MCHE-015

ASSIGNMENT BOOKLET

M.Sc. in Chemistry Programme
(MSCCHEM)

ADVANCED KINETICS AND ELECTROCHEMISTRY

(Valid from 1st July 2025 to 30th June 2026)

It is compulsory to submit the assignment before filling in the examination form

School of Sciences
Indira Gandhi National Open University
New Delhi-110068
(2026)

Dear Learner,

Please read the section on assignments in the Programme Guide for M.Sc. in Chemistry that we sent you after your enrolment. A weightage of 30 per cent, as you are aware, has been earmarked for continuous evaluation, which would consist of one tutor-marked assignment for this course. The assignment is in this booklet, and covers both the blocks of the course. The total marks of all the parts are 100, of which 40% are needed to pass it.

Instructions for Formatting Your Assignments

Before attempting the assignment please read the following instructions carefully:

1. On top of the first page of your answer sheet, please write the details exactly in the following format:

ENROLAMENT NO. :…..…….

NAME :……...

ADDRESS :……

COURSE CODE :……..

COURSE TITLE :……..

ASSIGNMENT NO :……..

STUDY CENTRE :…….. DATE :…….

(Name and Code)

PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION AND TO AVOID DELAY.

2. Use only foolscap size paper (but not of very thin variety) for writing your answers.
3. Leave about 4 cm margin on the left, top and bottom of your assignment response sheet.
4. Your answers should be precise.
5. Submit the complete assignment answer sheets within the due date.
6. The assignment answer sheets are to be submitted to your Study centre within the due date. Answer sheets received after the due date shall not be accepted.
   We strongly suggest that you retain a copy of your answer sheets.
7. This assignment is valid from 1st July, 2025 to 30th June, 2026. If you have failed in this assignment or fail to submit it by June 2026, then you need to get the assignment for the year 2027, and submit it as per the instructions given in the Programme Guide.
8. You cannot fill the examination form for this course until you have submitted the assignment.

Wishing you good luck

Tutor Marked Assignment

Advanced Kinetics and Electrochemistry (MCHE-015)

Course Code: MCHE-015
Assignment Code: MCHE-015/TMA/2026
Maximum Marks: 100

Note: Attempt all questions. The marks for each question are indicated against it.

1. **(a)** What are consecutive reactions? Derive an expression for the rate laws for intermediate formation and decay. **(5)**

   (b) Discuss the concept of autocatalysis. Explain with an example how autocatalytic behavior influences reaction rates. **(5)**

2. **(a)** What are photochemical reactions? Outline the kinetic features of photochemical reactions. **(5)**

   (b) Define the steady-state approximation and explain its importance in the analysis of complex reactions with the help of a suitable example. **(5)**

3. **(a)** Explain the mechanism of the Briggs–Rauscher oscillatory reaction. How does it differ from the Belousov–Zhabotinskii reaction? **(5)**

   (b) Explain the concept of rate laws for solid-state reactions and list the main factors affecting the rate of solid-state reactions. **(5)**

4. **(a)** Explain Marcus theory for outer sphere electron transfer reactions. How does this theory account for the activation energy of an electron transfer reaction? **(5)**

   (b) Discuss the Michaelis-Menten mechanism for enzyme reactions. Derive the rate equation for the same and give its limitations. (5)

5. **(a)** Outline the King-Altman method for analysing complex enzyme reactions and discuss its importance. **(5)**

   (b) Define impact parameter, collision cross-section, & reaction cross-section and discuss their importance in molecular reaction dynamics. **(5)**

6. **(a)** Derive the Butler-Volmer equation for electrode kinetics and explain its significance. **(5)**

   (b) What is a Tafel plot? How is it obtained from the current-overpotential data? **(5)**

7. **(a)** Explain the concept of a multistep electrode reaction pathway and give one of its examples. **(5)**

   (b) Discuss the role of the rate determining step in complex electrode reactions. **(5)**

8. **(a)** What is coulometry? Differentiate between the controlled potential coulometry and controlled current coulometry. **(5)**

   (b) What are corrosion cells? Give the working principle of a corrosion cell with a simple diagram. **(5)**

9. **(a)** Explain the working principle of any one corrosion prevention method, such as metallic coating, electrical protection, or corrosion inhibitors. **(5)**

   (b) What is a fuel cell? Write its basic working principle with a schematic representation. **(5)**

10. **(a)** Explain the advantages and disadvantages of Lithium-Ion batteries with suitable examples. **(5)**

    (b) Describe the steps involved in the hydrogen evolution reaction (HER) at an electrode surface. **(5)**