OR

13. (P) Show that when an a.c. is applied through a pure capacitor, the current leads the applied alternating voltage by $\pi/2$. 4

(Q) Define :—

(i) Resistance

(ii) Reactance

(iii) Impedance 3

(R) Derive an expression for average power in an a.c. Circuit. 4

(S) What is 'j' operator ? 1

AR – 511

Second Semester B. Sc. (Part – I) Examination

2 S - PHYSICS

(Kinetic Theory, Thermodynamics and Electric Currents)

P. Pages : 8

Time : Three Hours] [Max. Marks : 80

Note : (1) All questions are compulsory.
(2) Draw neat and well labelled diagrams wherever necessary.

1. (A) Fill in the blanks.

(i) The ratio L/R is called the ——— of a LR circuit.

(ii) Figure of merit of B.G. is the reciprocal of ———.

(iii) Coefficient of thermal conductivity (K) is ——— proportional to the square root of the absolute temperature of the gas.

(iv) Each molecule of monotomic gas has ——— degree of freedom. 2

(B) Choose the correct alternative :—

(i) Mean Free Path 'λ' is

(a) Inversely proportional to the pressure.

(b) Directly proportional to the pressure.

(c) Inversely proportional to the absolute temperature.

(d) Both b and c.

(ii) In porous plug experiment enthalpy (H) of the gas

(a) Increases.

(b) Slowly decreases.

(c) Remains constant.

(d) Rapidly decreases.

(iii) In equation $P_{av} = E_{rms} \times I_{rms} \times \text{Cos}\phi$ the product $E_{rms} \times I_{rms}$ is called as

(a) Power factor.

(b) Apparent power.

(c) Wattless current.

(d) True power.

EITHER

10. (A) Give the theory of Moving Coil Ballistic Galvanometer. 5

(B) State and prove maximum power transfer theorem. 4

(C) Explain rise of current in LR circuit. 3

OR

11. (P) State and explain Thevenin's theorem. 6

(Q) Explain decay of charge in series C-R circuit. 4

(R) State superposition theorem. 2

EITHER

12. (A) State and explain energy losses in transformer. 5

(B) Define :—

(i) Apparent power.

(ii) Sharpness of resonance. 2

(C) Using j-operator method, obtain an expression for the current when a sinusoidal alternating e.m.f. is applied to a circuit having capacitor and resistor in series. 5

(Q) Derive thermodynamic relations.

(i) $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$

(ii) $\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial V}{\partial S}\right)_P$ 4

(R) What is Boyle's temperature ? 2

EITHER

8. (A) Explain the motion of charged particle in a transverse magnetic field. 4

(B) What is discharge tube ? 2

(C) Give the principle and working of Bain bridge mass spectrograph. 6

OR

9. (P) Explain construction and working of cyclotron. 6

(Q) State the limitations of cyclotron. 2

(R) How energy of nuclear particles can be determined from curvature of tracks, obtained from mass spectrograph. 4

(iv) If R_L is load resistance and r is internal resistance of the source, the power transferred from the source to the load is maximum when

(a) $r > R_L$

(b) $r < R_L$

(c) $r = R_L$

(d) $r \neq R_L$ 2

(C) Answer in a **one** sentence.

(i) Define Avagadro's number.

(ii) What is collision-cross section ?

(iii) Define charge sensitivity of a ballistic galvanometer.

(iv) State first law of thermodynamics. 4

EITHER

2. (A) State assumptions of kinetic theory of gases. 3

(B) Explain transport phenomenon in gases. 5

(C) State and prove law of equipartition of energy. 4

OR

3. (P) Derive the values of critical constants Tc, Pc and Vc of real gas in terms of constants of Vander-Waal's equation. 5

(Q) What are limitations of vander waal's equation of state ? 2

(R) State the effect of temperature on the thermal conductivity of the gas. 2

(S) Show that the pressure exerted by an ideal gas is 2/3 times the mean kinetic energy per unit volume. 3

EITHER

4. (A) Define efficiency of heat engine. 2

(B) Explain construction and working of Carnot's ideal reversible heat engine. 4

(C) State and prove Carnot's theorem. 6

OR

5. (P) Derive an expression for the work done by an ideal gas during an adiabatic process. 4

(Q) Define :—

(i) Isothermal process.

(ii) Adiabatic process. 4

(R) Show that the thermodynamic temperature scale and the perfect gas scale of temperature are identical. 2

(S) Find efficiency of Carnot's engine working between the steam point (373^0K) and the ice point (273^0K) ? 2

EITHER

6. (A) Define :—

(i) Inversion Temperature.

(ii) Extensive variables. 4

(B) Describe the method for the liquefaction of hydrogen. 6

(C) What is the effect of change of pressure on the boiling point of a liquid ? 2

OR

7. (P) Describe the porous plug experiment and discuss its result. 6