CENTRAL LIBRARY N.C.COLLEGE

2021/TDC(CBCS)/EVEN/SEM/
PHSHCC–602T/097

TDC (CBCS) Even Semester Exam.,
September—2021

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

SECTION—A

Answer any *ten* questions : 2×10=20

1. What is phase space?

2. Define most probable microstate.

3. What is partition function?

4. Define the term 'thermodynamic probability'.

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5. State two properties of thermal radiation.

6. State Kirchhoff's law of radiation.

7. What do you understand by radiation pressure?

8. What is ultraviolet catastrophe?

9. Explain Planck's quantum postulates.

10. Explain Stefan-Boltzmann law.

11. What do you understand by Wien's law of energy distribution?

12. Describe Rayleigh-Jeans law in brief.

13. State two basic assumptions of Bose-Einstein statistics.

14. What do you mean by photon gas?

15. What is liquid helium?

16. Briefly explain Bose-Einstein condensation.

17. State two basic assumptions of Fermi-Dirac statistics.

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18. What is electron gas?

19. Explain in brief about Fermi energy.

20. Discuss Chandrasekhar mass limit.

SECTION—B

Answer any *five* questions : 6×5=30

21. *(a)* Define and explain the terms 'macro-state' and 'microstate' with examples. 4

(b) State the law of equipartition of energy. 2

22. *(a)* What is ensemble? Distinguish among microcanonical, canonical and grand canonical ensembles. 1+3=4

(b) Explain Gibbs' paradox in brief. 2

23. What is a black body? What is black-body radiation? Describe how has the idea of a black body been achieved in practice. 1½+1½+3=6

24. Explain the terms 'emissive power' and 'absorptive power'. Prove that at any temperature the ratio of emissive power to the absorptive power of a substance is constant and is equal to the emissive power of a perfectly black body. 1+1+4=6

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25. *(a)* Discuss Planck's law of black body radiation. 3

(b) Give the experimental verification of Planck's radiation law. 3

26. *(a)* Starting from Planck's radiation law, deduce Wien's displacement law. 4

(b) Deduce Rayleigh-Jeans law from Planck's law. 2

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

28. Starting from Bose-Einstein energy distribution law, derive Planck's law of black-body radiation. 6

29. Derive an expression for the probability distribution of particles governed by Fermi-Dirac statistics. 6

30. *(a)* Use Fermi-Dirac statistics to calculate the energy of free electrons inside a metal. 5

(b) Do electrons have zero energy at 0 K? If not, why? 1

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