

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2008-09&thereafter)

SUBJECT CODE : PH/MC/EM54

B.Sc. DEGREE EXAMINATION NOVEMBER 2011
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

- The distance between the electron and proton in the hydrogen atom is 5.3×10^{-11} m. What is the magnitude of the electrical force?
a) 8.1×10^8 N b) 8.1×10^{-8} N c) 1.8×10^{-8} N
- Four charges $+q$, $+q$, $-q$ and $-q$ respectively are placed at the corners of square of side 'a'. The electric potential at the centre 'O' of the square is
a) $\frac{4q}{4\pi\epsilon_0 a}$ b) $\frac{-4q}{4\pi\epsilon_0 a}$ c) Zero
- The capacitance of a parallel plate capacitor increases from $5\mu F$ to $60\mu F$, when a dielectric is filled between the plates. The dielectric constant of the dielectric is
a) 10 b) 12 c) 6
- The number of electric lines of force originating from a charge of 1C is
a) 1.129×10^{11} b) 6.25×10^8 c) 8.85×10^{12}
- The polar molecule is
a) N_2O b) O_2 c) H_2
- The magnitude of the Lorentz force is
a) $\frac{BqV}{\sin\theta}$ b) $Bqv\sin\theta$ c) $Bqv\cos\theta$
- The angular frequency and period of rotation of the particle in the magnetic field do not depend up on
a) mass of the particle b) charge of the particle c) velocity of the particle
- The unit of magnetic induction is
a) Tesla b) Weber – m^2 c) $m^2/weber$
- _____ Substance exhibit negative magnetic susceptibility
a) Para b) ferro c) dia

10. A magnetic dipole is kept in a uniform magnetic field it experiences
 a) a force and a torque b) a torque but not force c) a force but not a torque.
11. Which of the following is correct?
 a) $B = (\mu_0 H + I)$ b) $B = \left(\frac{\mu_0}{H} + I\right)$ c) $B = (\mu_0 I + H)$
12. The energy stored in an inductor is
 a) LI_0^2 b) $2 LI_0^2$ c) $\frac{1}{2} LI_0^2$
13. The Co-efficient of mutual induction between a pair of coils depends on the following factors.
 a) size and shape of coils, number of turns and permeability.
 b) proximity of the coils. c) both a and b.
14. The differential form of ampere's law is
 a) $\nabla \times \vec{B} = \mu_0 \vec{j}$ b) $\nabla \times \vec{H} = \mu_0 \vec{j}$ c) $\nabla \times \vec{j} = \mu_0 \vec{B}$
15. The Maxwell's equations are
 a) i) $\nabla \cdot \vec{E} = \frac{\delta}{\epsilon_0}$ ii) $\nabla \times \vec{E} = -\frac{\partial B}{\partial t}$
 b) i) $\nabla \cdot \vec{B} = 0$ ii) $\nabla \times \vec{H} = \vec{j} + \frac{\partial \vec{D}}{\partial t}$ c) both a and b

II. Fill in the blanks

16. The poissons equation for the electric potential is _____.
17. The non polar molecules do not have permanent _____.
18. A long closely wound helical coil is called _____.
19. The magnetic field is _____ at points outside the toroid .
20. A plane electromagnetic wave travelling in free space is _____ in nature.

III. State whether True or False

21. Electric flux over a surface may be +ve zero (or) -ve.
22. A polar molecule is one in which the centre of gravity of the positive charges is separated from the centre of gravity of the negative charges by a finite distance .
23. When looked from one end if the current through the solenoid is along clockwise direction the nearer end corresponds south pole and the other end is north pole.
24. The magnetic susceptibility at any point is defined as the ratio of the magnification at that point to the magnetic intensity at that point.

25. The coefficient of self induction of a coil is numerically equal to emf induced in the coil when the rate of change of current through the coil is unity.

IV. Answer the following

26. State coulomb's law in electrostatic forces.

27. Define polarization.

28. State first law of electromagnetic induction.

29. State Ampere's circuital law.

30. Define poynting vector.

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COURSE : MAJOR – CORE
PAPER : ELECTROMAGNETISM
TIME : 2 ½ HOURS **MAX. MARKS : 70**

SECTION – B

ANSWER ANY FIVE OF THE FOLLOWING (5 x 5 = 25)

1. A cylinder of large length has a charge of $2 \times 10^{-8} \text{C/m}$. Find the field intensity at a distance of 0.2m from it. Given $\epsilon_0 = \frac{10^{-9}}{36\pi} \text{Nm}^2\text{c}^{-2}$
2. The plates of a parallel plate capacitor have an area of 90cm^2 each and are separated by 2.5mm. The capacitor is charged by connecting it to a 400V supply. How much electrostatic energy is stored by the capacitor.
3. Find an expression for the Gauss's law in a dielectric medium.
4. A circular coil of 200 turns and of radius 20cm carries a current of 5A. calculate the magnetic induction at a point along its axis at a distance three times the radius of the coil from its centre .
5. Two parallel wires of each length 5m are placed at a distance of 10cm apart in air. They carry equal currents along the same direction and experience a mutually attractive force of $3.6 \times 10^{-4} \text{ N}$. Find the current through the conductor.
6. 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 $3.4 \times 10^{-30} \text{ Cm}$. Find the maximum torque that can act on a molecule.
7. a) What is an electromagnetic induction?
b) State faraday's laws of an electromagnetic induction.
c) Define self inductance and its unit.

SECTION-C

ANSWER ANY THREE OF THE FOLLOWING (3x 15=45)

8. State and prove Gauss's law in electrostatics. Hence show that at a point 'P' inside a charged sphere the electric- field is directly proportional to the distance of P from the centre of the sphere.

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9. a) Obtain the capacity of a spherical condenser when
i) The outer sphere is earthed ii) The inner sphere is earthed
- b) Discuss the capacity of a dielectric on the capacity of a capacitor.
10. a) State Biot-Savart law.
b) Explain Lorentz force.
c) Derive an expression for the magnetic induction at a point due to an infinitely long straight conductor carrying current.
11. a) Write a brief note on magnetic properties of materials.
b) Derive an expression for torque acting on electric dipole when placed in an uniform field.
c) Define magnetic susceptibility.
12. a) Use Maxwell's equations to show that an electromagnetic waves travel with the velocity of light in free space.
b) Obtain an expression for the energy associated with an inductor.
