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

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**End Semester Examination – Nov/Dec – 2018**

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| **Code :** | **17CH3007** | **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. | Explain state and path functions with a suitable example. | CO1 | 5 |
| b. | What is Joule-Thomson effect? Derive its coefficient. | CO1 | 8 |
| c. | What is the work done on the system, if one mole of an ideal gas at 300 K is compressed isothermally and reversibly to one third of its initial volume? Calculate the change in entropy of this process | CO1 | 3 |
| d. | Derive an expression for entropy change of an ideal gas as a function of temperature and pressure. | CO1 | 4 |
| (OR) | | | | |
| 2. | a. | Show that (i) (δE/δV)P + P = CP (δT/δV)P and (ii) (δE/δV)P = CvP/nR | CO3 | 5 |
| b. | Describe the Carnot cycle process and calculate the net heat absorbed and net work done. | CO1 | 12 |
| c. | Calculate the relative number of distinguishable states in ice and water at 273 K:  ΔHfus = 6.0 kJ mol-1 at 273 K; kB = 1.38 x 10-23 JK-1. | CO1 | 3 |
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| 3. | a. | What is fugacity? Explain it. Also determine the fugacity of a gas. | CO2 | 7 |
| b. | What is Nernst theorem? Find out the absolute entropy of gas at 25⁰ C under atmospheric pressure. | CO1 | 10 |
| c. | Derive Gibbs-Helmholtz equation. | CO1 | 3 |
| (OR) | | | | |
| 4. | a. | What is chemical potential? Derive an expression of chemical potential in a system of ideal gases . | CO1 | 10 |
| b. | Prove that dG = VdP – SdT. | CO3 | 5 |
| c. | Prove that CP-CV = [P + (δE/δV)T] (δV/δT)P. | CO3 | 5 |
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| 5. | a. | Derive the Maxwell-Boltzmann statistics for a system consists of “N” particles. | CO4 | 10 |
| b. | Derive the translation partition function for a system consists of “N” particles. | CO4 | 10 |
| (OR) | | | | |
| 6. | a. | Find out the value of β for M-B statistics. | CO4 | 10 |
| b. | Derive the rotational partition function for a system consists of “N” particles. | CO4 | 10 |
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| 7. | a. | Describe the following thermodynamic parameters in terms of molecular partition functions. (i) Internal energy and (ii) Helmholtz function (A). | CO5 | 5 |
| b. | Derive the Debye theory of heat capacity of solids. | CO5 | 15 |
| (OR) | | | | |
| 8. | a. | Derive the Sackur-Tetrode equation. | CO5 | 10 |
| b. | Describe the following thermodynamic parameters in terms of molecular partition functions. i) Chemical potential (μi), (ii) Heat capacity (Cv), (iii) Pressure (P) and iv) Entropy (S). | CO5 | 10 |
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|  | | **Compulsory**: |  |  |
| 9. | a. | Verify the Onsager reciprocal relationship. | CO1 | 10 |
| b. | Explain various double layer theories in detail. | CO6 | 10 |