III Semester B.Sc. Examination, Nov./Dec. 2007
(Semester Scheme)
PHYSICS (Paper –III)
Electricity, Magnetism and Radiation

Time: 3 Hours Max. Marks: 60

PART – A

Answer **any five** of the following questions. **(5×6=30)**

1. State and prove Thevenin's theorem. **(2+4)**

2. State Biot-Savart's law. Obtain an expression for the magnetic field at a point on the axis of a current carying solenoid. **(2+4)**

3. State and explain Lenz's law. Obtain an expression for the magnetic energy stored in an inductor. **(3+3)**

4. Derive the following Maxwell's field equations

   i) $\nabla \times \vec{E} = -\frac{2\vec{B}}{2t}$ ii) $\nabla \times \vec{B} = \mu\left(\vec{J} + \frac{2\vec{D}}{2t}\right)$ **(3+3)**

5. Obtain an expression for growth of current in a LR circuit applied with d.c. emf. Indicate the growth graphically and define time constant of the circuit. **(4+1+1)**

6. Derive an expression for instantaneous value of current through LCR series circuit using j-operator method. **6**

7. a) Explain the variation of thermoemf with temperature.

   b) State and explain the laws of thermoelectric circuits. **(3+3)**

8. Give the thermodynamical proof of Stefan-Boltzmann's law and derive Newton's law of cooling. **(4+2)**

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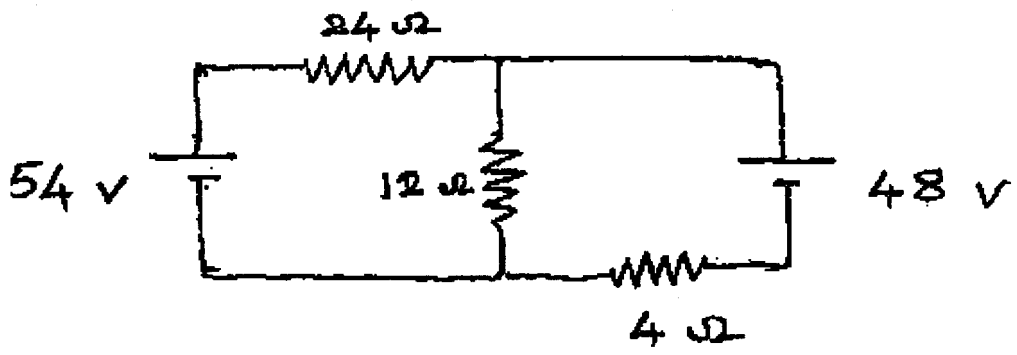
PART – B

Answer **any four** of the following : **(4×5=20**

9. In the network given below, find the current flowing through 12Ω resistance using superposition theorem.



10. Two identical circular coils of radius 0.1 m each having 20 turns are mounted co-axially at a distance of 0.1 m apart. A current of 0.5 A is passed through both of them in the same direction. Find the magnetic induction at a point on the axis midway between them.

11. A capacitor of capacity 500 pf is charged to a p.d. of 1.5 V and then discharged through a ballistic galvanometer. The first throw as noted on a scale away is 0.06 m. If the time period of oscillations is 5 s and logarithmic decrement is 0.02, calculate the ballistic constant of the galvanometer.

12. A resistance of 2Ω and an inductance of 10 mH are connected in series with an ac source of 50 Hz. Calculate the power factor of the circuit.

13. The thermo emf of a thermo couple in microvolt is given by the equation $e = 16.3\theta - 0.021\theta^2$, when the junctions are at 0°C and θ°C. Calculate
i) thermoelectric power at 100°C ii) the neutral temperature and
iii) the temperature of inversion.

14. To what temperature must a black body be raised in order to double the total radiation, if the original temperature is 727 °C.

PART – C

15. Answer **any five** of the following : **(5×2=10)**

a) What is the force experienced by a conductor carrying current when placed along the magnetic field ? Explain.

b) Why, stray external magnetic fields do not effect the measurements made by a ballistic galvanometer ? Explain.

c) Why, is induced emf during break of the circuit greater than that during make of the circuit ? Explain.

d) What is the significance of large value of time constant in CR circuit ? Explain.

e) Why, in ac circuit containing capacitor or inductor the power consumed is zero ? Explain.

f) What is the physical significance of the equation $\nabla . \vec{B} = 0$?

g) Is Seebeck effect reversible ? Explain.

h) Why does a piece of red glass when heated and taken out, glow with green light ?