

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2011-12 & thereafter)

SUBJECT CODE : 11PH/MC/EM54

B.Sc. DEGREE EXAMINATION NOVEMBER 2015
BRANCH III - PHYSICS
FIFTH SEMESTER

REG. No. _____

COURSE : MAJOR – CORE
PAPER : ELECTROMAGNETISM
TIME : 30 MINS.

MAX. MARKS : 30

SECTION – A

TO BE ANSWERED IN THE QUESTION PAPER ITSELF

ANSWER ALL QUESTIONS:

(30 x 1 = 30)

I. CHOOSE THE CORRECT ANSWER:

1. Coulomb proved by a torsion balance that the force between charged bodies depends upon
 - a. magnitude of the charge
 - b. the distance between the charged bodies
 - c. the nature of the intervening medium
 - d. all the above
2. Which of the following quantity is scalar?
 - a. dipole moment
 - b. electric potential
 - c. electric field
 - d. electric force
3. The plates of a parallel plate capacitor have an area of $90 \times 10^{-4} m^2$ each and are separated by $2.5 \times 10^{-3} m$. The capacitance of a capacitor is
 - a. $31.86 \times 10^{-11} F$
 - b. $0.3186 \times 10^{-11} F$
 - c. $3.186 \times 10^{-11} F$
 - d. $318.6 \times 10^{-11} F$
4. i) The centre of gravity of the positive charges coincides with the centre of gravity of the negative charges.
ii) The non polar molecules have a permanent dipole moment.
Which of the above statement is correct?
 - a. Only (i)
 - b. Only (ii)
 - c. Both (i) & (ii)
 - d. none of the above
5. The magnitude of the induced dipole moment is directly proportional to
 - a. dielectric constant
 - b. electric field
 - c. area
 - d. thickness
6. The displacement of charges in the atoms of a dielectric under the action of applied field is called
 - a. polarisation
 - b. potential
 - c. displacement
 - d. energy

7. The magnetic Lorentz force on the charge is zero
- if the charge is at rest
 - if the direction of motion of the charge is parallel to the magnetic field
 - if the direction of motion of the charge is antiparallel to the magnetic field
 - all the above
8. Cyclotron is used to accelerate
- protons and deuterons only
 - protons and α particles only
 - protons and β particles only
 - protons, deuterons and α – particles
9. The magnetic field is at any point in the open space inside the toroid
- maximum
 - minimum
 - zero
 - constant
10. Which of the following substance have a net magnetic moment of atoms is Zero?
- paramagnetic substance
 - diamagnetic substance
 - ferromagnetic substance
 - dia & para magnetic substance
11. A magnetic dipole is kept in uniform magnetic field it experiences
- a force only
 - a torque only
 - a force and a torque
 - maximum force and minimum torque
12. For which of the following substances, the magnetic susceptibility is independent of temperature?
- diamagnetic
 - paramagnetic
 - ferromagnetic
 - diamagnetic and paramagnetic
13. The unit of self induction is
- Farad
 - Henry
 - Ampere
 - Joule
14. The coefficient of mutual induction between a pair of coils depends on the following factors
- size and shape of the coils
 - number of turns at permeability of material on which the coils are wound
 - proximity of the coils
 - all the above
15. Electromagnetic induction is not used in
- transformer
 - room heater
 - AC generator
 - choke coil

II. FILL IN THE BLANKS:

16. According to Gauss's law, if \vec{E} is directed inwards at every point of a closed surface, ϕ_E will be negative and there must be a net charge within the surface.

17. molecules have permanent dipole moment.
18. The Ampere's circuital law is written as
19. The differential form of Ampere's law is
20. Lenz's law provides another example illustrating the truth of law of

III. STATE WHETHER TRUE OR FALSE:

21. Positive charge is stored as the potential energy of the charge which can be released if the charge is permitted to return to infinity.
22. A non-polar molecules acquire induced dipole moment in opposite direction of the electric field.
23. The magnetic field due to the solenoid is the vector sum of the magnetic fields due to current through individual turns of the solenoid.
24. Magnetic permeability is the ability of the material to allow the passage of magnetic lines of force through it.
25. The induced emf is produced only when the magnetic field near the coil is changes.

IV. ANSWER THE FOLLOWING :

26. Define electrostatic field.
27. Write one example for polar & non-polar molecule.
28. State Biot-Savart law.
29. Define magnetic susceptibility.
30. Define electromagnetic induction.

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COURSE : MAJOR – CORE

PAPER : ELECTROMAGNETISM

TIME : 2 ½ HOURS

MAX. MARKS : 70

SECTION – B

(5 x 5 = 25)

ANSWER ANY FIVE QUESTIONS

1. The electric field near the earth's surface is 300 volt/meter directed downwards. What is the surface density of charge on earth's surface?
2. A sample of HCl gas is placed in an electric field of $2.5 \times 10^4 \text{ Nc}^{-1}$. The dipole moment of each HCl molecule is $3.4 \times 10^{-30} \text{ C m}$.
 - i) Find the value of molecular polarizability.
 - ii) Find the maximum torque that can act on a molecule.
3. A solenoid is 2m long and 3m in diameter. It has 5 layers of windings of 1000 turns each and carries a current of 5A. Find the magnetic induction at its centre along its axis.
4. Deduce the relation for the magnetic induction at a point along the axis of a circular coil carrying current.
5. A magnetizing field of 50Am^{-1} produces a magnetic field induction 0.024T in a bar of length 8 cm and area of cross section 1.5cm^2 . Calculate i) the magnetic permeability ii) the magnetic susceptibility
6.
 - i) State Faraday's law of electromagnetic induction
 - ii) Define coefficient of mutual induction.
 - iii) Give the practical application of self-induction.
7. Magnetic field through a coil having 200 turns and cross sectional area 0.04m^2 changes from 0.1Wbm^{-2} and 0.04Wbm^{-2} in 0.02 s. Find the induced emf.

SECTION C

(3 x 15 = 45)

ANSWER ANY THREE QUESTIONS

8.
 - i) State the principle of a capacitor.
 - ii) Derive an expression for the capacity of a parallel plate capacitor. What will be the capacity of the space between the plates is partially filled with a slab of thickness d and dielectric constant K?

9. i) Find an expression for the Gauss's law in a dielectric medium.
ii) What are called induced dipoles?
10. Describe the principle, construction and working of a cyclotron. What are its limitations?
11. Establish the following relations;
- i) $B = \mu_0(H + M)$
 - ii) $\mu = \mu_0(1 + \chi_m)$
 - iii) $\mu_r = (1 + \psi_m)$
12. Derive Maxwell's equation.
