MCH-003

ASSIGNMENT BOOKLET

M.Sc. in Analytical Chemistry Programme
(MSCANCHEM)

SPECTROSCOPIC METHODS

(Valid from July, 2025 to June, 2026)

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

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

Dear Learner,

We hope, you are familiar with the system of evaluation to be followed for the M.Sc. in Analytical Chemistry Programme (MSCANCHEM) Programme. You may probably like to re-read the section on assignments in the Programme Guide that was sent to you earlier. As you are aware, a weightage of 30 percent has been earmarked for continuous evaluation component. For this you have to submit the response to the enclosed tutor marked assignment to the coordinator of the Study Centre. The assignment is based on the content of all the 5 blocks of the Spectroscopic Methods (MCH-003) course. The total marks of all the parts are 100, of which 40% are needed to pass it.

Before attempting the assignment, please read the following instructions carefully.

1 On top of the first page of your assignment response, please write the details exactly in the following format; write your answers from second page onwards.

ENROLMENT NO: ……...

NAME: ……...

ADDRESS: ……...

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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 While writing answers, clearly indicate the Question No. and part of the question being solved.

6 Though the validity of assignment is for one year, we advise you to submit the assignment within 12 weeks after receiving it.

7 We strongly suggest that you should retain a copy of your assignment responses.

Wishing you good luck.

Tutor Marked Assignment

Spectroscopic Methods

Course Code: MCH-003
Assignment Code: MCH-003/TMA/2025-26
Maximum Marks: 100

Note: Attempt all the questions given below.

1. a) Define electromagnetic radiation in terms of the wave mechanical model. Compute the energy of a photon corresponding to 102.6 MHz frequency. (5)

   b) The transmittance of a solution, containing 7.3 mg of an potassium dichromate per 100 cm^3, taken in a cuvette of path length of 1 cm is measured at 455 nm. If the percentage transmittance found to be 6, calculate the molar absorptivity of the oxidizing agent. (5)

2. a) What are monochromators? Describe the working of a grating monochromator. In what way is the standard addition method of calibration in UV-VIS spectrophotometry better than the standard solution method? (5)

   b) Explain the origin of Raman spectrum in terms of quantum theory of radiation. State the 'Rule of mutual exclusion'. What is its significance? (5)

3. a) Explain the origin of fluorescence and phosphorescence spectra in terms of Jablonski diagram. What is meant by fluorescence quenching? How does it affect the quantum yield of a fluorescence emission? (5)

   b) Why do we need to modify the instrumental set up for the fluorescence spectrometer to make phosphorescence measurements? Describe the modification (5)

4. a) What is chemiluminescence? Describe an analytical application of chemiluminescence in the area of environmental pollution measurement. (5)

   b) What is meant by room temperature phosphorescence? How is it achieved? (5)

5. a) Briefly explain the origin of atomic spectrum. Explain why the atomic spectra are line spectra whereas the molecular spectra are band spectra (5)

   b) Discuss the fate of analyte sample in the flame of a flame photometer. What is internal standard method? Under what conditions is it used? (5)

6. a) Briefly explain the different types of spectral interferences observed in flame photometry. (5)

   b) Explain different pathways of atomic fluorescence emission. In what way is halogen cathode lamp (HCL) better than a continuous source for atomic fluorescence measurement? (5)

7. a) Explain the principles of atomic absorption spectrophotometry and atomic emission spectrometry. (5)

   b) Enlist the advantages of GFAAS over FAAS and the advantage of line sources over continuum sources for AAS. (5)

8. a) Enlist different components of an ICP torch. What makes argon a good choice for the plasma gas? (5)

   b) What are different types of instruments used for ICP-AES? Which of these is better and why? Explain. (5)

9. a) Explain spin-spin splitting and Larmor precession the following terms in the context of NMR spectrometry. (5)

b) What is the principle of mass spectrometry? Explain how it is different from other spectrometric methods. (5)

10. a) Explain McLafferty rearrangement with the help of a suitable example. (5)

b) What kind of structural information is available from UV, IR, NMR and Mass spectra of an organic compound? (5)