SUBJECT CODE : PH/MC/EM54

B.Sc. DEGREE EXAMINATION NOVEMBER 2009
BRANCH III - PHYSICS
FIFTH SEMESTER

REG. No._____

COURSE   :   **MAJOR – CORE**
PAPER   :   **ELECTRICITY AND MAGNETISM**
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. The electric field lines in equipotential surface are
   a) parallel lines   b) curved lines   c) crossed lines

2. The work done in moving a unit negative charge from infinity along the equatorial line of a dipole is
   a) zero   b) positive   c) negative

3. A parallel plate capacitor is immersed in oil of dielectric constant 6. The field between the plates is
   a) increased by 6 times   b) decreased by 1/6 times   c) decreased by $1/\sqrt{6}$ times

4. An electron is traveling from south to north in a magnetic field acting from east to west, then it moves
   a) upwards   b) downwards   c) north west

5. The energy stored in a parallel plate capacitor of area 'A', surface charge density 'σ', plate separation 'd' and charged to a potential 'V' is
   a) $\sigma A / 2 V$ b) $\varepsilon_o AV / 2d$ c) $\sigma^2 Ad / 2\varepsilon_o$

6. Faraday's law in differential form is
   a) $\nabla \times \mathbf{B} = \varepsilon_o\mu_o \, \partial\mathbf{E} / \partial t$ b) $\nabla \times \mathbf{E} = - \partial\mathbf{B} / \partial t$ c) $\nabla \cdot \mathbf{E} = \rho / \varepsilon_o$

7. The radius of curvature of the path of a charged particle moving in a magnetic field can be increased by
   a) increasing magnetic field   b) increasing its velocity   c) increasing its charge

8. For an LCR circuit at resonance the impedance is
   a) X_L b) $X_L + R$ c) R

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9. The deflection in a ballistic galvanometer is reduced to one fourth when it is shunted with a 30 Ω resistor. The resistance of the galvanometer is
   a) 10 Ω   b) 60 Ω   c) 90 Ω

10. The relation $\mathbf{D} = \varepsilon_o \mathbf{E} + \mathbf{P}$ holds good
    a) only in vacuum   b) only in dielectric   c) everywhere

11. Two parallel long wires separated by a distance 'd' carry equal current 'i'. if the currents are in the opposite direction, the magnetic field at a point midway between the wires is
    a) $2 \mu_o i / \pi d$ b) $4\mu_o i / \pi d$ c) zero

12. In an LR series ac circuit, the energy in one cycle is
    a) V_o^2 / R b) $V_o^2 / (R+X_L)$ c) $V_o^2 / (R^2+X_L^2)$

13. When a substance is placed in a magnetic field, its ability to get magnetized depends upon its,
    a) susceptibility   b) magnetic viscosity   c) permeability

14. The source of magnetizing field strength (**H**) is
    a) magnetization (**M**)   b) current (**I**)   c) magnetic field (**B**)

15. The ratio of **M / H** is
    a) $1 / \chi_m$ b) $\mu_r - 1$ c) $1 / \mu$

II   FILL IN THE BLANKS:

16. The electric dipole moment vector **p** points _____

17. Poisson's equation is _____

18. $\nabla \cdot \mathbf{B} = 0$. It means that _____

19. The magnetic field _____ a solenoid is uniform.

20. High value of Q factor determines _____.

III   STATE WHETHER TRUE OR FALSE:

21. Electric lines of force are parallel to equipotential surface.

22. A ballistic galvanometer measures steady currents.

23. The differential form of Ampere's law is $\nabla \times \mathbf{B} = \mu_o I$

24. The susceptibility of paramagnetic material is more than one.

25. When two capacitors are connected then energy is lost.

IV   ANSWER BRIEFLY:

26. Define electric polarization.

27. What is displacement current?

28. State Ampere's circuital law.

29. Define magnetic permeability.

30. What is meant by wattless current?

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TIME	**:**	**2 ½ HOURS**

MAX. MARKS : 70

SECTION – B

ANSWER ANY FIVE QUESTIONS: **(5 x 5 = 25)**

1. A sphere of 10cm diameter is suspended within a hollow sphere of 12cm diameter. If the inner sphere be charged to a potential of 15000 volts and the outer sphere be earthed, find the charge on the inner sphere.

2. If the earth has a surface density of charge equal to the charge of an electron, calculate the potential on the surface of the earth. Also calculate the electric field just outside the earth. ($R = 6.4 \times 10^6$ m)

3. Calculate the energy stored in a parallel plate capacitor with plate area $300cm^2$ each, plate separation 0.5cm and potential difference of 1000 volts.

4. A square coil of side 'd' carries a current 'i'. Calculate the magnetic induction at the centre of the coil.

5. The electron in hydrogen atom circulates around the nucleus in a path of radius 5.29×10^{-11} m at a frequency of 6.58×10^{15} Hz. Find the magnetic induction at the centre of the orbit.

6. An alternating voltage of 10 volts at 100Hz is applied to a choke of inductance 5H and of resistance 200 ohms. Find the power factor of the coil and the power absorbed.

7. A magnetic induction (B_o) of 2×10^{-4} wbm^{-2} in vacuum produces a magnetic flux (ϕ) of 2.4×10^{-8} wb in a bar of area of cross section $0.2cm^2$. Calculate the intensity of magnetization.

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SECTION – C

ANSWER ANY THREE QUESTIONS: (3 x 15 = 45)

8. a) Explain the significance of divergence and curl of electrostatic fields.

    b) Calculate the electric field strength due to an infinite cylinder of radius 'R' at any
       point distant lying i) inside ii) on the surface and iii) outside the cylinder.

9. a) Obtain an expression for the energy stored in a capacitor.

    b) Derive an expression for the capacitance per unit length of a capacitor consisting of
       two co – axial cylinders.

10. a) What do you mean by magnetic vector potential? Deduce an expression for it.

     b) Find an expression for the magnetic field due to a toroid coil using Ampere's law.

11. a) Explain magnetic susceptibility and establish its relation with relative permeability.

     b) Explain the boundary condition for **B** and **H.**

12. a) Give the theory of B.G.

     b) Discuss the power consumption in ac resonant circuit.

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