SN – 200

III Semester B.Sc. Examination, Nov./Dec. 2010
(Semester Scheme)
PHYSICS – III
Electricity, Magnetism and Radiation

Time : 3 Hours Max. Marks : 60

PART – A

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

1. Give the theory of Helmholtz tangent galvanometer. **6**

2. State and explain Ampere's circuital law and hence obtain an expression for magnetic field at a point due to an infinitely long straight current carrying conductor. **6**

3. Derive the Maxwell's field equations $\nabla \cdot D = 0$ and $\nabla \cdot B = 0$. **6**

4. Define Poynting vector and derive an equation for the pointing vector in case of plane EM wave. **6**

5. Show that the discharge of a capacitor through C and R is oscillatory for small value of R. Find the frequency of oscillation. **(5+1)**

6. Give the theory of series resonance circuit, represent the variation of impedance and current with frequency. **6**

7. a) State and explain the laws of thermoelectricity.

   b) Applying the law of thermodynamics to a thermocouple, deduce $\pi = T\left(\frac{dE}{dT}\right)$ where the symbols have their usual meaning. **6**

8. Derive Planck's law of radiation. **6**

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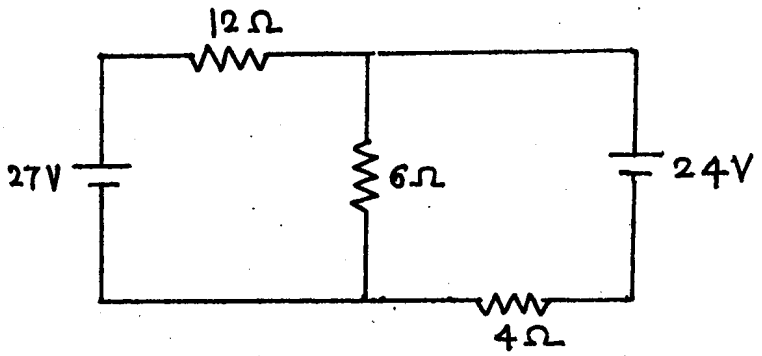
PART – B

Solve **any four** problems. **Each** problem carries **five** marks : **(4×5=20)**

9. In the network given below, find the current through 6 ohm resistor using Super position theorem.



10. A coil has an inductance of 2 H and a resistance of 10 Ω. An emf of 100 volt is applied. Find the maximum energy stored in the magnetic field after the current has built up to its maximum value.

11. A 10 μF capacitor is charged and then discharged through a resistance of 10 MΩ. Calculate the time in which the charge on the capacitor decreases to half of its initial value.

12. A resistance of 4 Ω and an inductance of 20 mH are connected in parallel with an a.c. source of 50 Hz. Calculate the power factor and phase angle with voltage of the circuit.

13. The thermo-electric powers for copper at 0°C and 100°C are 2.8 and 3.98 μV/°C and those of iron are 16.7 and 13.7 μV/°C. Calculate (i) thermo emf when the junctions are at 0°C and 100°C. (ii) the neutral temperature for copper-iron thermocouple.

14. If the average energy radiated per unit area of the surface of the sun is 7.452×10^4 kW. Estimate the surface temperature of the sun, assuming it to be a black body. Stefan's constant is 5.67×10^{-8} W/m^2/K^4.

PART – C

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

a) Why do cellular phones sometimes have poor reception inside steel frame office buildings ?

b) It is desirable to have a high value of power factor. Explain.

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

d) If the divergence of a vector field is zero, the field is called solenoidal ? Explain.

e) How can you increase the time constant of CR circuit ?

f) Can resonance be achieved without changing the supply frequency ? If yes, How ?

g) How is the neutral temperature and inversion temperature affected when the cold junction temperature is increased from 0°C to 10°C ?

h) Animals curl their body when they feel cold. Why ?