Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**End Semester Examination – Nov/Dec – 2017**

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| **Code :** | **15CH3007** | **Duration :** | **3hrs** |
| **Sub. Name :** | **CHEMICAL THERMODYNAMICS AND ELECTROCHEMISTRY** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | Write a note on internal energy. Describe its relationship with work and heat. | CO1 | 6 |
| b. | One mole of an ideal gas (mono-atomic) at 27⁰ C expands adiabatically against a constant external pressure of 1 atm from a volume of 10 dm3 to a volume of 20 dm3. Calculate i. q ii. w iii. ΔU and ΔH for this process. Also calculate the final temperature of the gas. Assume that Cv = 3/2 R | CO1 | 6 |
| c. | What is Joule-Thomson effect? Derive its coefficient. | CO1 | 8 |
| (OR) | | | | |
| 2. | a. | Prove that CP-CV = [V- (δH/δP)T] (δP/δT)V | CO1 | 8 |
| b. | CP-CV = [P + (δE/δV)T] (δV/δT)P | CO1 | 6 |
| c. | What is heat capacity of a system and prove that Cp is always greater than Cv. | CO1 | 6 |
|  |  |  |  |  |
| 3. | a. | Explain the Carnot cycle and calculate the net heat absorbed and net work done. | CO1 | 12 |
|  | b. | Show that for an ideal gas (δP/δV)T = P/V. | CO1 | 3 |
|  | c. | Show that (δE/δV)P = CVP/Nr. | CO1 | 3 |
|  | d. | Prove that (δCV/δV)T = 0. | CO1 | 2 |
| (OR) | | | | |
| 4. | a. | Derive the Gibbs-Helmholtz equation. | CO1 | 7 |
|  | b. | Show that for an ideal gas (δH/δV)T = 0. | CO1 | 3 |
|  | c. | Derive an expression of chemical potential in a system of ideal gases. | CO1 | 6 |
|  | d. | Prove that dG = VdP – SdT. | CO1 | 4 |
|  |  |  |  |  |
| 5. | a. | What is Nernst theorem? Find out the absolute entropy of gas at 25⁰ C under atmospheric pressure. | CO1 | 10 |
|  | b. | Derive the rotational partition function for a system consists of “N” particles. | CO1 | 10 |
| (OR) | | | | |
| 6. | a. | Derive Bose-Einstein (B-E) statistics for a system consists of “N” particles. | CO1 | 10 |
|  | b. | Derive the vibrational partition function for a system consists of “N” particles | CO1 | 10 |
|  |  |  |  |  |
| 7. | a. | Derive the Sackur-Tetrode equation | CO1 | 10 |
|  | b. | Describe the following thermodynamic parameters in terms of molecular partition functions, i. Enthalpy (H) ii. Internal Energy (U) and iii. Helmholtz function (A) | CO1 | 10 |
| (OR) | | | | |
|  |  |  |  |  |
| 8. | a. | Elaborate on Einstein theory of heat capacity of solids. | CO1 | 10 |
|  | b. | Find out the value of β for M-B statistics. | CO1 | 10 |
|  | |  |  |  |
|  | | **Compulsory**: |  |  |
| 9. | a. | What is streaming potential? Derive its expression. | CO1 | 10 |
|  | b. | Explain the various double layer theories in detail. | CO1 | 10 |

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