11321

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

III Semester B.Sc. Degree Examination, March/April - 2022

PHYSICS

Electricity and Magnetism

(CBCS Semester Scheme Repeaters 2018-19 and onwards prior to 2020)

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. a) Distinguish between an ideal voltage source and an ideal current source.
   b) State and prove superposition theorem. **(2+6)**

2. Derive an expression for the decay of current in a series LR circuit. Define time constant. Show the variation graphically. **(8)**

3. a) State and explain Biot-Savart's law.
   b) Arrive at the expression for the magnetic field at any point on the axis of a current carrying solenoid. **(3+5)**

4. a) State and explain Ampere's circuital law.
   b) Using Ampere's circuital law, deduce an expression for magnetic field at any point near an infinitely long straight wire carrying current. **(4+4)**

5. Derive Maxwell Electromagnetic equations $\nabla.\vec{B}=0$ and $\nabla\times\vec{E}=-\frac{\partial\vec{B}}{\partial t}$ **(4+4)**

6. Derive Maxwell's electromagnetic wave equation $\nabla^2\vec{E}=\mu_0\varepsilon_0\frac{\partial^2\vec{E}}{\partial t^2}$ **(8)**

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7. What is resonance in a series LCR ac circuit? Arrive at the expression for its resonant frequency and current at resonance. (8)

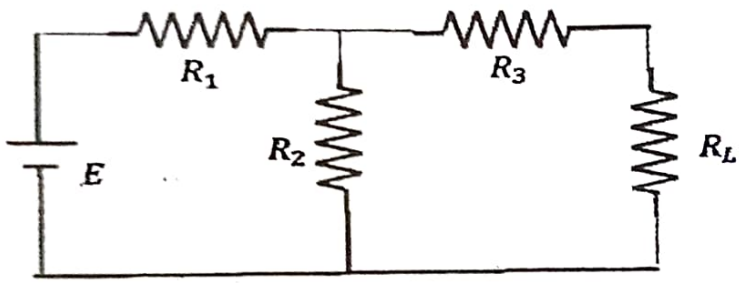
8. a) State and explain the two laws of thermoelectricity.
   b) Explain with a diagram the working of a thermopile. (4+4)

PART - B

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

9. Find the value of R_L required to obtain maximum power in the circuit shown.

$R_1 = 300\Omega$, $R_2 = 100\Omega$, $R_3 = 25\Omega$ and E = 100V



10. A coil having a resistance of 15 Ω and an inductance of 10 H is connected to a 90 V battery. Determine the value of current after 0.67 s.

11. An electron is approaching a straight wire carrying a current of 20 A at a speed of 10^7 ms^{-1}. What is the force on the electron when it is at a distance of 0.02 m from the wire?

12. A Helmholtz galvanometer has coils each of radius 0.2 m and number of turns 100. Calculate the current through the coils which produces a deflection of 45°. Given $B_H = 0.35\times10^{-4}$T.

13. Find the divergence of an electric field $\vec{E} = x^2z\,\hat{i} + 2y^2z^2\,\hat{j} + xy^2z\,\hat{k}$ at point (1, -1, 1).

14. Determine the value of permittivity of free space using the value of speed of light in vacuum $= 3\times10^8$ms^{-1} and permeability of free space $= 4\pi\times10^{-7}\,Hm^{-1}$.

15. A 60V, 10 W lamp to be run on a 100 V, 60 Hz ac mains. Calculate the inductance of the choke coil to be connected with the lamp.

16. Calculate the neutral temperature and temperature of inversion for a thermocouple between 0° C and 100° C for which Seebeck coefficients are $a = 20\mu V/^\circ C$ and $b = -0.05\mu V/^\circ C^2$.

PART - C

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

a) Self-inductance of a coil is called electrical inertia. Explain.

b) When does a dc LCR series circuit get critically damped?

c) An electrical charge is kept near a magnet. Will it experience force? Explain.

d) Why two coils are used in a Helmholtz galvanometer instead of single coil?

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

f) Displacement current is as real as conduction current. Explain.

g) Is power dissipated by a pure inductor? Justify.

h) Is Seebeck effect reversible? Explain.
