STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2011-12)
SUBJECT CODE : 11PH/MC/EM54

B.Sc. DEGREE EXAMINATION NOVEMBER 2013
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. <u>CHOOSE THE CORRECT ANSWER</u>: **(15 x 1 = 15)**

1. The electrostatic force between two point charges kept at a distance d apart, in a medium $\varepsilon_r = 6$, is 0.3 N. The force between them at the same separation in vacuum is

(a) 20 N (b) 0.5 N (c) 1.8 N (d) 2 N

2) The electric field outside the plates of two oppositely charged plane sheets of charge density σ is

(a) $+\sigma/2\varepsilon_o$ (b) $-\sigma/2\varepsilon_o$ (c) $+\sigma/\varepsilon_o$ (d) zero

3) Which of the following quantities is scalar?

(a) dipole moment (b) electric force
(c) electric field (d) electric potential

4) The work done in moving 500 μC charge between two points on equipotential surface is

(a) zero (b) finite positive (c) finite negative (d) infinite

5) The number of electric lines of force originating from a charge of 1 C is

(a) 1.129×10^{11} (b) 1.6×10^{-19} (c) 6.25×10^{18} (d) 8.85×10^{12}

6) The capacitance of a parallel plate capacitor increases from 5 μF to 60 μF when a dielectric is filled between the plates. The dielectric constant of the dielectric is

(a) 65 (b) 55 (c) 12 (d) 10

7) A dipole is placed in a uniform electric field with its axis parallel to the field. It experience

(a) only a net force (b) only a torque
(c) both a net force and torque (d) neither a net force nor a torque

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8) If a point lies at a distance x from the midpoint of the dipole, the electric potential at this point is proportional to
(a) $1/x^2$ (b) $1/x^3$ (c) $1/x^4$ (d) $1/x^{3/2}$

9) Which of the following equations represents Biot-Savart law?

(a) $dB = \mu_0 Idl/4 \pi r^2$ (b) $dB = \mu_0 Idl\sin\theta/4 \pi r^2$

(c) $\vec{dB} = \mu_0 \vec{Idl} \times \vec{r}/4 \pi r^2$ (d) $\vec{dB} = \mu_0 \vec{Idl} \times \vec{r}/4 \pi r^3$

10) Magnetic induction due to an infinitely long straight conductor placed in a medium of permeability μ is

(a) $\mu_0 I/4\pi a$ (b) $\mu_0 I/2\pi a$ (c) $\mu I/4\pi a$ (d) $\mu_0 I/2\pi a$

11) The torque on a rectangular coil placed in a uniform magnetic field is large, when
(a) the number of turns is large
(b) the number of turns is less
(c) the plane of the coil is perpendicular to the field
(d) the area of the coil is small

12) Electromagnetic induction is not used in
(a) Transformer (b) room heater
(c) AC generator (d) choke coil

13) An emf of 12 V is induced when the current in the coil changes at the rate of 40 A S^{-1}. The coefficient of self induction of the coil is
(a) 0.3 H (b) 0.003 H (c) 30 H (d) 4.8 H

14) In an electromagnetic wave
(a) power is equally transferred along the electric and magnetic fields
(b) power is transmitted in a direction perpendicular to both the fields
(c) power is transmitted along electric field
(d) power is transmitted along magnetic field

15) In an electromagnetic wave the phase difference between electric field $\vec{E}$ and magnetic field and magnetic field $\vec{B}$ is

(a) $\pi/4$ (b) $\pi/2$ (c) π (d) zero

II. FILL IN THE BLANKS: **(5 x 1 = 5)**

16) Charge, energy and mass are quantized and not _____.

17) According to Gauss's law, the charge inside the closed surface is _____.

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18) In Ampere's law, the sum of the quantities B.dl for all the elements in the closed path = _____.

19) In Hysteresis Curves, the area of the B-H loop is _____ than the corresponding M-H loop.

20) When the current in the circuit A changes, there is change in the magnetic flux linked with it, and an emf is induced in the circuit. This phenomenon is called _____.

III. STATE WHETHER TRUE OR FALSE: **(5 x 1 = 5)**

21) The unit of electric field is N/C or V/m.

22) In capacitors, the region between the two plates is filled with dielectric like mica or oil.

23) Magnetic induction along the axis of a circular coil carrying current, at the centre of the coil, $x = 0$, $B = \mu_0 nI/2a$.

24) In free space, magnetic susceptibility $\aleph = 1$.

25) When a current I flows through a coil, the magnetic flux (φ) linked with the coil is proportional to the voltage.

IV. ANSWER THE FOLLOWING : **(5 x 1 = 5)**

26) Mention any one application of Gauss's law.

27) Explain Polarization Vector.

28) State Ampere's law.

29) Define Magnetic Susceptibility.

30) State Faraday's law.

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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) What is dielectric? Explain the effect of introducing a dielectric slab between the plates of parallel plate capacitor.

2) State Gauss's law. Applying this, calculate electric field due to an infinitely long straight charge with uniform charge density.

3) An infinite line charge produces a field of 9×10^4 N C^{-1} at a distance of 2 cm. Calculate the linear charge density.

4) In a hydrogen atom electron moves in an orbit of radius 0.5 Å making 10^{16} revolutions per second. Determine the magnetic moment associated with orbital motion of the electron.

5) A solenoid is 2m long and 3 cm in diameter. It has 5 layers of windings of 1000 turns each and carries current of 5A. Find the magnetic induction at its centre along its axis.

6) A circular coil of 200 turns and of radius 20 cm 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.

7) Calculate the mutual inductance between two coils when a current of 4 A changing to 8 A in 0.5 s in one coil, induces an emf of 50 mV in the other coil.

SECTION C (3 x 15 = 45)
ANSWER ANY THREE QUESTIONS

8) State Gauss's law in electrostatics. Apply it to calculate the electric field intensity due to a uniformly charged non conducting sphere at points (i) outside the sphere, (ii) at the surface of the sphere and (iii) inside the sphere.

9) What is Ampere's circuital law? Applying Amperes circuital law, find the magnetic induction due to a straight solenoid.

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10) State Biot – Savart law. Obtain an expression for the magnetic induction at a point due to an infinitely long straight conductor carrying current.

11) Discuss the magnetic circuit of an electro magnet. Explain the terms permeability and susceptibility and derive the relation between them.

12) Explain the mutual induction between two long solenoids. Obtain an expression for the mutual inductance.

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