Reg. No…….. Name…… **19U529**

B. Sc. DEGREE END SEMESTER EXAMINATION - OCTOBER 2019

SEMESTER –5: PHYSICS (CORE COURSE)

COURSE: 15U5CRPHY07: THERMAL AND STATISTICAL PHYSICS

(Common for Regular 2017 Admission & Supplementary/Improvement 2016/2015 Admissions)

Time: Three Hours Max. Marks: 60

PART A (Very short answer questions)

*Answer **all** questions, each question carries **1** Mark*

1. Define Zeroth law of thermodynamics.
2. Explain adiabatic reversible process.
3. How are the slopes of adiabatics and isothermals related?
4. What is Clausius statement of second law of thermodynamics?
5. Compare the entropy change in a reversible and irreversible process.
6. What is enthalpy?
7. State Stefan – Boltzman law.
8. What is meant by microstate of a system?
9. Express Boltzmann's entropy relation.
10. State any two differences between bosons and fermions. (1 x 10 = 10)

PART B (Short answer)

*Answer **any Seven** questions, each question carries **2** Marks*

11. What is the effect of pressure on the boiling point of a liquid?
12. What is an adiabatic process? What happens to the internal energy of a system when it undergoes adiabatic expansion?
13. What are the effective ways to increase the efficiency of a Carnot's engine?
14. Discuss the principle of increase of entropy.
15. Explain the ultra-violet catastrophe according to Rayleigh – Jean's distribution law.
16. What is meant by thermal conductivity of a material?
17. How would you represent the Carnot's reversible cycle on T – S diagram?
18. What is meant by thermodynamic probability?
19. Discuss about Fermi-Dirac statistics. (2 x 7 = 14)

PART C (Problem/Derivations)

*Answer **any four** question, each question carries **4** Marks*

20. Calculate the change in entropy when 10 gram of ice at 0°C is converted to water and heated to 80°C. (Latent heat of fusion of ice = 3.35×10^5 J/kg, specific heat capacity of water = 4180 J kg^{-1} K^{-1}.
21. A Carnot's engine whose cold reservoir is at 280 K has an efficiency of 40%. It is desired to increase the efficiency to 50%. By how much should the temperature of the hot reservoir be increased?

22. Prove that the work done during an adiabatic process depends only upon the initial and final bv temperatures.
23. A blackbody at 300 K radiates energy at the rate of 459 Wm^{-2}. Deduce the value of Stefan's constant. Also find the amount of heat radiated per second by a sphere of radius $5x10^{-2}$ m at a temperature of 1200 K.
24. Deduce the Clausius - Clapeyron equation from Maxwell's thermodynamic relation.
25. Show that the probability of a macrostate is proportional to the thermodynamic probability.

(4 x 4 = 16)

PART D (Long answer questions)

*Answer **any Two** question, each question carries **10** Marks*

26. Derive Maxwell's thermodynamic relations from thermodynamic potentials.
27. What is a heat engine? Explain the working of a Carnot's ideal heat engine.
28. Obtain the expressions for change in entropy for unit mass of a perfect gas interims of :
    (a) Volume and temperature
    (b) Pressure and temperature
    (c) Pressure and volume
29. Explain the differences in the way of distributing the particles among various energy levels according to the BE and FD statistics. Derive the mathematical representation of the two quantum statistics. (10 x 2 = 20)

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