UN – 169

III Semester B.Sc. Examination, November/December 2015
(Semester Scheme)
(2012 – 13 and Onwards)
(CBCS/NS)
PHYSICS – III
Electricity and Magnetism

Time : 3 Hours | Max. Marks : 70

Instruction : *Answer* ***any five*** *questions from* ***each*** *Part.*

PART – A

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

1. State and prove super position theorem. **8**

2. a) Discuss the force acting on a charge moving in a magnetic field.

   b) Give the theory of ballistic galvanometer. **(3+5)**

3. a) State and explain Biot – Savart's law.

   b) Derive an expression for magnetic field at a point near a straight conductor carrying current using Biot – Savart's law. **(3+5)**

4. a) State and prove Ampere circuital law.

   b) Using Ampere circuital law, obtain an expression for magnetic field at the centre of a long solenoid carrying current. **(4+4)**

5. Derive an expression for decay of charge in CR circuit. Represent graphically. Define time constant. **8**

P.T.O.

6. Derive Maxwell's field equations

$\vec{\nabla}.\vec{B}=0$ and $\vec{\nabla}\times\vec{E}=-\frac{\partial\vec{B}}{\partial t}$. Mention their physical significance. **8**

7. a) Define the terms average value and r.m.s. value of an alternating current.
   b) Derive an expression for current in an a.c. circuit containing LCR in series. **(2+6)**

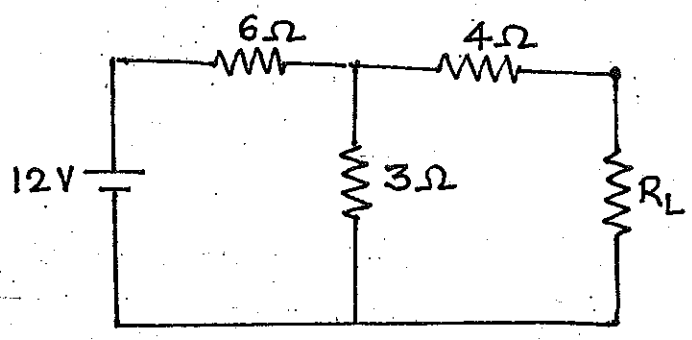
8. a) Distinguish between Joule effect and Thomson effect.
   b) Apply the principles of thermodynamics and arrive at the relation

$$\Pi = T\left[\frac{dE}{dT}\right].$$ **(3+5)**

PART – B

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

9. In the network given below, find the current flowing through R_L using Thevenin's theorem if $R_L = 5\Omega$.



10. A potential of 1 V is applied to a coil of resistance 4 Ω and self inductance of 4 H. What is the current after 0.1s ?

11. Two identical circular coils of radius 0.1 m each having 20 turns are mounted axially 0.1 m apart. A current of 0.5 A is passed through both of them in the same direction. Find the magnetic field at the point mid way between both the coils.

12. The magnetic flux linked with a coil of resistance 10 Ω at any instant is given by $\phi = 5t^2 + 2t + 3$. Calculate the magnitude of induced emf and current in a time interval of 0.5 s.

13. In an L - R circuit, the current attains $\left(\frac{1}{3}\right)$ of its final steady value in one second after the circuit is closed. What is the time constant of the circuit ?

14. Find the value of constant 'C' for which the vector $A = i(x+3y) + j(y-2z) + k(x+cz)$ is solenoidal.

15. An inductance of 10 H is connected in series with a resistance of 50 Ω to a 220 V, 50 Hz a.c. source. Calculate the value of capacitor to be connected in series to make the power factor unity. Also, calculate the current in the circuit.

16. Calculate the neutral temperature and temperature of inversion of a thermocouple between 0°C and 100°C for which seebeck coefficients are

    $a = 20\ \mu V/°C$ and

    $b = -0.05\ \mu V/°C^2$

PART – C

17. Answer **any five** of the following questions. **Each** question carries **two** marks. **(5×2= 10)**

    a) Electric potential at a point due to a dipole is zero. Will electric intensity necessarily be zero ? Explain.

    b) A strong magnetic field applied to a stationary charge, will it experience a force ? Explain.

c) The moment of inertia of a suspended part of B.G. is made large. Why ?

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

e) Self inductance of a coil is also known as electrical inertia. Explain.

f) It is possible to have only electric wave or magnetic wave propagating through space ? Explain.

g) A capacitor blocks d.c. but allows a.c. Explain.

h) Does thermo electric effect obey the law of conservation of energy ? Explain.