
- d) Define:

a) Magnetic susceptibility	b) magnetic permeability
c) Curie temperature	d) Hysteresis

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

- a) Derive an expression for electric intensity at a point due to uniformly charged ring.
- b) Distinguish between polar molecule and non-polar molecule.
- c) Using loop model for electron orbit, obtain an expression for Bohr magneton.
- d) A closed curve encircles several conductors. The line integral $\oint \vec{B} \cdot d\vec{x}$ around the curve is $3.83 \times 10^{-4} \text{ Tm}$
 - i) What is the net current in the conductor?
 - ii) If you were to integrate around the curve in opposite direction, what would be the value of line integral?
(Given: $\mu_0 = 4\pi \times 10^{-7} \text{ Wb/A.m}$)
- e) An electric flux of 6×10^3 in SI unit is found to be linked with a sphere due to some charge inside it. Calculate the magnitude of charge inside the sphere.
(Given: $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 / \text{Nm}^2$)

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

- a) State and prove Gauss's law in dielectrics.
- b) Obtain expression for magnetic induction at a point within solenoid using Ampere's law.
- c) The maximum value of the permeability of some metals is 0.150 T m/A. Find the value of maximum relative permeability and susceptibility.

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

- a) Derive an expression for electric potential at any point due to electric dipole.
- b) What is toroid? Obtain an expression for magnetic induction inside the toroid.
- c) Two spheres of charges 20C and 80 C are placed 18cm apart. Find the position of the point between them where the intensity is zero.