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(Pages : 4)

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Reg. No. : .....

Name : .....

Second Semester B.Sc. Degree Examination, September 2023

First Degree Programme under CBCSS

Physics

Complementary Course for Mathematics

PY 1231.1 : THERMAL PHYSICS AND STATISTICAL MECHANICS

(2018 Admission onwards)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions in **one** or two sentences. Each question carries **1** mark.

1. What is solar constant?
2. Which are the modes of heat transfer from one point to another?
3. What is the purpose of bolometer?
4. State Wien's law.
5. State the postulate of equal a priori probability.
6. How does entropy change in reversible and irreversible processes?
7. Give the statement by Clausius for the second law of thermodynamics.
8. What are isoentropics?

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9. Does the efficiency of a perfectly reversible engine depend on working substance. Explain.

10. Express the first law of thermodynamics for an isochoric process.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions, not exceeding a paragraph. **Each** question carries **2** marks.

11. Distinguish between thermal conductivity and thermometric conductivity.

12. State the postulates of Planck's quantum hypothesis.

13. What are the characteristics of a black body?

14. State and explain Wiedemann Franz law.

15. Plot the blackbody spectrum for at least three temperatures with respect to frequency.

16. Explain the concept of phase space.

17. Distinguish between open and isolated systems with example.

18. How does the internal energy of a system originate?

19. Draw the indicator diagram for a diesel engine.

20. Give the mathematical formulation of the first law of thermodynamics and its related ideas.

21. Briefly the strokes of petrol engine.

22. How is entropy related to the disorder of the system? What is its dimension?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. Each question carries **4** marks.

23. Derive Rayleigh Jeans law from Planck's law.

24. A brass bar and copper bar of same length and same cross sectional area are joined together. The free ends of copper and brass are kept at temperatures 100°C and 0°C respectively. Find the temperature of the joint in the condition of steady state. Do calculations based on the following assumptions. Heat loss due to radiation is neglected. Thermal conductivity of brass is 4 times of copper.

25. Calculate the average energy of an oscillator of frequency 60 THz at 1800 K, treating it as (a) Planck's oscillator and (b) classical oscillator.

26. Compare the various statistical ensembles.

27. Show that the adiabatic curve has a steeper negative slope than an isothermal curve at the same point.

28. Determine the work done when one litre of monatomic perfect gas at NTP is compressed isothermally to half its volume. $\gamma = 1.66$

29. Air at 27°C is suddenly compressed to $\frac{1}{4}$ of its original volume. Find the resulting rise in temperature. For air $\gamma = 1.4$

30. A Carnot's engine is working between steam point and ice point. How much should be the temperature of the sink must be lowered to obtain an efficiency of 30%?

31. When 200 g of water is heated from 10°C to 90°C, by how much does its entropy change?

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

32. Describe the Lee's disc method for finding the conductivity of bad conductors.

33. Explain the Maxwell Boltzmann energy distribution.

34. Analyse the working of a Carnot's engine.

35. Establish the relation between the second law of thermodynamics and entropy. Analyse the change in entropy when ice is converted into steam.

(2 × 15 = 30 Marks)
