TB165415F

Reg. No.: .....

Name : .....

B. Sc. DEGREE (C.B.C.S.S.) EXAMINATION, JANUARY 2019

(2016 Admission Supplementary)

SEMESTER V- CORE COURSE (PHYSICS)

PH5B07TB – THERMAL AND STATISTICAL PHYSICS

Time: Three Hours **Maximum Marks: 60**

PART A

I. Answer all questions. Each question carries 1 mark.

1. What is meant by thermodynamic equilibrium?
2. What is the amount of heat energy given to a system in a cyclic process?
3. Explain Wien's displacement law?
4. State and explain the principle of equal a priori probability.
5. Define thermodynamic probability and probability of occurrence of a macro state.

(5×1 = 5)

PART B

II. Answer any five questions. Each question carries 2 marks.

6. What is an indicator diagram? Give the indicator diagram for a Carnot's engine.
7. Show that work is a path dependent function
8. State and explain Carnot's theorem.
9. Show that the net change in entropy in a reversible process is zero.
10. State and explain Nernst's heat theorem.
11. What is Gibb's paradox? How is it resolved?
12. Explain the term phase space. What is the minimum size of phase space in classical and quantum mechanics?
13. Explain how F- D statistics differs from B- E statistics?

(5× 2 = 10)

PART C

III. Answer any five questions. Each question carries 5 marks.

14. A Carnot engine working between 300K and 600Khas a work output of 800J per cycle. What is the amount of heat energy supplied to the engine from source per cycle?
15. The temperature inside and outside a refrigerator are 273K and 303K respectively. Assuming that the refrigerator cycle is reversible, calculate the heat delivered to the surroundings for every joule of work done.
16. Obtain an expression for the external work done, when one mole of an ideal gas is suddenly expanded.
17. Prove that in a T S diagram, the slope of an isochoric curve is T/C_V and that of an isobaric curve is T/Cp.
18. Two large closely spaced concentric spheres (both are black body radiators) are maintained at temperatures 200K and 300K respectively. The space in between the two

spheres is evacuated. Calculate the net rate of energy transfer between the two spheres, given $\sigma = 5.672 \times 10^{-8}$ MKS units.

19. What is a statistical ensemble? Explain the different types of ensembles
20. Calculate the probability that in tossing a coin 10 times, one gets a) 5 heads and 5 tails b) 7 heads and 3 tails.
21. Derive Planck's law of radiation from Bose – Einstein statistics

(5× 5 = 25)

PART D

IV. Answer any two questions. Each question carries 10 marks.

22. . Explain the working of an Otto engine. Derive the expression for efficiency.
23. Describe Maxwell's thermodynamic relations using thermodynamic potentials.
24. What is a perfectly black body? Describe how has the idea of a black body been achieved in practice?
25. Obtain the expression for the most probable distribution of particles among the energy levels according to Maxwell – Boltzmann statistics.

(2 × 10 = 20)