

KAMARAJ COLLEGE (Autonomous)

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(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

(3 Pages)

Reg. No:.....

Question Code: 26E01202

Course Code : 24UMPH21/25UMPH21

UG Degree - End Semester Examinations, April 2026

Second Semester

B.Sc., PHYSICS

Heat, Thermodynamics and Statistical Physics

(For those who joined in July 2024 and June 2025 onwards)

Time : 3Hours

Maximum : 75 Marks

PART - A (10 × 1 = 10 Marks)

Answer ALL Questions.

Choose the correct answer.

CO:1 1. The SI unit of heat is

- K:1 (a) Joule (b) Kelvin
(c) Celsius (d) Fahrenheit

CO:1 2. Interpret the process in porous plug experiment.

- K:2 (a) Isothermal (b) Adiabatic
(c) Isenthalpic (d) None of these

CO:2 3. The efficiency of a Carnot's engine is

- K:1 (a) Infinity (b) More than 1
(c) Less than 1 (d) 0

CO:2 4. Which quantity remains constant during isothermal change?

- K:1 (a) Pressure (b) Entropy
(c) Volume (d) Temperature

CO:3 5. Choose the shape of T-S diagram of Carnot's cycle.

- K:1 (a) Parabola (b) Square
(c) Rectangle (d) Circle

CO:3 6. What will happen to the entropy when a piece of ice is added to water in a cup?

- K:1 (a) Becomes zero (b) Increases
(c) Decreases (d) Remains the same

- CO:4 7. The fastest mode of heat transfer is
K:2 (a) Radiation (b) Convection
(c) Conduction (d) None of these
- CO:4 8. Which of the following will be useful in determining thermal
K:1 conductivity of bad conductor?
(a) Boltzmann's law (b) Lee's disc method
(c) Stefan's law (d) Planck's law
- CO:5 9. Select the particles that obey BE statistics from the following.
K:1 (a) Photons (b) Fermions
(c) Bosons (d) Phonons
- CO:5 10. The spin of fermion is
K:1 (a) Zero (b) No spin
(c) Integral (d) Half integral

PART - B (5 X 5 = 25 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 250 words.

- CO:1 11. (a) Deduce Mayer's relation.
K:3 **(OR)**
(b) Hydrogen and helium show heating effect at room temperature due to JK effect. Explain this phenomenon.
- CO:2 12. (a) State and prove the zeroth law of thermodynamics.
K:4 **(OR)**
(b) Write short note on heat engine.
- CO:3 13. (a) State and explain the second law of thermodynamics.
K:4 **(OR)**
(b) Deduce Clausius-Clapeyron latent heat equation.
- CO:4 14. (a) Define thermal conductivity. Derive an expression for it.
K:4 **(OR)**
(b) State and prove Stefan's law.
- CO:5 15. (a) Distinguish between microstates and macrostates.
K:4 **(OR)**
(b) Differentiate the canonical ensemble and micro-canonical ensemble with a suitable diagram.

PART - C (5 X 8 = 40 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 500 words.

CO:1 16. (a) Describe the theory of Joule - Kelvin effect.

K:6

(OR)

(b) Discuss the method of producing low temperature using adiabatic demagnetisation. List its disadvantages.

CO:2 17. (a) Discuss about Carnot's cycle.

K:5

(OR)

(b) Explain the construction and working of Diesel engine. Obtain an expression for its efficiency.

CO:3 18. (a) Interpret the change of entropy during reversible and irreversible process.

K:5

(OR)

(b) Deduce Maxwell's thermodynamical relations.

CO:4 19. (a) State and explain Planck's radiation law and Wien's displacement law.

K:5

(OR)

(b) Determine the thermal conductivity of a bad conductor by Lee's disc method.

CO:5 20. (a) Derive an expression for distribution function in the case of M-B statistics.

K:3

(OR)

(b) Compare M-B, B-E and F-D statistics.