Sixth Semester B.Sc., Degree Examinations

MAY/JUNE 2026

(NEP CBCS Scheme)

(New Syllabus 2021 onwards)

CHEMISTRY

NSF 0550: PAPER: SELECTED TOPICS IN PHYSICAL CHEMISTRY – III

Time: 2 hrs] [Max. Marks: 60

Instructions to Students:

1. ***The Students should legibly write Section number along with question numbers within the margin ONLY.***
2. ***The answer without Section number and question numbers will not be valued.***
3. ***Draw neat and labelled diagram wherever necessary.***
4. ***Use of Scientific non programmed calculator is permitted.***
5. ***Section – I multiple Choice Questions should be answered in the first page of main answer book and same questions shall not be answered repeatedly.***
6. ***Any identifications like marking, ticking, dots etc., in the options of MCQ (Section – I) on the question paper is strictly prohibited. Do not write anything (except register number) on the question paper.***

SECTION – I

Each one the following questions is provided with four answers a, b, c and d. Choose the correct answer among them and write it along with the respective answer in the main answer book: $10 \times 1 = 10$

I - 1) The EMF of Calomel Electrode at 25°C is _____.

a) 0.2422V b) 0.0V c) 0.5V d) 1.0V

I - 2) Which among the following is the Laplacian operator in three dimensions?

a) $\partial^2/\partial^2 x + \partial^2/\partial^2 y + \partial^2/\partial^2 z$ b) $\partial^3/\partial^2 x + \partial^2/\partial^2 y + \partial^2/\partial^2 z$ c) $\partial^2/\partial^2 x + \partial^3/\partial^2 y + \partial^2/\partial^2 z$ d) $\partial^2/\partial^2 x + \partial^2/\partial^2 y$

I - 3) Substances which increase the rate of enzyme catalyzed reactions are known as _____

a) substrates b) inhibitors c) activators d) enzymes

I - 4) Relationship between activity and activity coefficient is _____

a) $a = c\gamma$ b) $a = c/\gamma$ c) $a = c^{\gamma}$ d) $a\gamma = c$

Contd..... 2

QP CODE 31605

I - 5) Decomposition of ethane yields _____.

a) $CH_3 + CO$ b) $C + CH_4 + C_3H_6$ c) $CH_2 = CH_2 + CO_2$ d) CO_2

I - 6) Slope of the plot between logK and 1/T is _____.

a) $-E_a/R$ b) $-E_a/2.303R$ c) E_a/R d) $E_a/2.303R$

I - 7) According to the Kelvin equation, the vapor pressure of a curved surface is _____ than that of a flat surface

a) lower b) higher c) equal to d) proportional to

I - 8) The adsorption between adsorbate and adsorbant is by weak van der Waal's force is

a) Physisorption b) Chemisorption
c) Desorption d) Pseudo adsorption

I - 9) Stirling's approximation in N! = _____

a) NlnN-N b) $N/2\,\ln N+2$ c) lnN! d) NlnN+N

I - 10) According to the third law of thermodynamics, limit $T \to 0$

a) $\triangle G = 0$ b) $\triangle H = 0$ c) $\triangle V = 0$ d) $\triangle S = 0$

SECTION – II

Answer any FIVE of the following: 5 × 3 = 15

II - 1) Describe the construction and working of Calomel electrode.

II - 2) Write a short note on Ladder operators.

II - 3) Define energy of activation and give its significances.

II - 4) Compare the thermal and photochemical reactions.

II - 5) Give a brief account of Lock and key mechanism of enzyme catalysis.

II - 6) Calculate the surface excess concentration of solute, when the concentration of a solution is 10^{-4} M at 25°C and the change in surface tension w. r. t. concentration is 0.1Nm².

II - 7) Write the limitations of Van't Hoff equation.

II - 8) Give the expressions for rotational, vibrational and electronic partition functions.

Contd..... 3

SECTION – III

Answer any THREE of the following: 3 × 5 = 15

III - 1) Obtain an expression for EMF of electrolytic concentration cell without transference.

III - 2) Explain the stopped flow method of fast reactions.

III - 3) What are unimolecular reactions? Discuss the Hinshelwood theory of unimolecular reactions.

III - 4) Derive the Gibbs phase rule from the concept of chemical potential.

III - 5) Solve the Schrödinger wave equation for a particle in a one dimensional box.

SECTION – IV

Answer the following: 2 × 10 = 20

IV - 1) a) i) Explain the potentiometric titration involving $K_2Cr_2O_7$ vs FAS.

ii) What are quantum numbers? Explain their characteristics. (5 + 5)

OR

b) i) Explain primary and secondary salt effects with suitable examples.

ii) Discuss the mechanism of photochemical reactions between hydrogen-chlorine. (5 + 5)

IV - 2) a) i) Write the assumptions to derive BET isotherm and briefly explain the method to determine the surface area using BET isotherm.

ii) Explain the Henri-Michaelis-Menten mechanism enzyme catalyzed reactions. (5 + 5)

OR

b) i) Differentiate between Classical Mechanics and Statistical Mechanics.

ii) Derive the Duhem - Margules equation. (5 + 5)

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