Q.P. Code : 61903

First Semester M.Sc. Degree Examination, January/February 2020

(CBCS – New Scheme – Freshers)

Chemistry

Paper C 103 – PHYSICAL CHEMISTRY – I

Time : 3 Hours] *[Max. Marks : 70*

*Instructions to Candidates : Answer Q. No. 1 and any **FIVE** of the remaining questions.*

(10 × 2 = 20)

1. Answer any **TEN** of the following :

   (a) Define linear operator with an example.

   (b) Explain the terms normalization and orthogonality of wave functions.

   (c) Comment on quantum mechanical degeneracy.

   (d) Point out the significance of radial and angular distribution function.

   (e) What is Zeeman effect?

   (f) State and explain variation theorem.

   (g) What is temperature coefficient? How can it be evaluated?

   (h) Write the reaction scheme for the decomposition of ethane.

   (i) Explain relaxation time in the fast reactions.

   (j) What are auto catalytic reactions? Give an example.

   (k) How do you account for the fact that an enzyme reaction has a optimum p^H at which its activity is maximum?

   (l) Mention the salient features of Lindeman's theory of unimolecular reactions.

2. (a) Formulate the time-independent Schrödinger equation.

   (b) Explain all the postulates of quantum mechanics. **(5 + 5)**

3. (a) Set up and solve Schrödinger equation for a rigid rotator.

   (b) ψ_i and ψ_j represent the wave functions corresponding to the different states of a particle in a box, show that they are orthogonal to each other.

   (c) Write about eigen functions and eigen values of angular momentum. **(4 + 3 + 3)**

4. (a) Arrive the Schrödinger equation for the hydrogen atom and explain its R equation.

   (b) What are quantum numbers? Give their characteristics.

   (c) Show that the term symbol corresponding to an nd^{10} electron configuration is $^1S_0$. (4 + 3 + 3)

5. (a) Give a concise account of Rayleigh Schrödinger perturbation theory for time independent non-degenerate system.

   (b) Outline the collision theory of reaction rates and point out its limitations. (5 + 5)

6. (a) Describe Wyne-Jones and Eyring treatment for the thermodynamic formulation of reaction rates.

   (b) Discuss the kinetics and mechanism of thermal chain reaction between H_2 and Br_2. (5 + 5)

7. (a) Explain the effect of inhibitors on the enzyme activity using Lineweaver Burk Plot.

   (b) Deduce Gibbs adsorption isotherm equation.

   (c) Deduce Laplace equation. (3 + 4 + 3)

8. (a) Outline the flash photolysis technique for the study of fast reactions.

   (b) Explain mechanical adsorption.

   (c) The rate constant for a reaction at 300 K is 5.20×10^{-3} min^{-1} and its activation energy is 40 K cals/mol. Calcuate the Arrhenius factor. (4 + 3 + 3)