Reg. No……..…….. Name…… **20U531**

B. Sc. DEGREE END SEMESTER EXAMINATION OCT. 2020 : JANUARY 2021

SEMESTER **–5: PHYSICS (CORE COURSE)**

COURSE: **15U5CRPHY07: THERMAL AND STATISTICAL PHYSICS**

(Common for Regular 2018 admission & Improvement 2017/Supplementary 2017/ 2016/2015 admission)

Time: Three Hours Max. Marks: 60

PART A (Very short answer questions)

Answer all questions. Each question carries 1 Mark

1. Define quasi-static process.
2. State chemical equilibrium.
3. Write any two examples of irreversible process.
4. What are the limitations of first law of thermodynamics?
5. In a cycle of reversible process, the entropy of the system remains ……
6. Define Helmholtz free energy.
7. State Stefan's law.
8. Define thermodynamic probability.
9. Define Fermi free energy.
10. State Boltzmann's entropy relation. (1 x 10 = 10)

PART B (Short answer)

Answer any Seven questions. Each question carries 2 Marks

11. Explain internal energy of a: a) ideal gas b) real gas
12. Write the conditions for reversible process?
13. Explain isothermal elasticity.
14. Draw P-V diagram and T-S diagram.
15. Explain the properties of thermal radiation.
16. Explain convection with examples.
17. Explain microcanonical ensemble.
18. State the fundamental postulates of statistical mechanics.
19. Explain μ space and Γ space. (2 x 7 = 14)

PART C (Problem/Derivations)

Answer any 4 question. Each question carries 4 Marks

20. A gas occupying 1 litre at 80 cm of Hg pressure is expanded adiabatically to 1190 cc. If the pressure falls to 60 cm of Hg in the process, deduce the value of ratio of specific heat capacity (γ).
21. A Carnot engine working between a source at temperature 27°C and a sink at -73°C delivers 300 calorie of heat to the latter in one cycle. Calculate the work performed in joule by the engine per cycle.

22. Calculate the increase in efficiency of an Otto engine if its compression ratio is increased from 6 to 8. The ratio of specific heat capacities of the gas is 1.4.
23. Calculate the change in entropy of 1 g of nitrogen when its temperature rises from 50°C to 100°C while its volume is kept constant. Molar specific heat, C_v = 0.18 and molecular weight of nitrogen is 28.
24. What is the wavelength which human body radiates maximum energy? Temperature of human body is 37°C. Wein's constant is 2.898 x 10^{-3} mK.
25. An electron gas obeys the Maxwell-Boltzmann statistics. Calculate the average thermal energy (in eV) of an electron of the system at 300 K.

(4 x 4 = 16)

PART D (Long answer questions)

Answer any Two question. Each question carries 10 Marks

26. a) Explain indicator diagram.
    b) Explain with necessary theory: i) work done in an isothermal expansion of ideal gas.
    ii) Absolute scale of temperature
27. Derive Maxwell's four thermodynamic relations from thermodynamic potentials.
28. Derive Maxwell-Boltzmann velocity distribution law.
29. Arrive at the expression for the most probable distribution in a system of N indistinguishable particles obeying Fermi – Dirac statistics.

(10 x 2 = 20)

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