SUBJECT CODE : 15PH/MC/EM54

B.Sc. DEGREE EXAMINATION NOVEMBER 2019
BRANCH III - PHYSICS
FIFTH SEMESTER

COURSE   :   MAJOR – CORE
PAPER   :   ELECTROMAGNETISM
TIME   :   3 HOURS   MAX. MARKS 100

SECTION – A

ANSWER ALL QUESTIONS:

(30 x 1 = 30)

I.   CHOOSE THE CORRECT ANSWER:

1. Which one of the following statements regarding electrostatics is wrong?
    a) Charge is quantized
    b) Charge is conserved
    c) There is no field near an isolated charge at rest.
    d) A stationary charge produces both electric and magnetic fields.

2. Gauss law cannot be used to find which of the following quantity?
    a) Electric field intensity   b) Electric flux density
    c) Charge   d) Permittivity

3. Which component of the electric field intensity is always continuous at the boundary?
    a) Tangential   b) Normal   c) Horizontal   d) Vertical

4. The capacitance of a material refers to
    a) ability of the material to store magnetic field
    b) ability of the material to store electromagnetic field
    c) ability of the material to store electric field
    d) potential between two charged plates

5. The best definition of polarization is
    a) orientation of dipoles in random direction b) electric dipole moment/unit volume
    c) orientation of dipole moments   d) change in polarity of every dipole

6. When air in a capacitor is replaced by a medium of dielectric constant K, the capacity
    a) Decreases K tomes   b) increases K times
    b) Increases K_2 times   d) remains constant

7. The magnetostatics highly relies on which property?
    a) Resistance   b) Capacitance   c) Inductance   d) Moment

8. Find current density J when $B = 50 \times 10^{-6}$ units and area dS is 4 units.

    a) 9.94   b) 8.97   c) 7.92   d) 10.21

9. _____ force experienced by an electromagnetic wave in a conductor?

    a) Electrostatic   b) Magneto static   c) Electro motive   d) Lorentz

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10. The expression for magnetization is given by(I-current, A-area, V-volume)
    a) M = IAV   b) M = IA/V   c) M = V/IA   d) M = 1/IAV

11. The presence of parallel alignment of magnetic dipole moment is given by which materials?
    a) Diamagnetic   b) Ferromagnetic   c) Paramagnetic   d) Ferromagnetic

12. Very small and positive susceptibility is found in_____ magnetic
    a) Ferro   b) Dia   c) Para   d) Antiferro

13. The Faraday's law states about which type of EMF?
    a) Transformer EMF   b) Back EMF   c) Generator EMF   d) Secondary EMF

14. Using Maxwell equation which of the following cannot be calculated directly?
    a) B   b) D   c) A   d) H

15. The inductance is the measure of
    a) Electric charges stored by the material   b) Emf generated by energising the coil
    c) Magnetic field stored by the material   d) Magnetization of dipoles

II. FILL IN THE BLANKS:

16. The Coulomb law is an implication of _____ law.
17. The unit of charge is _____.
18. The Ampere law is based on _____ theorem.
19. The permeability and permittivity of air or free space is _____
20. The Mutual inductance M of a current carrying coil is given by _____

III. STATE TRUE OR FALSE:

21. The equation $V = x^2 + y^2 - z^2$ satisfies the Laplace equation.
22. Capacitance of a parallel plate condenser varies inversely with the separation of the plates.
23. The magnetic vector potential is a scalar quantity.
24. All the magnetic materials lose their magnetic properties when heated.
25. Maxwell second equation is based on Ampere law.

IV. ANSWER BRIEFLY:

26. What is meant by electric potential?

27. Define the unit farad.

28. What do you mean by magnetic vector potential?

29. Define Magnetic susceptibility.

30. Define coefficient of self-inductance of a coil.

SECTION – B (5 x 5 = 25)

ANSWER ANY FIVE QUESTIONS:

31. Find the energy stored in a uniformly charged solid sphere of radius R and total charge Q.

32. Three equal point chares, +q, are located at the vertices of an equilateral triangle of side a. Calculate the electrostatic energy W_3 of the configuration. What charge must be placed at the ceratoid of the triangle, so that $W_4 = 0$?

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

34. In the Bohr model of the hydrogen atom, the electron 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 magnitude of the magnetic induction at the centre of the orbit. What is its dipole moment?

35. A rod of magnetic material, 0.5 m 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 $\chi_m = 6 \times 10^{-3}$.

36. Calculate the self-inductance of a solenoid having 1000 turns and length 1 m. the area of cross-section is 7 cm^2 and the relative permeability of the core is 1000.

37. Distinguish dia, para and ferro magnetic materials.

SECTION - C (3 x 15 = 45)

ANSWER ANY THREE QUESTIONS:

38. State and prove Gauss's law in electrostatics.

39. Derive an expression for capacity of a parallel plate capacitor. What will be the capacity if the space between the plates is partially filled with a slab of thickness t and dielectric constant ε_r?

40. Use Biot-Savart's law to find the magnetic field due to

    a) a straight line conductor   b) along the axis of a circular coil.

41. Establish the relation $B = \mu_0(H + M)$ and $\mu = \mu_0 (1 + \chi)$

42. Give an account of Maxwell's equations. Deduce the equation for the propagation of the plane electromagnetic waves in free space.

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