Reg. No. ☐☐☐☐☐☐☐☐☐☐

ICH 403

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 radial, cationic and anionic species. (6+6=12)

P.T.O.

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) $11\dfrac{h^2}{8ma^2}$ (ii) $14\dfrac{h^2}{8ma^2}$.   (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 $CuSO_4$. Calcuate 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)