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Reg. No. : .....

Name : .....

**Second Semester M.Sc. Degree Examination, September 2022**

**Chemistry / Analytical Chemistry/Polymer Chemistry**

**CH/CL/PC 223 – PHYSICAL CHEMISTRY - II**

**(2020 Admission Onwards)**

Time : 3 Hours

Max. Marks : 75

**SECTION – A**

Answer **two** sub questions among (a) (b) and (c) from each question each sub question carries **2** Marks

1. (a) What are spherical harmonics?  
(b) Distinguish between radial and angular distribution functions  
(c) Discuss Pauli's Anti-symmetric principle.
2. (a) Give any one application of stark effect in rotational spectrum  
(b) For polyatomic molecules like OCS or NH<sub>3</sub> knowledge of one moment of inertia is insufficient to deduce the bond length and bond angles from line spacing in the Rotational spectra, how will you overcome this difficulty?  
(c) What is the condition for a molecule to give rise to rotational Raman scattering?
3. (a) What is the origin of residual entropy?  
(b) Discuss the concept of ensemble.  
(c) State the principle of equi-partition of energy?

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4. (a) Distinguish between Fermions and Bosons  
(b) What is Dulong and Petit's Law?  
(c) Discuss the anomalous heat capacity of hydrogen.
5. (a) What are the significance of Tafel plot?  
(b) What is over voltage? What is its application?  
(c) What are fuel cells? What are its uses?

(10 × 2 = 20 Marks)

### SECTION – B

Answer either (a) or (b) from each question, each sub question carries 5 marks.

6. (a) Discuss the spin – orbital coupling.  
(b) Discuss the separation of variables in the wave equation of Hydrogen like systems.
7. (a) Give a brief account on P, Q, and R branches of vibrational rotational spectrum  
(b) Briefly explain Mutual exclusion principle
8. (a) Derive Sachur – Tetrode relation using Partition function  
(b) Derive the relation to show how thermodynamic functions internal energy and entropy related to partition function?
9. (a) Discuss Debye theory of specific heat capacity of solids  
(b) Deduce Fermi – Dirac Distribution Law.
10. (a) Discuss the principle and applications of polarography.  
(b) Briefly explain Debye-Falkenhagen effect.

(5 × 5 = 25 Marks)



### SECTION – C

Answer any **three** questions, each question carries **10** Marks

11. Elaborate Vector atom model.
12. (a) Discuss the fundamentals of rotational spectroscopy and how it is used in the elucidation of molecular structure.  
(b) The rotational spectrum of  $\text{H}^{35}\text{Cl}$  has lines equally separated by  $6.26 \times 10^{11}$  Hz. Calculate the bond length of  $\text{H}^{35}\text{Cl}$ . **(6+4)**
13. Derive the expression for Maxwell Boltzmann distribution of particles
14. Discuss Einstein theory of heat capacity of solids. What are the limitations of Einstein's theory of heat capacity?
15. Derive Debye- Huckel Onsager equation and discuss.

**(3 × 10 = 30 Marks)**

