3 (Sem–6) PHY M 4

2020

PHYSICS

(Major)

Paper : 6·4

Full Marks : 60

Time : Three 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) State the postulate of "Equal a priori probability" of statistical physics.

    (b) Define the term microstate and macrostate.

    (c) Which statistics is obeyed by electron gas ?

(d) Write the postulates of Fermi-Dirac statistics.

2. Answer the following questions :   2×3=6

   (a) What do you mean by an Ensemble ? What type of ensemble would be used to describe the behaviour of a photon gas ?

   (b) How do the degeneracies of Bose-Einstein and Fermi-Dirac gas differ ?

   (c) Write the distinguishing features of M-B and B-E statistics.

3. Answer the following :

   (a) How is entropy related to probability ? Derive a relation between them.

$$1+4=5$$

   (b) What is Fermi-energy ? Calculate the value of Fermi-energy of a metal. Does the Fermi-energy depend upon size or volume of the conductor ?   1+3+1=5

4. Answer **any one** of the following :

   (a) Write basic assumptions of Bose-Einstein quantum statistics.

   Derive the expression $n_i = \dfrac{g_i}{e^{\alpha} e^{u_i/kT} - 1}$ for the most probable distribution of a system of particles obeying Bose-Einstein statistics.   2+8=10

Or

(b) What is the difference between photon gas and ideal gas ? Starting from Bose-Einstein energy distribution law, derive Plank's law of Blackbody radiation.

2+8=10

Or

(c) Discuss Maxwell-Boltzmann's law of distributions of velocity for gas molecules. How can it be represented graphically ?

8+2=10

Group – B

(Computer Applications)

Marks : 30

1. State true *or* false : 1×3=3

   (a) Precedence of assignment operator is higher than arithmetic operators.

   (b) An array is used to store a collection of data of the same type.

   (c) A function can return multiple quantities.

2. Write statements to perform the following tasks : 2+2=4

   (a) To display natural numbers between 50 and 80.

   (b) To interchange value of two variables.

3. Answer *any three* of the following questions : 5×3=15

   (a) Write a program to find solution of a quadratic equation.

   (b) Write a program to sort a list of numbers in ascending order.

   (c) Write a program to generate n terms of the series :

   $$1, 4, 9, 16, 25,.....$$

   (d) Give a brief description of operaters available in the programming language of your choice.

   (e) Write a program to implement Runge-Kutta 4th order method of solving differential equation.

4. Write a program to find the roots of a system of linear equations. 8

   Or

   Write a program to find cube root of a number using iterative method. (Do not use library function to find cube root of the given number).

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