TDC (CBCS) Even Semester Exam., 2022

PHYSICS

(Honours)

(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

SECTION—A

Answer any *ten* of the following questions : 2×10=20

1. Define macrostate with example.

2. Give the elementary concept of ensemble.

3. What do you understand by entropy?

4. What do you understand by blackbody radiation?

5. State Stefan-Boltzmann law.

6. Discuss Saha's ionization formula.

7. State Planck's quantum postulates.

8. Briefly explain Wien's law of energy distribution.

9. Explain briefly Planck's law of blackbody radiation.

10. Explain photon gas in brief.

11. Write a brief note on Bose-Einstein condensation.

12. Briefly outline the properties of liquid helium.

13. Mention two basic assumptions of Fermi-Dirac statistics.

14. Write a brief note on Fermi energy.

15. What are white dwarf stars?

SECTION—B

Answer any *five* of the following questions : 6×5=30

16. State and prove the law of equipartition of energy. 1+5=6

17. Deduce the relation between entropy and thermodynamic probability.

18. State and prove Kirchhoff's law of radiation. 1+5=6

19. Discuss about Wien's displacement law and Rayleigh-Jeans law. 3+3=6

20. Discuss the spectral distribution of blackbody radiation.

21. Starting from Planck's radiation law, deduce *(a)* Wien's energy distribution law and *(b)* Stefan-Boltzmann law. 3+3=6

22. What distribution would you use for the study of photon gas? Using quantum-statistical method, derive Planck's radiation law for the spectral distribution of energy in blackbody radiation. 1+5=6

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

24. Obtain an expression for the probability distribution of particles obeying Fermi-Dirac statistics.

25. *(a)* Write a brief note on Fermi surface. 2

(b) 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. 4

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