

THIRD SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2023
(Regular/Improvement/Supplementary)**CHEMISTRY****FCHE3C09 - ELECTROCHEMISTRY, SOLID STATE CHEMISTRY AND
STATISTICAL THERMODYNAMICS****Time: 3 Hours****Maximum Weightage: 30****Section A: Short answer questions. Answer any *eight* questions. Each carries *one* weightage.**

1. Write Nernst equation and explain the terms.
2. Explain Helmholtz model of double layer.
3. Define exchange current density. Explain its significance.
4. Write any two consequences of metal excess defects.
5. Explain briefly ensembles.
6. Draw stereographic projection formula of 2/m and 3m systems.
7. Calculate the possible number of ways of distribution of 2 particles among 4 energy states, when particles are Fermions.
8. At very low temperature, H₂ behaves like a monoatomic gas. Why?
9. Elaborate on Meissner effect.
10. Certain insulators become conductors when exposed to radiation. Explain.
11. Calculate the Miller indices of crystal planes which cut through the crystal axes at (2a,3b,c).
12. Explain briefly Stirling's approximation.

(8 × 1 = 8 weightage)**Section B: Short essay questions. Answer any *four* questions. Each carries *three* weightage.**

13. Give a brief discussion on primary cells with an example.
14. The rotational constant of gaseous HCl, determined from microwave spectroscopy is 10.59cm⁻¹. Calculate rotational partition function of HCl at 100K.
15. What is dropping mercury electrode? What are the advantages of using DME in polarography? What is its limitation?
16. KNO₃ crystallizes in orthorhombic systems with the unit cell dimension a= 542 pm, b= 917 pm and c= 645 pm. Calculate the diffraction angle for first order X-ray reflection from (100), (010), (111) planes using radiation with wavelength 154.1pm.

(P.T.O.)

17. Derive Butler-Volmer equation.
18. Give a note on overvoltage and the factors affecting it.
19. Derive an equation for the vibrational contribution towards heat capacity of gases.

(4 × 3 = 12 weightage)

Section C: Essay questions. Answer any *two* questions. Each carries *five* weightage.

20. Explain band theory of the solids.
21. Maximizing the thermodynamic probability of a microstate and invoking Lagrange's undetermined multipliers, derive an expression for Fermi-Dirac statistics.
22. Discuss the Debye-Huckel theory of mean ionic activity coefficient. Derive the Debye-Huckel limiting law equation. How can this equation be verified?
23. Discuss briefly Bose-Einstein condensation.

(2 × 5 = 10 weightage)