

2019

PHYSICS

(Major)

Paper : 6.4

Full Marks : 60

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

Write the answers to the two Groups in separate books

GROUP—A

(Statistical Mechanics)

(Marks : 30)

1. Answer the following questions : 1×4=4
 - (a) Give the statistical definition of entropy.
 - (b) What is Fermi energy?
 - (c) State Liouville's theorem.
 - (d) What do you mean by 'bosons' and 'fermions'?

2. Answer the following questions : 2×3=6
 - (a) How do you define the most probable macrostate? What is its importance in statistical physics?

(2)

- (b) Name the statistics which is obeyed by photoelectrons and photons.
- (c) What is phase space and how can it be related to elementary cell?

3. Answer the following questions : 5×2=10

- (a) Assuming M-B distribution of molecular velocity, show that the most probable velocity is given by

$$v_{mp} = \sqrt{\frac{2kT}{m}}$$

- (b) Compare the distribution laws according to M-B, B-E and F-D statistics. Under what conditions do B-E and F-D statistics yield classical result?

4. Answer any one of the following : 10

- (a) What are fermions? Write down the postulate of F-D statistics. Derive an expression for the probability distribution of particles governed by F-D statistics. 1+2+7=10
- (b) What is B-E condensation? Explain B-E condensation applying B-E statistics. Define gas degeneracy. 1+8+1=10

(3)

Or

- (c) (i) Starting from

$$g(p)dp = \frac{V}{n^3} \iiint dp_x dp_y dp_z$$

find the number of phase space cells lying in the momentum interval p and $p+dp$, and energy interval u and $u+du$.

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- (ii) Using Maxwell's velocity distribution law, obtain the energy distribution law for the kinetic energy u .

5

GROUP—B

(Computer Applications)

(Marks : 30)

1. State True or False : 1×3=3

- (a) Arithmetic operators are associative from left to right.
- (b) Keywords can be used as identifiers.
- (c) Loops cannot be nested.

2. Write FORTRAN-95 or C or C++ statements to perform the following tasks : 2+2=4

- (a) To increment each element of an array by 5
- (b) To find the result of

$$2+4+6+\dots 20 \text{ terms}$$

3. Answer any three of the following questions :

$$5 \times 3 = 15$$

(a) Write a program in either FORTRAN-95 or C or C++ to find real roots of the equation $x^3 - 27 = 0$.

(b) Write a program in either FORTRAN-95 or C or C++ to arrange a list in ascending order.

(c) Write a program in either FORTRAN-95 or C or C++ to find the smallest of five numbers.

(d) A rocket is launched from the ground. Its acceleration is registered during the first 80 seconds and is given in the table below. Write a program to find velocity of the rocket at $t = 80$ sec using Simpson's $1/3$ rd rule :

t (sec)	0	10	20	30	35.47	37.75	40.33	43.25	46.69	50.67
f (cm/sec ²)	30	31.6	33.34	35.47	37.75	40.33	43.25	46.69	50.67	

(e) Give a brief description of data types available in the programming language of your choice.

4. Write a program in either FORTRAN-95 or C or C++ to fit a straight line to a given set of data points using least square method.

Or
Write a program to find the roots of a system of linear equations.
