(6 pages) **Reg. No. :** .....

Code No. : 20600 E **Sub. Code : EMPH 21**

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2025.

Second Semester

Physics — Core

HEAT, THERMODYNAMICS AND STATISTICAL PHYSICS

(For those who joined in July 2023 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. The ratio of two specific heats of a diatomic gas is
   (a) 1.67 (b) 1.40
   (c) 1.00 (d) 2.00

2. In Joule-Thomson effect, tempt of inversion is
   (a) $T_i = 2a/R.b$ (b) $T_i = 2b/R.a$
   (c) $T_i = 4a/R.b$ (d) $T_i = 4b/R.a$

3. The efficiency of a Carnot's engine working between steam point and ice point is
   (a) 1 (b) 0
   (c) 26.81% (d) 16.81%

4. The gas law PV/T = constant is true for
   (a) isothermal change only
   (b) adiabatic change only
   (c) both (a) and (b)
   (d) none of the above

5. On T-S diagram, the carnot cycle is a
   (a) Square (b) Rectangle
   (c) Parallelogram (d) None of the above

6. Clausius-Calpeyron equation is
   (a) $\frac{dP}{dT} = L.(V_2 - V_1)$ (b) $\frac{dP}{dT} = \frac{L}{T(V_2 - V_1)}$
   (c) $\frac{dT}{dP} = \frac{L}{T}(V_2 - V_1)$ (d) $\frac{dP}{dT} = \frac{T}{L(V_2 - V_1)}$

7. For a perfectly blackbody, the absorption power is
   (a) 1 (b) more than 1
   (c) less than 1 (d) zero

8. Weins displacement law is

(a) λT = constant

(b) $\frac{1}{3}\cdot\frac{\lambda}{T}$ = constant

(c) $\frac{\lambda}{TV}$ = constant

(d) $\frac{\lambda T}{V}$ = constant

9. The spin of photon is

(a) zero (b) $\frac{1}{2}\hbar$

(c) $\hbar$ (d) $\frac{3}{2}\hbar$

10. Paulis exclusion principle applies to _____.

(a) M-B statistics

(b) B-E statistics

(c) F-D statistics

(d) None of the above

PART B — (5 × 5 = 25 marks)

Answer ALL questions by choosing either (a) or (b).
Each answer should not exceed 250 words.

11. (a) Write a short notes on :

(i) Joule-Thomson effect

(ii) Temperature of inversion.

Or

(b) Write a short notes on :

(i) Boyle's temperature

(ii) Joule-Kelvin effect.

12. (a) Explain the working process of P-V diagram.

Or

(b) Write a short notes on : Carnots engine.

13. (a) Define : Entropy. State its unit and explain its physical significance.

Or

(b) Explain the third law of thermodynamics.

14. (a) Write a short notes on :

(i) Rayleigh-Jeam law

(ii) Planck's law of radiation.

Or

(b) State and explain Stefan's law of heat radiation.

15. (a) Define the term with suitable examples macrostate and microstate.

Or

(b) Write a short notes on :

(i) Statistical ensemble

(ii) Canonical ensemble.

PART C — (5 × 8 = 40 marks)

Answer ALL questions by choosing either (a) or (b).
Each answer should not exceed 600 words.

16. (a) Discuss the Regnault's method to find the specific heat of a gas at constant pressure.

Or

(b) Describe the porous plug experiment.

17. (a) Explain the first law of thermodynamics. State its physical significance.

Or

(b) State and prove P-V diagram.

18. (a) State and explain T-S diagram.

Or

(b) Define : Entropy. Show that entropy remains constant in reversible process but increase in irreversible process.

19. (a) Describe the Planck's law for energy distribution in black-body radiation.

Or

(b) Discuss in detail Forbe's method to find the thermal conductivity of a good conductor.

20. (a) Discuss Maxwell-Boltzmann statistics.

Or

(b) Write a short notes on :

(i) Quantum statistics

(ii) Classical statistics

(iii) Phase space.

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