Reg. No……..…….. **Name:** ……. **P 143**

MSc DEGREE END SEMESTER EXAMINATIONS NOVEMBER - 2015

SEMESTER: 1, **CHEMISTRY/PHARMACEUTICAL CHEMSITRY**

COURSE: **P1CHET04 / P1CPHT04 - CLASSICAL AND STATISTICAL THERMODYNAMICS**

(*Regular- 2015 Admission; Supplementary / Improvement-2014 Admission)*

Time: Three Hours Max. Marks: 75

Section A

(Answer any **10** *questions. Each question carries* **2** *marks)*

1. What is meant by absolute entropy of a system?
2. Prove that
$$\left(\frac{\partial S}{\partial P}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_P$$
3. Explain the significance of chemical potential.
4. What is meant by fugacity? How is it related to pressure of a real gas?
5. Explain Nernst heat theorem.
6. Represent a three component system (ABC), where the composition is 60% A, 20% B and 20% C.
7. State Onsager reciprocal relation. Provide the conditions at which the relation becomes valid.
8. Explain the exergonic nature of ATP hydrolysis.
9. Expalin Fermi level and its significance.
10. What is meant by partition function? Expalin the significance.
11. State the Boltzmann Planck equation and explain the terms.
12. State Dulong Petit law.
13. Distinguish between Bosons and Fermions.

(2 × 10 = 20)

Section B

(Answer any **5***questions by attempting not more than* **3***questions from each bunch. Each question carries* **5** *marks)*

Bunch 1 (Short essay type)

14. What is meant by residual entropy? Explain the residual entropy of NO and ice.
15. Explain a method to determine partial molar volume of a binary mixture.
16. Derive the expression for vibrational partition function.
17. Explain the Virial equation of state. How is it related to cluster integrals?

Bunch 2 (Problem type)

18. A 2.5 L sample of an ideal monoatomic gas is compressed to 1.05 L reversible and adiabatically. The initial pressure and temperature are 10 atm and 300K. Calculate the work, heat, and changes in enthalpy and internal energy during the process.

19. A solution is 36% HCl and 64% water by weight. Its density is 1.18 g/ cm^3. Calculate mole fraction, and molality of HCl in the mixture.

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20. Calculate the translational partition function of one mole of oxygen at 1 atm pressure at 25°C, assuming ideal behaviour.
21. The characteristic Debye temperature of diamond is 1860 K. Calculate its heat capacity at 100K. (5 × 5 = 25)

Section C

(Answer any **2** *questions. Each question carries* **15** *marks)*

22. Define thermodynamic excess functions. What is their significance? Derive expressions for excess free energy, excess enthalpy, excess entropy and excess volume.
23. Explain various electrokinetic phenomena. Derive expressions and relate them using Onsager reciprocal relations.
24. Derive Bose Einstein's distribution and its application to liquid Helium.
25. Write a note on classical and quantum statistical approach to heat capacity of gases. Comment on anomalous heat capacity of hydrogen.

(15 × 2 = 30)

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