



PG – 959

I Semester M.Sc. Degree Examination, January 2015  
(2010-2011 Onwards) (NS)  
CHEMISTRY  
C – 103 : Physical Chemistry – I

Time : 3 Hours

Max. Marks : 80

**Instruction :** Answer question 1 and **any five** of the remaining.

1. Answer **any ten** of the following. (2×10=20)
- a) Define Hermitian operator.
  - b) What is quantum mechanical degeneracy ?
  - c) Write the normalized eigen functions and eigen values for a rigid rotator with  $l = 1$  and  $m = -1$ .
  - d) Write the normalized spherical functions for H-like atoms with  $l = 1$  and  $m = 0$ .
  - e) Explain the term symbol and give its significance.
  - f) State and explain variation theorem.
  - g) Explain the influence of ionic strength on reaction rates.
  - h) Explain why the quantum yield for the photochemical formation of HBr is low.
  - i) Define relaxation time.
  - j) What is mechanical adsorption ?
  - k) Explain autocatalytic reaction with an example.
  - l) Explain fast reaction with two examples.
2. a) Explain orthogonality and orthonormality of wavefunctions.  
b) Solve the Schrodinger equation to a system of particle in a three dimensional box.  
c) State any three postulates of quantum mechanics. (4+5+3=12)
3. a) Solve the Schrodinger equation to a system of harmonic oscillator.  
b) Write a note on J- Jcoupling.  
c) Explain the radial distribution function and its significance. (5+4+3=12)

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4. a) Discuss the application of variation method to helium atom.  
b) Explain the Slater's rules for the calculation of effective nuclear charge.  
c) Describe the SCF method for many electron systems. **(5+3+4=12)**
5. a) Discuss the mechanisms of thermal and photochemical reactions between hydrogen and bromine.  
b) Explain any two methods for the determination of order of a reaction. **(7+5=12)**
6. a) Compare the enzyme and chemical catalyzed reactions.  
b) Describe the Lineweaver-Burk plot.  
c) Explain the Michaelis-Menten mechanism for enzyme catalyzed reactions. **(4+4+4=12)**
7. a) Discuss the Hinshelwood theory of unimolecular reaction.  
b) How do you determine the surface area of the catalyst using BET equation ?  
c) Write a note on effect of inhibitors on enzyme activity. **(5+4+3=12)**
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