



First Semester M.Sc. Degree Examination, December 2018
INDUSTRIAL CHEMISTRY
Physical Chemistry

Time : 3 Hours

Max. Marks : 70

- Note :** 1) Answer **any five** sub-divisions from Part – A, and **any five** questions from Part – B.
2) Figures to the **right** indicate marks.

PART – A

1. Answer **any five** of the following : (5×2 = 10)
- a) What are commutative and non commutative operators ?
 - b) Write spectroscopic term symbols for the ground states of P.
 - c) Give the significance of chemical potential.
 - d) What is the importance of steady state approximation ?
 - e) The rate of corrosion for zinc metal is faster than copper metal. Give reasons.
 - f) Explain why metal nitrates are not used in electroplating.
 - g) What is the significance of divided and undivided cells ?
 - h) Write the reactions of electrolysis of brine solution.

PART – B

- Answer **any five** of the following : (5×12=60)
2. a) Solve the Schrödinger equation for a harmonic oscillator and find its asymptotic solution.
- b) Derive the π -electron MO energy levels for allyl system and calculate the total π electron energy for its radical, cationic and anionic species. (6+6=12)



3. a) What are σ , π , σ^* and π^* molecular orbitals? Give their characteristics.
 b) Explain the need of approximate methods in quantum mechanics for many electron systems.
 c) Discuss degeneracy. In case of a particle moving in a cubic box, calculate the degeneracy corresponding to energy E equal to

$$(i) 11 \frac{h^2}{8ma^2} \quad (ii) 14 \frac{h^2}{8ma^2} \quad (4+4+4=12)$$

4. a) Define thermodynamic excess function and obtain the expressions for G^E , S^E and H^E .
 b) Write brief notes on (i) Thermodynamics of mixing and (ii) Born-Haber cycle. (6+6=12)

5. a) Discuss the kinetics of consecutive reactions.
 b) Taking an example describe the kinetics of an explosive reaction.
 c) Calculate the energy of activation of a reaction whose rate constant at 27°C gets doubled for 10°C rise in temperature. (4+4+4=12)

6. a) Explain how deaeration causes the corrosion of metals.
 b) Discuss the effect of plating variables on the nature of electro-deposit.
 c) 0.2964 g of Cu was deposited on the passage of a current of 0.5 ampere for 30 minutes through a solution of CuSO_4 . Calculate the quantity of electricity (Q) in coulombs. (4+4+4=12)

7. a) What are corrosion inhibitors? Explain their characteristic features. Discuss the mechanism of mixed corrosion inhibitors.
 b) Discuss the Tafel extrapolation method of determination of corrosion rate.
 c) Write a note on analysis of corrosion failures. (4+4+4=12)

8. a) Discuss the role of electrode potential in electro-synthesis.
 b) Write explanatory notes on (i) Electrochemistry of transport system and (ii) Electro-inorganic synthesis of ozone. (4+8=12)

9. a) Describe the various electrolysis parameters in electro-synthesis.
 b) Explain the synthesis of adiponitrile.
 c) Discuss the role of electrochemistry in fixing of carbon dioxide and treatment of industrial waste. (4+4+4=12)