Reg. No…………………..…………. Name……………………………………………

B.SC DEGREE END SEMESTER EXAMINATION OCTOBER 2016
SEMESTER – 5: PHYSICS (CORE COURSE)
COURSE: **U5CRPHY7– THERMAL AND STATISTICAL PHYSICS**

Time: Three Hours   Max. Marks: 60

Part A
(Very short answer questions)
*(Answer **all** questions) Each question carries 1 Mark*

1. What is an adiabatic process?
2. Which is the effective way to increase the efficiency of a Carnot's engine?
3. Melting point of ice is _____ by the increase of pressure.
4. What is the significance of indicator diagram?
5. Substantiate the statement 'Work done by an adiabatic process is at the expense of its internal energy'.
6. What is ultraviolet catastrophe?
7. What is the S.I unit of thermal conductivity?
8. Ten particles are distributed in two equal sized cells. What is the number of possible microstates?
9. How is entropy and thermodynamic probability related?
10. What types of particles obey Fermi - Dirac statistics?

$$(1 \times 10 = 10)$$

Part B (Short answer)
*(Answer **any seven** questions) Each question carries 2 Marks*

11. Draw the indicator diagram for the Carnot's cycle and mark the different processes in the cycle.
12. Prove that the adiabatic elasticity is γ times the isothermal elasticity.
13. Discuss the principle of increase of entropy.
14. What is the significance of Helmholtz Free Energy?
15. What is Wien's displacement law?
16. State and explain Nernst Heat Theorem?
17. What is a statistical ensemble?
18. Distinguish between macrostate and microstate with a suitable example.
19. How can you differetiate between Quantum and Classical Statistics?

$$(2 \times 7 = 14)$$

Part C (Problem/Derivations)

*(Answer **any four** question) Each question carries 4 Marks*

20. One mole of a gas at 90ºC expands isothermally until its volume is thrice the initial volume. Calculate the work done.
21. Prove that for a reversible adiabatic process $\partial T/\partial V = (C_v - C_p)/(\alpha V C_v)$
22. A Carnot's engine whose low temperature reservoir is at 10ºC has an efficiency of 50%. It is desired to increase the efficiency to 70%. By how many degree should the temperature of the high temperature reservoir be increased?
23. Compare the rate at which energy is radiated per unit area of a black body at 300 K and 3000 K. Given $\sigma = 5.669 \times 10^{-8}$ Wm^{-2}K^{-4}
24. Calculate under what pressure ice freezes at 272 K, if the change in specific volume when 1 kg of water freezes is 91×10^{-6} m^3. Latent Heat of ice is 3.36×10^5 Jkg^{-1}.
25. Three particles are to be distributed in four energy levels. Calculate all possible ways of this distribution when particles are (i) Fermions (ii) Bosons.

(4 x 4 = 16)

Part D (Long answer questions)
*(Answer **any two** question) Each question carries 10 Marks*

26. Explain in detail the working of an Otto Engine.
27. What are thermodynamic potentials? Derive Maxwell's thermodynamical relations from these potentials.
28. Derive Maxwell-Boltzmann velocity distribution law on the basis of classical statistics.
29. Using Fermi-Dirac statistics derive an expression for distribution of energies among electrons in a metal.

(10 x 2 = 20)

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