



DCPH201

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II Semester B.Sc. (NEP) Degree Examination, October - 2022

PHYSICS

Electricity and Magnetism

(Freshers-2021-22 and onwards)

Paper: Phy DSCT2



Time : 2½ Hours

Maximum Marks : 60

Instructions to Candidates:

1. Follow the instructions under each Part
2. Use of Non-Programmable scientific calculator is allowed

PART - A

Answer ALL the questions. Each question carries 1 mark.

(5×1=5)

1. The electrostatic potential energy of two charges kept at a distance is  $U$ . If the magnitude of both the charges is doubled, the new potential is
  - a)  $2U$
  - b)  $4U$
  - c)  $U/2$
  - d)  $U/4$
2. Capacitance of a capacitor depends on the
  - a) area of the plates
  - b) thickness of the plates
  - c) potential difference between the plates
  - d) charge on the plates
3. A resistance is connected to a cell. The power transferred to the resistance by the cell can be \_\_\_\_\_ the total power.
  - a) equal to
  - b) 80% of
  - c) 70% of
  - d) 40% of
4. In a pure capacitor connected to an ac source,
  - a) current leads voltage by  $90^\circ$ .
  - b) current lags voltage by  $90^\circ$ .
  - c) current and voltage are in phase.
  - d) current leads voltage by  $45^\circ$

[P.T.O.]



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5. Susceptibility of \_\_\_\_\_ magnetic material is negative.

- a) para
- b) ferro
- c) dia
- d) all

**PART - B**

Answer any THREE questions. Each question carries 10 marks.

(3×10=30)

6. a) Define electric potential and mention its SI unit. Obtain the relation between field and potential.  
b) Define electric dipole moment. Write the general expression for electric potential due to a dipole and explain the symbols. (6 + 4)
7. a) State and prove maximum power transfer theorem.  
b) Define time constant of an RC circuit. Write the expression for the same. (8 + 2)
8. a) Define impedance of an LCR series circuit. Mention its SI unit.  
b) Obtain an expression for the impedance and current for an LCR series circuit connected to an ac source using j-operator method. (2 + 8)
9. Derive the Maxwell's field equations (with usual notation): (4+6)
- i)  $\nabla \cdot \vec{B} = 0$
  - ii)  $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$
10. a) Mention any two properties of electric field lines.  
b) Define self-inductance. Obtain the expression for the coefficient of self-inductance of a coil.  
c) Distinguish between hard and soft magnetic materials. (2 + 5 + 3)

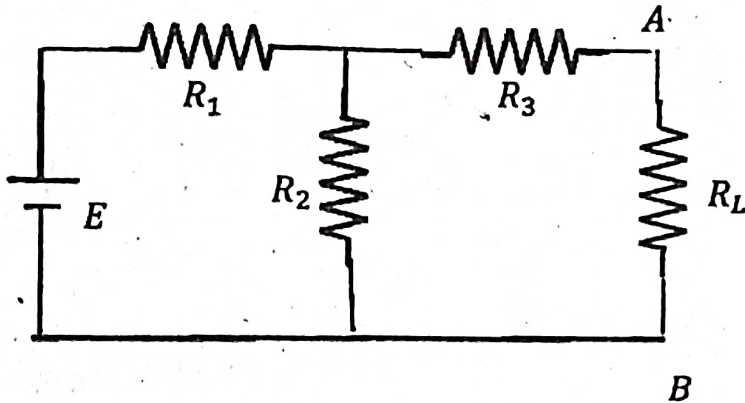
**PART - C**

Answer any THREE questions. Each question carries 5 marks.

(3×5=15)

11. Find the electrostatic force between the point charges  $5\mu\text{C}$  and  $2\mu\text{C}$  kept at a separation of 9 cm in
- i) vacuum and
  - ii) in a medium of relative permittivity 5.

12. Calculate the capacitance of a capacitor with plates of area  $100 \text{ cm}^2$  separated by  $1 \text{ mm}$ ,
- without dielectric
  - filled with a dielectric of dielectric constant 10. Given  $\epsilon_0 = 8.854 \times 10^{-12} \text{ Fm}^{-1}$ .
13. In the network shown, find the current through  $R_L$  using Thevenin's theorem  
Given  $R_1 = 6 \Omega$ ,  $R_2 = 3 \Omega$ ,  $R_3 = 4 \Omega$ ,  $R_L = 5 \Omega$  and  $E = 12 \text{ V}$ .



14. Calculate the force on a charge of  $5 \mu\text{C}$  moving with a speed of  $5 \text{ ms}^{-1}$  at an angle of
- $30^\circ$
  - $60^\circ$  to a magnetic field of  $3 \text{ T}$ .
15. The voltage between the plates of a parallel plate capacitor of capacitance  $1 \mu\text{F}$  changes uniformly from  $10 \text{ V}$  to  $20 \text{ V}$  in  $2 \text{ second}$ . What is the displacement current in the capacitor?

#### PART-D

Answer any FIVE the questions. Each question carries 2 marks. (5×2=10)

- 16 a) Electric potential at a point is zero. Should the electric field at that point be zero? Explain.
- b) How does the electric field due to an infinite line charge distribution vary with distance from the line? Explain.
- c) The net electric flux through a closed spherical surface is zero. Does this mean the sphere has no charges inside? Explain.
- d) Show that the ratio of resistance to inductance has same dimension as time.
- e) Mention two factors on which the Hall voltage depends.
- f) Average of sinusoidal AC voltage taken over a full cycle is zero. Explain.
- g) Mention any two-properties of paramagnetic materials.
- h) Write the equation of velocity of electromagnetic wave in free space and explain the symbols.
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