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

SUBJECT CODE : **PH/MC/EM54**

B.Sc. DEGREE EXAMINATION NOVEMBER 2010
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)

Choose the correct answer

1. Electric field at a point is defined as

   a. E = e/q, b. E = q/F, c. E = F/q,

2. The permittivity value of free space is

   a. $\varepsilon_o = 9.85418 \times 10^{-12} C^2 N^{-1} m^{-2}$, b. $\varepsilon_o = 8.85418 \times 10^{-12} C^2 N^{-1} m^{-2}$,

   c. $\varepsilon_o = 8.85418 \times 10^{-10} C N^{-2} m^{-1}$

3. The differential form of the Gauss's law
   a. $\nabla xE = \varepsilon_{o/}\rho$, b. $\nabla.E = \rho/ \varepsilon_o$, c. $\nabla xE = \rho/ \varepsilon_o$
4. Capacitance of a parallel plate capacitor
   a. $C = \varepsilon_r A/d$, b. $C= d/ \varepsilon_r A$, c. $C = \varepsilon_o A/d$
5. In dielectric the polarization P is
   a. $P = \varepsilon_o \chi E$, b. $P = \varepsilon_o/ \chi E$, c. $P= \chi E/ \varepsilon_o$
6. The induced dipole moment P is proportional to

   a. Internal electric field e, b. External electric field E,
   c. Charge of the field

7. Bound charge σ_b is given by

   a. p.n, b. n.e, c. p.e

8. Magnetic flux φ is

   a. $\varphi = \oint A.ds$, b. $\varphi = \oint B.dt$, c. $\varphi = \oint B.ds$

9. In S.I unit the magnetic field induction B is

   a. Weber, b. Tesla, c. Gauss

.2..

10. Magnetic induction at a point on the axis of a circular coil carrying current when x = 0

a. $B= \mu_o N/2a^2$ b. $B= \mu_o Ni/2a$, c. $B= \mu i/2a$

11. The differential form of Ampere's law in a current free space is given by

a. $\nabla \times B= \mu_o J$, b. $\nabla \times B= 0$, c. $\nabla.B= \mu_o J$

12. Which of the following is correct?

a. $B= H+M$, b. $B= \mu_o (H+M)$, c. $B= H+ \mu_o M$

13. The susceptibility of paramagnetic material

a. decreases with rise in temperature,

b. increases with decrease in temperature,

c. Increases with rise in temperature

14. Displacement current is given by

a. $\partial J/\partial t$, b. $\partial D/\partial t$ c. $\partial D/\partial s$

15. Which of the following is wrong?

a. $\nabla.D = \rho$, b. $\nabla \times B= 0$, c. $\nabla \times E=-\partial B/\partial t$

Fill in the blanks

16. All charged bodies of dimensions small in comparison with the distance between them are referred to as ---------- (charges / point charges)

17. In a dielectric material all electrons are ---------- (tightly bound /free electron)

18. The magnetic effect of electric current was first noticed by ---------- (Ampere / Oersted)

19. In magnetic materials the numerous tiny localized surface current can be replaced by a single closed current is along the surface, such a current is called ---------- (Direct current/ Amperian current)

20. Light is a form of ---------- (FM waves/ sine wave/ electromagnetic wave)

State whether True or False

21. Electrostatics deals with the behavior of stationary electric charges.

..3..

22. In dielectric materials free electrons are present.

23. In electrostatic field the line integral for a closed path is zero.

24. Ferromagnetic materials set themselves parallel to the external field if suspended freely.

25. Ampere's law $\nabla \times B = \mu_o J$ does not hold good for time varying fields.

Answer the following

26. State coulomb's law.

27. Define electric polarization.

28. State Biot savart law.

29. Write three properties of diamagnetic materials.

30. What is poynting vector?

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PAPER : ELECTROMAGNETISM
TIME : 2 ½ HOURS MAX. MARKS : 70

SECTION – B

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

1. Calculate the electrostatic force and gravitational force between the protons and electrons in free space, when they are separated by a distance of 0.5×10^{-10} meter given that the charge of a proton is 1.6×10^{-27} kg, mass of electron = 9.1×10^{-31}kg, and G=$6.67 \times 10^{-11} Nm^2 kg^{-2}$

2. Find the equivalent capacity of two capacitors having capacities equal to 1μF and 2μF when they are grouped in (i) series and (ii) parallel.

3. Using Ampere's law derive the magnetic field inside a long solenoid.

4. A circular coil has a radius of 0.1m and a number of turns of 50. Calculate the magnetic induction at a point (i) on the axis of the coil and distance 0.2m from the centre. (ii) at the centre of the coil, when a current of 0.1A flows in it.

5. A rod of magnetic material 0.5m in length has a coil of 200 turns wound over it uniformly. If a current of 2 ampere is sent through it, calculate

   a) the magnetizing field H, b) the intensity of magnetization M,
   c) the magnetic induction B and d) the relative permeability μ_r of the material.
   Given $\chi_m = 6 \times 10^{-3}$

6. A magnetic field of 2000 ampere. turns/meter produces a flux density of 8π webers/m^2 in a bar of iron. Calculate the relative permeability and susceptibility.

7. Using Maxwell's equations to show that electromagnetic waves travel with the velocity of light in free space.

SECTION-C

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

8. a. State and prove Gauss law in electrostatics.

   b. Apply Gauss law to determine the field due to a spherical charge distribution

   (i) Outside the sphere, (ii) inside the sphere

..2.

9. a. Obtain the capacity of spherical condenser when
(i) the outer sphere is earthed

(ii) The inner sphere is earthed.

b. Discuss the effect of a dielectric on the capacity of a capacitor.

10. a. (i) Define magnetic flux. Write its S.I unit.

(ii) Define Lorentz force on a moving charge.

b. Obtain magnetic induction at a point due to a solenoid carrying current.

11. a. Obtain the divergence and curl of B in magnetic materials.

b. Derive the equation for magnetic vector potential.

12. a. State Faraday's laws of electromagnetic induction. Explain the phenomenon of Mutual induction and show that the co-efficient of coupling between two coils is given by $M/\sqrt{L_1 L_2}$

b. Define co-efficient of self inductance of a coil. Deduce a mathematical expression for the self inductance of a solenoid.

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