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B.M.S. COLLEGE FOR WOMEN, AUTONOMOUS
BENGALURU – 560004
SEMESTER END EXAMINATION – SEPTEMBER 2023

B.Sc in Physics – 2nd Semester

ELECTRICITY & MAGNETISM
(NEP Scheme 2021-22 onwards F+R)

Course Code: PHY2DSC02

Duration: 2 ½ Hours

QP Code:2013

Max. Marks: 60

Instruction: Use of non-programmable scientific calculator is allowed.

PART – A

Answer ALL questions. Each question carries ONE Mark. (5X1=5)

1. The SI unit of Electric field is
a) NC b) NC^{-1} c) N^2C d) NC^2
2. The value of energy stored in a capacitor is
a) $\frac{1}{2} CV^2$ b) CV^2 c) $\frac{1}{2} C^2V$ d) $\frac{1}{2} C^2 V^2$
3. The work done in bringing a unit positive charge from infinity to a point against electric field is
a) Gauss law b) Faradays law c) Biot savarts law d) Electric Potential
4. For a series RLC circuit at resonance
a) $X_L > X_C$ b) $X_L < X_C$ c) $X_L = - X_C$ d) $X_L = X_C$
5. Which magnetic material has negative susceptibility
a) Para b) Ferro c) Dia d) Anti Ferro

PART – B

Answer any THREE questions. Each question carries TEN Marks. (3X10= 30)

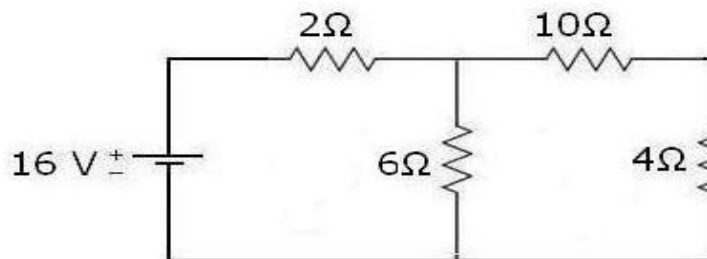
6. a) Derive an expression for electric field at a point outside uniformly charged thin spherical shell using gauss law.
b) Derive ohms law in vector form. **(6 + 4)**
7. a) Derive an expression for capacitance of a parallel plate capacitor with vacuum between plates.
b) Derive an expression for growth of current in series RL circuit. **(6 + 4)**
8. a) Derive an expression for magnetic force due to a current carrying conductor.
b) Derive an expression for current when AC is applied to series LR circuit. **(5 + 5)**

9. a) Derive $\nabla \cdot \mathbf{B} = 0$.
 b) Distinguish between dia, para and ferro magnetic materials. (4 + 6)
 10.a) State Faradays laws of EMI and derive an expression for energy stored in an inductor.
 b) Discuss maximum power transfer theorem. (6 + 4)

PART – C

Answer any **THREE** questions. Each question carries **FIVE** Marks (3X5=15)

11. A spherical shell of radius 5cm is charged uniformly to $10\mu\text{C}$. If then sphere is placed in air. Find the electric field intensity at a point. i) 10cm from the center ii) 4 cm from the center.
 12. Using Thevenin's theorem. Find the current in the load resistance of 4Ω .



13. An ac source of 110V, 50Hz is connected to a series circuit containing a resistance 200Ω , an inductance 5 H and a capacitance $100\mu\text{F}$. Calculate (a) the impedance of the circuit, (b) the phase angle.
 14. Find the force acting on a proton moving with a velocity of $\mathbf{V} = (2\mathbf{i} - 4\mathbf{j} + 2\mathbf{k}) \text{ ms}^{-1}$ which enters a magnetic field of $(2\mathbf{i} + 2\mathbf{j} - 3\mathbf{k}) \text{ T}$.
 15. The electric field amplitude of an electromagnetic wave is 120 SI units and its frequency is 50MHz. determine B_0 , ω , K and λ .

PART – D

16. Answer any **FIVE** questions. Each question carries **TWO** Marks. (5X2=10)

- (a) Can charge of a body be $\frac{5}{2} e$?
 (b) What is a dipole? Give example.
 (c) What happens to capacitance of a capacitor if the distance between plates is halved?
 (d) Differentiate between AC and DC.
 (e) What is the significance of the equation $\nabla \cdot \mathbf{B} = 0$?
 (f) Light is a transverse wave. Justify.
 (g) What is hysteresis?
 (h) State Thevenin's theorem.
