Reg. No. | | | | | | | | | |

CHH/ACH/OCH/CAH 453

II Semester M.Sc. Degree Examination, September/October 2022
(CBCS – 2016-17 Syllabus) (Freshers and Repeaters)
CHEMISTRY/APPLIED CHEMISTRY/ORGANIC CHEMISTRY/ANALYTICAL CHEMISTRY
Advanced Physical Chemistry

Time : 3 Hours Max. Marks : 70

Instructions : *1) Answer Part – **A** and **any four** questions from Part – **B**.*
*2) Figures to the **right** indicate marks.*

PART – A

1. Answer **all** sub-divisions. **(9×2=18)**
   a) Explain the significance of Van't Hoff reaction isochore.
   b) Write any two applications of Gibbs Helmholtz equation.
   c) State and explain Lewis Randall rule.
   d) Differentiate between Bosons and Fermions.
   e) Define electronic partition function. Give its significance.
   f) Write the relationship between force and flux with suitable example.
   g) State the conditions for orthogonality and normalization of wave functions.
   h) Set up the kinetic energy operator for a particle moving in one direction.
   i) Using molecular orbital theory, calculate the bond order of O_2.

PART – B

Answer **any four full** questions. **(4×13=52)**

2. a) By deriving a suitable mathematical expression, explain the variation of chemical potential with temperature. **5**
   b) Derive any two Maxwell's relations. **4**
   c) Explain the intercept method for the determination of partial molar volume. **4**

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3. a) State Nernst heat theorem and compare it with third law of thermodynamics. Write the applications of the theorem. **6**

   b) Describe the variation of fugacity with pressure and temperature. **4**

   c) Explain the entropy change for the isothermal expansion of an ideal gas with suitable equation. **3**

4. a) Derive Sackur-Tetrode equation for a monoatomic gas. **6**

   b) Calculate the translational partition function of benzene in a volume of $1m^3$ at 298 K. (Given : $m = 1.295 \times 10^{-25}$ kg mol^{-1}, $k = 1.38 \times 10^{-23}$ JK^{-1}, $h = 6.626 \times 10^{-34}$ Js, $R = 8.314$ JK^{-1} mol^{-1}). **3**

   c) Describe the irreversible thermodynamics of biological systems. **4**

5. a) Outline Einstein theory of heat capacity of solids. **8**

   b) Give a comparative account of different statistical distributions. **5**

6. a) Give a comparative account of valence bond and molecular orbital theories. **6**

   b) Construct quantum mechanical operator for angular momentum. **4**

   c) Define eigen functions and eigen values. Explain their physical significance in quantum mechanics. **3**

7. a) Obtain and solve Schrodinger equation for a particle in three dimensional box. **8**

   b) Discuss the applications of Huckel molecular orbital theory to ethylene molecule. **5**
