(E) How bond length of diatomic molecules is determined with the help of rotational spectra ? 2½

(F) Explain selection rule for pure vibrational spectra. Out of H_2, O_2, N_2, HCl, NO and CH_4 which will give pure vibrational spectra ? 2½

5. Attempt any **TEN** of the following :

(i) What do you mean by efficiency of a system ?

(ii) Define ''Chemical Potential''.

(iii) Why Helmholtz's free energy is now called Helmholtz's work function ?

(iv) Define an electrochemical cell.

(v) Why KCl is not used in the salt bridge in case of Cu-Ag Cell ?

(vi) How is an oxidation-reduction electrode set up ?

(vii) Define 'Nuclear fission'.

(viii) Define 'Dipple moment'. What is its SI unit ?

(ix) Write the relation between dielectric constant and dipole moment of a substance.

(x) What is zero point energy ? What does it indicate ?

(xi) Define force constant. State its SI unit.

(xii) Write Morse equation. 10×1=10

TKN/KS/16/5858

Bachelor of Science (B.Sc.) Semester–IV

(C.B.S.) Examination

CHEMISTRY (Physical Chemistry)

Paper—II (CH-402)

Time—Three Hours] [Maximum Marks—50

N.B. :— (1) All **FIVE** questions are compulsory and carry equal marks.

(2) Draw diagrams wherever necessary.

1. (A) Derive an expression for the entropy change accompanying the isothermal expansion of an ideal gas. 5

(B) Derive Van't-Hoff reaction isotherm. 5

OR

(C) Derive Gibb's Helmoltz equation. 2½

(D) The free energy change for a reaction :

$$N_2(g) + 3H_2(g) \text{—}^{-} 2(NH_3)(g)$$

is –33.20 kJ at 25°C. Calculate the equilibrium constant. 2½

(E) Give any five statements of 2nd law of thermodynamics. 2½

(F) Calculate the total entropy change when 5 moles of ice is converted into water at 0°C. The latent heat of fusion of ice is 80 cal gm^{-1}. 2½

2. (A) How can you determine various thermodynamic quantities such as ΔH, ΔG and ΔS accompanying the cell reaction ? 5

(B) Derive Nernst equation of EMF of a cell. Calculate the EMF of a cell at 25°C :

$Zn(s)/Zn^{++}$ (0.1 M) || Cu^{++} (0.01 M) Cu(s)

if E^{o} cell = 1.0993 V. 5

OR

(C) Define ''Liquid junction potential''. How can it be eliminated ? 2½

(D) How is pH of a solution calculated by using glass electrode ? 2½

(E) Derive an expression for emf of a concentration cell with transference. 2½

(F) Discuss briefly reversible and irreversible cells. 2½

3. (A) Discuss the liquid drop model of nucleus. What are the evidences in its favour and its limitations ? 5

(B) Explain the application of dipole moment in :

(i) Differentiating O, M and P-isomers and

(ii) Predicting the geometry of molecules. 5

OR

(C) Discuss applications of radioisotopes in :

(i) Medical Science and

(ii) Agriculture. 2½

(D) Calculate the binding energy per nucleon in helium atom $[{}^{4}_{2}He]$ which has a mass of 4.0026 amu. Calculated atomic mass is 4.03298 amu (1 amu = 931.5 MeV) 2½

(E) Explain Polarization of molecules in the electric field. 2½

(F) How is percentage of ionic character of a polar covalent bond calculated with dipole moment ? 2½

4. (A) What do you understand by non-rigid rotor ? Explain how its spectra differs from rigid rotor. Calculate rotational constant of HCl molecule. The H–Cl bond length is 136 $\times 10^{-12}$ m. The reduced mass of molecule is 1.626×10^{-27} kg. ($h = 6.626 \times 10^{-34}$ JS, $C = 3 \times 10^{8}$ ms^{-1}). 5

(B) What are harmonic and anharmonic oscillators ? Draw their potential energy diagram. What is fundamental band and overtones ? 5

OR

(C) The rotational constant of CO molecule is 166 m^{-1}. Calculate bond length if its reduced mass is 1.24 $\times 10^{-26}$ kg. 2½

(D) Calculate number of modes of vibrations in NO molecule and show them with vibrational frequency. 2½