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**3 (Sem-6) PHY M 4**

**2021**

**PHYSICS**

(Major)

Paper : 6·4

Full Marks : 60

Time : Three hours

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

**GROUP-A**

Marks : 30

1. Answer the following questions :  $1 \times 5 = 5$ 
  - (a) How do you define the most probable macrostate ?
  - (b) What type of wave function is required to describe a system of fermions ?
  - (c) Which statistics is applicable for nuclei containing odd number of nucleons ?
  - (d) Give the statistical definition of entropy.
  - (e) "Arithmetic operations are associative from left to right". State true or false.

*Contd.*

2. Answer the following questions :  $2 \times 5 = 10$
- (a) What is phase space and how it can be related to elementary cell ?
  - (b) Explain the principle of equal a priori probability.
  - (c) Explain the conditions of validity of classical and quantum mechanics.
  - (d) Write a FORTRAN-95 or C or C++ statements to find the result of  $2+4+6+\dots$  20 terms.
  - (e) What is an algorithm program and a flow chart ?
3. Answer the following questions :  $5 \times 3 = 15$
- (a) Derive the relation between entropy and thermodynamic probability.
  - (b) What do you mean by ensembles ? Discuss the different types of ensembles with its uses.
  - (c) Write a program in either FORTRAN-95 or C or C++ to compute the real roots of the following quadratic equations :  
 $ax^2+bx+c = 0$ ; for  $a = 5$ ,  $b = -8$  and  $c = 1$

## GROUP – B

Marks : 30

4. Answer **any three** of the following questions :
- (a) Write down the main assumptions of Maxwell-Boltzmann Statistics. Derive the Maxwell's distribution law of velocity using M-B Statistics.  $3+7=10$
- (b) What are fermions ? Write down the postulates of F-D Statistics. Derive an expression for the probability distribution of particles governed by F-D Statistics.  $1+2+7=10$
- (c) What are the fermi energy and fermi temperature ? Calculate the value of fermi energy. The number of conduction electrons per c.c is  $24.2 \times 10^{22}$  in Beryllium (*Be*) and  $0.91 \times 10^{22}$  in Caesium (*Cs*). If the fermi energy of conduction electrons in *Be* is  $14.44 eV$ , calculate that in Caesium (*Cs*).  $2+3+5=10$
- (d) Write down the flow chart and a program using C or C++ to find the greatest of the three given integers  $a, b, c$ . Discuss the method of least square straight line fitting of numerical data.  $3+7=10$

- (e) (i) Write down the flow chart and a program, in either FORTRAN -95 or C or C++ to generate an Arithmetic Progression series with common difference 2 and number of elements 10 and also find its sum.  
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- (ii) Write the program in either FORTRAN-95 or C or C++ to arrange a list in ascending order.  
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