

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MSC / IMSC / PRE Ph.D
BRANCH: CHEMISTRY

SEMESTER : II/VIII/NA
SESSION : SP/2023

SUBJECT: CH411 EQUILIBRIUM, NON-EQUILIBRIUM & STATISTICAL THERMODYNAMICS

TIME: 3 Hours

FULL MARKS: 50

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
-

- Q.1(a) Explain the types & conditions of equilibrium in respect of isolated system and a non-isolated system with suitable examples. A sample of a gas changes its volume from 4.00 L to 6.00 L against an external pressure of 1.50 atm, and simultaneously absorbs 1000J of heat. What is the change in Internal energy U of the system? (Given 1atm = 101.32 J). [5]
- Q.1(b) What are importance of Maxwell's relations? Derive one relation from $dU = Tds - PdV$ [5]
- Q.2(a) Define Gibbs free energy and Helmholtz work function with the help of final expression. Explain the variation of the gibbs free energy with temperature and pressure. [5]
- Q.2(b) Write down the final expression for Clausius and Clayperon equation (Differential and Integrated form of both). Explain the variation of chemical potential with temperature by deriving expression and also show graphically. [5]
- Q.3(a) Define and Explain Ensemble, Canonical ensemble, Grand canonical and microcanonical ensemble. [5]
- Q.3(b) Explain the types and characteristics of Thermodynamic ststistical theory. Derive the Thermodynamic probability, $W = \frac{N!}{n_1! n_2! \dots n_i!} \times \text{Constant}$ with symbols significance. [5]
- Q.4(a) What is multiplication theorem for the partition functions. Derive $q_{tr} = q_{tr}^0 \times V$ giving usual symbol's significance. [5]
- Q.4(b) What do you understand by intermolecular forces. Discuss in detail [5]
(i) dipole -dipole interactions and
(ii) induced dipole - induced dipole interactions.
- Q.5(a) List the various transport process and write their phenomenological equations. [5]
- Q.5(b) Define and discuss the four electrokinetic effects SP, EO, EOP, and SC. [5]

::::::26/04/2023::::::E