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UG 2nd Semester Examination – 2025 (Under NCCF)
Award: B.Sc.
Discipline: PHYSICS
Course Type: MNC – 2
Course Code: BSCPHSMN201
Course Name: Electricity and Magnetism

Full Marks: 35 **Time – 2 Hours**

1. Answer any five questions. **1×5=5**

(a) Is Electric flux a scalar or vector?
(b) What is an electric dipole?
(c) An electric dipole is placed in a uniform electric field. What would be the net force acting on it?
(d) What is equipotential surface?
(e) Sate uniqueness theorem.
(f) What is the relation between electric potential and electric field?
(g) What is the ratio of inductive and capacitive reactance in an ac circuit?
(h) Define Quality factor (Q-factor).

2. Answer any five questions. **2×5=10**

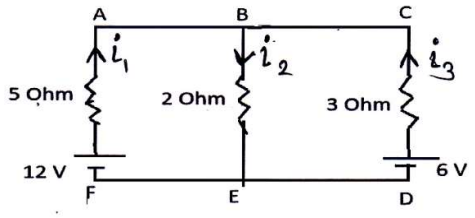
(a) The electric potential V is given as a function of distance r in meter as $V = 5r^2 + 10r - 9$ volt. Find the value of electric field at $r = 1m$.
(b) State Gauss theorem in electrostatics.
(c) How to increase the capacitance of a parallel plate capacitor?
(d) Is there any kind of material which when placed between the plates of a capacitor reduces its capacitance? Justify your answer.
(e) Compare between diamagnetic and paramagnetic substances.
(f) Find the magnetic field strength at the centre of a circular coil 15 cm in diameter containing 10 turns and carrying a current of 10 Ampere.
(g) Differentiate between ideal and practical voltage sources.
(h) The instantaneous current and voltage of an a.c circuit are given by

$$i = 2\sin \pi t \; amp\,.and\; v = 4\sin\left(\pi t + \frac{\pi}{2}\right)\; volt.$$

3. Answer any two questions. **5×2=10**

(a) Find the electric potential for the following two cases
i) Due to uniformly charged spherical shell at point both outside and inside the shell.
ii) Due to uniformly charged solid sphere at point both outside and inside the sphere.
$2\frac{1}{2} + 2\frac{1}{2} = 5$
(b) Define capacitance of a conductor. Calculate the capacitance of a spherical capacitor. Calculate the energy of a charged capacitor. 1+2+2
(c) State Biot-Savart law in magnetostatics. Find the magnetic field intensity at a point on the axis of a current carrying coil by using Biot-Savart Law. 1+4

(d) Using Kirchhoff's law in the electrical network as shown in figure. Calculate the values of i_1, i_2 and i_3.



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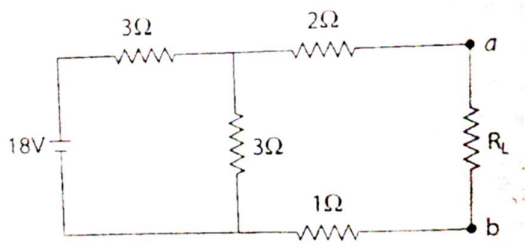
4. Answer any one questions. **10×1=10**

(a) i) Define an electric quadrupole. How dose it differ form a dipole?
ii) A bar magnet of magnetic moment M is cut into two parts of equal length. What will be the value of magnetic moment of either part?
iii) Show that the potential due to an arbitrary charge distribution of finite extend at a large distance can be expressed as a sum of multipole potential. 3+2 +5=10

(b) i) Consider the following circuit. Find the value of R_L such that maximum power is delivered to it. Also find the value of maximum power.



ii) Calculate the rms value of the current given by $i = I_0 + I_1 \cos(wt + \theta)$. 5+5=10

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