

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2014

FIRST YEAR

PHYSICS (General)

Date : 28/05/2014

Time : 11 am – 1 pm

Paper : II

Full Marks : 50

(Use a separate Answer Book for each group)

Group – A

Answer **any two** questions :

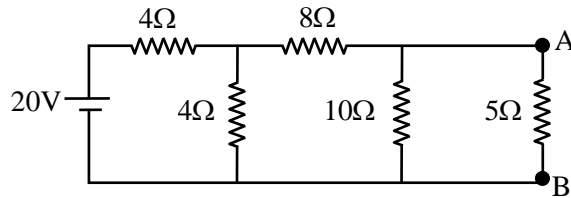
1. a) What is black body radiation? State some important properties of black body radiation. [1+2]
b) Define emissive power and absorptive power of a surface element. State Kirchhoff's law of thermal radiation. [2+1]
c) State and explain Stefan-Boltzmann Law. Derive Newton's law of cooling under suitable approximation. [2+2]
2. a) Write down the basic postulates of kinetic theory of gases. [3]
b) Give the expression of pressure according to kinetic theory of gases. Hence deduce Dalton's law of partial pressure. [1+2]
c) Derive the expression of critical constants of a gas obeying van-der-Waals equation of state. [4]
3. a) State the law of equipartition of energy. [2]
b) What do you mean by degrees of freedom(f) of a gas molecule? Find out the expression of γ in terms of f. Hence find the value of γ for a diatomic gas. [2+3+1]
c) Establish a relation between pressure and volume of an ideal gas undergoing reversible adiabatic change. [2]
4. a) Define internal energy. Write down the differential form of first law of thermodynamics. [2+1]
b) Draw the Carnot cycle in T – S diagram. Find out the efficiency of Carnot cycle. [1+4]
c) State Carnot theorem. [2]

Group – B

Answer **any three** questions :

5. a) State Gauss' Divergence theorem in vector calculus. [2]
b) What do you mean by divergence of a vector field? [2]
c) If a closed surface S enclose a volume V, then prove that $\oint_S \vec{r} \cdot d\vec{s} = 3V$. \vec{r} is position vector. [3]
d) If $\vec{v} = \vec{w} \times \vec{r}$, show that $\vec{w} = \frac{1}{2} \text{curl } \vec{v}$. \vec{w} is a constant. [3]
6. a) Write down the differential form of Gauss' theorem. [1]
b) What is the main characteristics of equipotential surface? [1]
c) Show that electric field vector (\vec{E}) is irrotational in nature. [3]
d) The electrostatic potential of a region is defined as $v = 2x + 3y - z$. Calculate the potential gradient and field intensity over the region. [3]
e) Find the expression of the torque acting on an electric dipole in a uniform electric field. [2]

7. a) An e.m.f (E) is applied to a series L – R circuit. Discuss about the growth of current. [4]
 b) What do you mean by time constant of L – R circuit? [2]
 c)



Calculate the current through the 5Ω resistance using Norton's theorem in above circuit [4]

8. a) Discuss the nature of energy stored in an inductive circuit carrying a steady current? Find its magnitude. [1+3]
 b) Define magnetic induction and magnetic flux. [2]
 c) Calculate the magnetic induction at any point on the axis of a circular coil. [4]
9. a) What do you mean by Wattless current? Deduce an expression for it. [2+2]
 b) Assuming the expression of current in series LCR circuit with an AC source, derive the resonance condition. [3]
 c) A 200V, 50Hz supply is applied to a CR circuit. The power dissipation in the circuit is 150W, when the current is 2A. Calculate the capacitance and resistance of the circuit. [3]

