TDC (CBCS) Even Semester Exam., 2024

PHYSICS

(6th Semester)

Course No. : PHSHCC–602T

(Statistical Mechanics)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

UNIT—1

1. Answer any *two* questions from the following : 2×2=4

(a) What is phase space?

(b) Explain the term 'macrostate' with example.

(c) What do you understand by entropy?

2. Answer *either* [*(a)* and *(b)*] *or* [*(c)* and *(d)*] : 6

(a) Distinguish among microcanonical, canonical and grand canonical ensembles. 3

(b) Write a short note on partition function. 3

(c) What do you understand by Gibbs' paradox? State the law of equipartition of energy. 3+1=4

(d) What does the Sackur-Tetrode equation describe? 2

UNIT—2

3. Answer any *two* questions from the following : 2×2=4

(a) What do you understand by black-body radiation?

(b) Explain briefly Wien's distribution law.

(c) Briefly describe Saha's ionization formula.

4. Answer *either* [*(a)* and *(b)*] *or* [*(c)* and *(d)*] : 6

(a) State two properties of thermal radiation. 2

(b) State and explain Kirchhoff's radiation law. 4

(c) Explain Wien's distribution law. 3

(d) Discuss ultraviolet catastrophe in brief. 3

UNIT—3

5. Answer any *two* questions from the following : 2×2=4

(a) State Planck's quantum postulates.

(b) Explain briefly Planck's law of black-body radiation.

(c) Explain Stefan-Boltzmann law.

6. Answer *either* [*(a)* and *(b)*] *or* [*(c)* and *(d)*] : 6

(a) What do you understand by spectral distribution of black body radiation? 3

(b) Discuss how Planck's radiation law was verified experimentally. 3

(c) Starting from Planck's radiation law, deduce Wien's distribution law. 3

(d) Derive Stefan-Boltzmann law from Planck's law of radiation. 3

UNIT—4

7. Answer any *two* questions from the following : 2×2=4

(a) Briefly explain Bose-Einstein condensation.

(b) What is liquid helium?

(c) State two basic assumptions of Bose-Einstein statistics.

8. Answer *either (a) or (b)* : 6

(a) Derive an expression for the most probable distribution of a system of particles obeying Bose-Einstein statistics. 6

(b) Describe the thermodynamic functions of photon gas. 6

UNIT—5

9. Answer any *two* questions from the following : 2×2=4

(a) What is Fermi energy?

(b) What are white dwarf stars?

(c) Explain briefly what do you understand by Chandrasekhar mass limit.

10. Answer *either* [*(a)* and *(b)*] *or* [*(c)* and *(d)*] : 6

(a) What is electron gas? 1

(b) Describe Fermi-Dirac distribution and show qualitatively that it accounts for the anomaly of specific heat of electrons in metals. 5

(c) Explain in brief what do you mean by Fermi surface. 3

(d) Calculate the Fermi energy at 0 K of metallic silver containing one free electron per atom. The density of silver is $10{\cdot}5\ g/cm^3$ and its atomic weight is 108. 3

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