AS–1377

B.Sc. (Part—I) Semester—II Examination

PHYSICS

(Kinetic Theory, Thermodynamics and Electric Currents)

Time : Three Hours] [Maximum Marks : 80

N.B. :— (1) **ALL** questions are compulsory.

(2) Draw neat and well labelled diagrams wherever necessary.

1. (A) Fill in the blanks :— 2

(i) The change in entropy for reversible cycle is _____.

(ii) Current density is a _____ quantity.

(iii) The phenomenon of diffusion is due to the transport of ____.

(iv) S.I. unit of inductance is _____.

(B) Choose the correct alternative :— 2

(i) The phenomenon of thermal conductivity is due to the transport of :

(a) Energy (b) Mass

(c) Momentum (d) Electrons

(ii) During isothermal process :

(a) P is constant (b) V is constant

(c) T is constant (d) None of these

(iii) Parallel resonant circuit is known as :

(a) rejector circuit

(b) tank circuit

(c) rejector circuit as well as tank circuit

(d) acceptor circuit.

(iv) Thevenin equivalent circuit gives :

(a) Voltage equivalent source

(b) Current equivalent source

(c) Both (a) and (b)

(d) None of these

(C) Answer in one sentence :— 4

(i) What is transformer ?

(ii) State the condition for velocity selector.

(iii) What is critical temperature ?

(iv) What is adiabatic process ?

EITHER

2. (A) Define mean free path. Show that mean free path is inversely proportional to the density. 6

(B) Derive an expression for the viscosity of a gas on the basis of transport phenomenon. 6

OR

3. (P) Define :—

(i) Frequency of Collision.

(ii) Collision cross section. 2

(Q) State and prove law of equipartition of energy. 5

(R) Give the interpretation of temperature on the basis of kinetic theory of gases. 5

EITHER

4. (A) A Carnot's engine works between the reservoirs at temperatures 27°C and 127°C. It absorbs the 80 Joules from hot source. Calculate the efficiency and work done in each cycle. 3

(B) Explain :—

(i) Isobaric process

(ii) Free expansion. 4

(C) State and prove Carnot's theorem. 5

OR

5. (P) Show that the total change in entropy of the working substance in complete reversible process is zero. 4

(Q) Find the efficiency of Carnot's engine working between the steam point and ice point. 2

(R) Explain the S-T diagram and hence show that area of rectangle on this diagram is equal to the work done for Carnot's cycle. 6

EITHER

6. (A) Obtain Maxwell's third thermodynamical relations :

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

(B) Derive Claussius-Clapeyron latent heat equation. 5

(C) Explain Intensive and Extensive variables. 3

OR

7. (P) What is Joule -Thomson effect ? 3

(Q) Explain Liquefaction of helium. 5

(R) Obtain Maxwell's first thermodynamical relations $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$. 4

EITHER

8. (A) Explain the principle, construction and working of Bainbridge Mass Spectrograph. 6

(B) Explain the motion of charged particle in a uniform transverse electric field. 4

(C) What is an electron gun ? 2

OR

9. (P) What is velocity selector ? 2

(Q) Explain the principle, construction and working of cyclotron. 6

(R) Explain the motion of charged particle in a uniform transverse magnetic field. 4

EITHER

10. (A) State Kirchoff's Law. 2

(B) Obtain an expression for growth of charge in C-R circuit when connected to a constant source of e.m.f. 6

(C) Define :—

(i) Current sensitivity

(ii) Charge sensitivity. 4

OR

11. (P) Give the construction and theory of Ballistic Galvanometer. 6

(Q) State and prove Maximum Power Transfer theorem. 6

EITHER

12. (A) An alternating sinusoidal E.M.F. is applied to a circuit containing an inductance L and resistance R. Calculate the current at any instant in the circuit using j-operator method. 5

(B) Explain, in detail, the construction and theory of an ideal transformer. 5

(C) A capacitor of 0.1 μF and an inductance of 0.1 henry are connected in series. If the resistance of the circuit is negligible. Find the frequency at which resonance takes place. 2

OR

13. (P) What are the energy losses in transformer ? 4

(Q) Discuss the series resonant circuit. What is its resonant frequency ? 4

(R) Find the impedance of a circuit containing resistance of 12 ohms and capacitor of 25μF, when frequency of the alternating emf applied is 50 C/S. 4