11321

Reg. No. | | | | | | | | |

III Semester B.Sc. Degree Examination, March - 2021

PHYSICS

Electricity & Magnetism

(CBCS Semester Scheme 2018-19 Onwards Freshers and Repeaters)

Paper : III

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates:

1. Answer any **five** questions from each part.
2. Use of non - programmable scientific calculator is allowed.

PART - A

Answer any **Five** questions. Each question carries **8** marks. **(5×8=40)**

1. State and prove Thevenin's theorem. **(8)**

2. Derive an expression for growth of current in a CR circuit and represent it graphically. Hence Define its time constant. **(8)**

3. Give the theory of Ballistic galvanometer and define Logarithmic decrement. **(8)**

4. Derive the expression for force between two thin infinitely long straight parallel conductors carrying currents. Define Ampere. **(8)**

5. a) State and explain Divergence theorem.

b) Derive Maxwell's equation $\nabla \times \vec{H} = \vec{J} + \frac{\delta \vec{D}}{\delta t}$ **(2+6)**

6. Derive one - dimensional electromagnetic wave equation in free space. **(8)**

7. Obtain the expression for current in a series LCR circuit connected to an ac source using j-operator. **(8)**

8. a) Explain the variation of thermo-emf w.r.t temperature of the hot junction.

b) Define neutral temperature, temperature of inversion and obtain the relation between them. **(4+4)**

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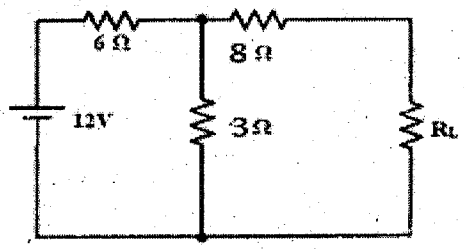
PART - B

Answer any **Five** questions. Each question carries **4** marks. **(5×4=20)**

9. In the given network, calculate the value R_L for maximum power transfer and also calculate the maximum power.



10. The current in LR circuit builds up to 1/3rd of its steady state value in 5s. Calculate the time constant.

11. The radius of the first orbit of hydrogen atom is $0.5\,\text{Å}$. The electron moves in a circular orbit with a uniform speed of $2.2\times10^{+6}$ ms^{-1}. What is the magnetic field produced at the centre of the nucleus due to the motion of the electron. (Given $e = 1.6\times10^{-19}C$).

12. A Helmholtz tangent galvanometer has a coil of mean radius 20 cm and 200 turns. What current through the coil produces a deflection of 45°? What would be the deflection if the current is doubled? $B_H = 0.36\times10^{-4}T$.

13. Find the value of constant ***m*** for which the vector

$\vec{A} = (x+3y)\hat{i}+(y-2z)\hat{j}+(x+mz)\hat{k}$ is solenoidal.

14. Calculate the displacement current between the square plates of a capacitor of side 1cm, if the electric field between the plates is changing at the rate of $3\times10^{+6}$ $Vm^{-1}s^{-1}$.

15. An inductance of 20 mH and a resistance of 100Ω are connected in series with 220 V, 50 Hz, ac mains. Calculate the current and phase angle.

16. The emfs of a thermocouple are $50\mu V$ at 300°C and $10\mu V$ at 100°C with its cold junction being at 0°C. Find the thermo emf when the hot junction is at 300°C and the cold junction at 100°C.

PART - C

Answer any **Five** questions. Each question carries **2** marks. **(5×2=10)**

17. a. How does the time constant vary if the value of inductance in LR circuit is doubled? Explain.

b. Can the power transferred to the load resistance in a circuit be 100%? Explain.

c. Does a current loop behave as a magnetic dipole? Explain.

d. How does the radius of the trajectory of a charge moving in a uniform magnetic field vary, if its charge is doubled? Explain.

e. Is it possible to have only electric wave or magnetic wave propagating through space? Explain.

f. How does the skin depth vary with frequency of electromagnetic wave? Explain.

g. Can resonance be achieved without changing supply frequency? Explain.

h. Does thermoelectric effect obey the law of conservation of energy? Explain.