

## III Semester B.Sc. Examination, November/December 2008

(Semester Scheme)

## PHYSICS (Paper - III)

## Electricity, Magnetism and Radiation

Time : 3 Hours

Max. Marks : 60

## PART - A

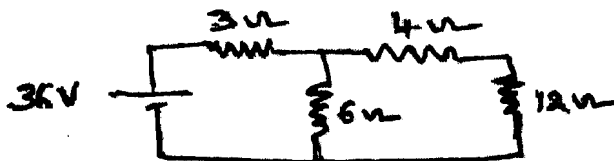
Answer any five of the following questions. Each carries six marks. (5×6=30)

1. State and prove superposition theorem. (2+4)
2. State Biot-Savart's law. Obtain an expression for the magnetic field at a point due to a long straight current carrying conductor. (2+4)
3. a) What are Eddy currents ? Explain.  
b) Explain any two applications of Eddy currents. (2+4)
4. Set up differential equations for electromagnetic waves and hence obtain an expression for the velocity of these waves. (4+2)
5. Show that the discharge of a capacitor through an inductance and resistance is oscillatory for small value of R. Find the frequency of oscillation. (5+1)
6. Deduce an expression for the current in an a.c circuit containing an inductance and resistance using 'j' operator. Obtain an expression for the impedance of the circuit. (4+2)
7. Applying the principle of thermodynamics deduce expressions for Peltier and Thomson coefficients. (4+2)
8. State Plank's law of distribution of energy in the spectrum of Black-body radiation. Show that Wein's law and Rayleigh-Jeans law are special cases of Plank's law.

## PART - B

Answer any four questions, each carries five marks. (4×5=20)

9. Using Thevenin's theorem, calculate the current flowing through  $12\Omega$  resistor in the circuit shown below.



10. The coils of a Helmholtz galvanometer have diameter 0.14 m and 275 turns each. Calculate the magnetic field mid way between the coils, when a current of 0.1 amp flows through it. The distance between the coils is 0.07m.
11. A condenser of capacity  $10\mu\text{f}$  is charged and then discharged through a resistance of  $10\text{M}\Omega$ . Calculate the time in which the charge on the condenser decreases to  $\frac{1}{4}$ <sup>th</sup> of its initial value.
12. A series LCR circuit is fed with a Sinusoidal e.m.f whose r.m.s value is 120V. The impedance of the circuit is  $150\Omega$  and resistance is  $50\Omega$ . Find the power consumed in the circuit.
13. Calculate the neutral temperature, temperature of inversion and total e.m.f. of a thermo couple between  $0^\circ\text{C}$  and  $100^\circ\text{C}$  for which the Seebeck coefficients are  $a = 10\mu\text{V}/^\circ\text{C}$  and  $b = -0.025\mu\text{V}/^\circ\text{C}$ .
14. The solar constant on the surface of Earth is  $1400\text{Wm}^{-2}$  what will be its value on the surface of Jupiter, which is about 5.2 A.u. away from the sun.
- 1 A.u. = Mean distance between centre of the sun to the centre of the earth.  
 $= 1.496 \times 10^{11}\text{m}$

### PART – C

15. Answer **any five** of the following, **each** carries **two** marks. (5×2=10)
- If the speed of the charged particle is doubled, keeping the magnetic field same, what happens to the radius of the trajectory ?
  - Stray external fields do not effect the measurements made by a ballastic galvanometer, explain.
  - Lenz's law is in accordance with law of conservation of energy, explain.
  - If the divergence of a vector is zero, the field is called solenoidal, explain.
  - How can you increase the time constant of an LR circuit ? Can time constant be infinite ?
  - Can resonance be achieved, without changing the supply frequency ? If Yes how ?
  - Mention any two applications of Tait's diagrams.
  - Coffee Kettle should have clean and shining surface inside. Explain.
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