# বিদ্যাসাগর বিশ্ববিদ্যালয়
# VIDYASAGAR UNIVERSITY

## Question Paper

## B.Sc. General Examinations 2020
**(Under CBCS Pattern)**
## Semester - III
## Subject: PHYSICS
**Paper: DSC 1C/2C/3C-T & DSC 1C/2C/3C-P**
**(Thermal Physics and Statistical Mechanics)**

**Full Marks : 60**
**Time : 3 Hours**

*Candiates are required to give their answer in their own words as far as practicable.*
*The figures in the margin indicate full marks.*



### Group - A

### THEORY (Marks : 40)

Answer any ***two*** from the following questions : 2×20

1. Answer any ***five*** from the following : 5×4

   (a) Define entropy and explain its physical significance.

   (b) Prove that adiabatic curve is stepper than isothermal curve.

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

(d) Define Gibb's potential. For isothermal and isobaric processes prove that Gibb's potential is constant.

(e) Prove that $C_P - C_V = \left[\left(\frac{dU}{dV}\right)_T + P\right]\left(\frac{dV}{dT}\right)_P$, where $C_P$= specifice heat at constant pressure, $C_V$ = specific heat at constant volume.

(f) Using Maxwell's relation establish Clausius-Clapeyron equation $dp/dT = L/T(V_2 - V_1)$

(g) Define Wien's displacement law of radiation. Give the example of macro state and microstate in statistical mechanics.

2. (a) Write comparison between MB and FD statistics. Sun's surface radiates energy at the rate of $6.3\times10^8$ W/m$^2$.K$^4$. Find the temperature of the sun's surface. 6

(b) Calculate work done for 1 mole of ideal gas expands isothermally from 5 Atm to 1 Atm at 300k. Show that $Tds = C_V \beta/\alpha\ dp + C_P\ 1/\alpha v\, dv$, where $\beta$ = isothermal compressibility, $\alpha$ = co-efficient of volume expansion at constant pressure. 7

(c) Distinguish between reversible and irreversible process. Calculate the mean free path, Collision rate and molecular diameter of hydrogen, given $\eta = 85\times10^{-6}$ dyn / sq.cm per unit velocity gradient, $\bar{c} = 16\times10^4$ cm / s and $\rho = 0.000089$ g / cc. 7

3. (a) Define degree of freedom. Write value of specific heat ratio of diatomic gases. From kinetic theory of gases prove that mean free path $\lambda = 1/\pi\sigma 2n$ (symbol has been used as their usual meaning). 7

(b) State third law of thermodynamics. Draw entropy - temperature diagram. Write the importance of the ratio of two molar specific heats. 6

(c) Prove that entropy increases in an irreversiblel process. Write the difference between adiabatic and isothermal process. 7

4. (a) (i) Define thermodynamic probability. Give the concept of energy density from radiation.

(ii) Give the comparison between Planck's law, Rayleigh's law and Wien's law.

(iii) Derive Maxwell's velocity distribution in a given direction from Maxwell's energy distribution. 9

(b) (i) From Maxwell's velocity distribution law prove that most probable speed $C_m = \sqrt{2kT/m}$.

(ii) Write the ratio of three speeds $\bar{c}$, $C$ and $C_m$ where $\bar{c}$ = average velocity, $C$ = *r.m.s* velocity and $C_m$ = most probable speed. 5+6

## Group - B

## PRACTICAL (Marks : 20)

Answer any ***one*** from the following questions : 1×20

1. Write down the theory and working formula to determine the coefficient of thermal conductivity of a bad conductor in form of a disc using Lee's method. Briefly describe the experimental set up needed for this experiment. Discuss the experimental procedure and draw a typical cooling curve (Time vs Temperature).

2. Write down the theory and working formula to determine the temperature co-efficient of resistance by Platinum resistance thermometer. Draw the circuit diagram for this experiment. Discuss the experimental procedure. Draw a typical graph showing the variation of resistance with temperatures.

3. Write down the theory and working formula to study the variation of thermo emf across two junctions of a thermocouple with temperature. Draw the necessary circuit diagram needed for this experiment. Discuss the experimental procedure.

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