P. R. Thakur Govt. College

Department of Physics

B.Sc. Semester- II Internal Examination, 2024

Paper – **PHSMIN202T**

Electricity and Magnetism

***Time*: 1 Hour** **Full Marks: 20**

1. Answer any five questions from the following: 2×5=10

(a) Why two electric lines of force do not intersect each other?

(b) A battery of emf E and internal resistance r is connected to an external variable load R. Find the condition for maximum power transfer from the battery to the load.

(c) State Thevenin's theorem.

(d) Find a unit normal to the surface $x^2 + 3y^2 + 2z^2 = 6$ at point (2,0,1).

(e) If $\boldsymbol{A} = (x+3y)\boldsymbol{i} + (y-2z)\boldsymbol{j} + (x+pz)\boldsymbol{k}$ is a solenoidal vector, then find the value of p.

(f) State Biot-Savart's law.

(g) Show that the electrostatic field is a conservative field.

2. Answer any two questions from the following: 5×2=10

(a) State Gauss's law in electrostatics. Apply this law to calculate the electric field due to a uniformly charged sphere at a point outside the sphere. 2+3

(b) State Norton's theorem. What do you mean by electric potential? In an electron gun electrons of charge e mass m are accelerated through a potential difference V. Find the maximum speed attained by electrons.

2+1+2

(c) If $\boldsymbol{v} = \boldsymbol{\omega} \times \boldsymbol{r}$, then show that $2\boldsymbol{\omega} = \nabla \times \boldsymbol{v}$ Where, $\boldsymbol{\omega}$ is a constant vector and $\boldsymbol{r}$ is a position vector. Calculate $\nabla \cdot \boldsymbol{r}$ where $\boldsymbol{r} = \boldsymbol{i}x + \boldsymbol{j}y + \boldsymbol{k}z$ 3+2

(d) What is an electric dipole? Define dipole moment. Find an expression for the potential due to an electric dipole. 1+1+3

P. R. THAKUR GOVT. COLLEGE

CBCS Second semester Internal Examination-2019

Physics-Generic Elective

Paper-GE T2 (Electricity and Magnetism)

Time Allotted: 40 Minutes | Full Marks: 20

1. Answer any five questions from the following: **2x5=10**

(a) Two electric field lines never intersect-explain.

(b) Show that the electrostatic field of a point charge is irrotational.

(c) State and explain Kirchhoff's laws for the distribution of currents and voltages in a network.

(d) Show that the Kirchhoff's voltage law is consistent with the principle of conservation of energy.

(e) State Thevenin's theorem as applied to network analysis.

(f) State Faraday's laws of electromagnetic induction.

(g) Show that the magnetic energy stored in an inductor is $\frac{1}{2}LI^2$, where I is the current through it.

(h) What do you mean by self-inductance and mutual inductance?

Answer any two questions from the following: **5x2=10**

2. (a) State Gauss's law in electrostatics. Apply this law to calculate the electric field due to a uniformly charged sphere at an inside point.

2+3

3. Applying Kirchhoff's laws find the current through the galvanometer for an unbalanced Wheatstone bridge. Hence find the condition of balance.

4+1

4. Self –inductances of two coils are L_1 and L_2. Their mutual inductance is M. Show from energy consideration that $M^2 \leq L_1 L_2$.
What is coefficient of coupling?

4+1