

ASSIGNMENT BOOKLET**Bachelor's Degree Programme (B.Sc.)
SPECTROSCOPY**

(Valid from 1st January, 2024 to 31st December, 2024)

It is Compulsory to submit the Assignment before filling in the Term-End Examination Form.

Please Note

- You can take electives (56 to 64 credits) from a minimum of TWO and a maximum of FOUR science disciplines, viz. Physics, Chemistry, Life Sciences and Mathematics.
- You can opt for elective courses worth a **MINIMUM OF 8 CREDITS** and a **MAXIMUM OF 48 CREDITS** from any of these four disciplines.
- At least 25% of the total credits that you register for in the elective courses from Life Sciences, Chemistry and Physics disciplines must be from the laboratory courses. For example, if you opt for a total of 64 credits of electives in these 3 disciplines, at least 16 credits should be from lab courses.
- You cannot appear in the Term-End Examination of any course without registering for the course. Otherwise, your result will not be declared and the onus will be on you.



**School of Sciences
Indira Gandhi National Open University
New Delhi
(2024)**

Dear Student,

We hope, you are familiar with the system of evaluation to be followed for the Bachelor's Degree Programme. At this stage you may probably like to re-read the section on assignments in the Programme Guide that we sent you after your enrolment. A weightage of 30 percent, as you are aware, has been earmarked for continuous evaluation, which would consist of one tutor-marked assignment. The assignment is based on Blocks 1, 2, 3 and 4.

Instructions for Formatting Your Assignments

Before attempting the assignments, 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:

ENROLMENT 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.

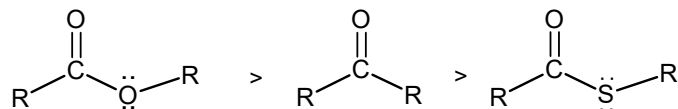
- 2 Use only foolscap size writing paper (but not of very thin variety) for writing your answers.
- 3 Leave 4 cm margin on the left, top and bottom of your answer sheet.
- 4 Your answers should be precise.
- 5 While writing answers, clearly indicate the Question No. and part of the question being solved.
- 6 Please note that:
 - i) The Assignment is valid from 1stJanuary, 2024 to 31stDecember, 2024.
 - ii) The response to this assignment is to be submitted to the Study Centre Coordinator within eight weeks of the receipt of this booklet in order to get the feedback and comments on the evaluated assignment.
 - iii) In any case, you have to submit the assignment response before appearing in the term end examination.
- 7 **We strongly suggest that you should retain a copy of your assignment responses.**
Wishing you all good luck.

Tutor Marked Assignment CHE-10: SPECTROSCOPY

Course Code: CHE-10
Assignment Code: CHE-10/TMA/2024
Maximum Marks: 100

Note: * This assignment is based on all the four Blocks of the entire course.
* All questions are compulsory. Marks for the questions are shown within brackets on the right hand side.
* Please answer in your **own words**; do not copy from the course material.

1. Draw a labeled diagram for various series of spectral lines observed in the atomic spectrum of hydrogen atom. (5)
2. Derive the spectroscopic states of carbon atom. (5)
3. Illustrate the axis/axes of symmetry present in the following molecules: (5)
(i) H₂O (ii) NH₃ (iii) BF₃ (iv) benzene
4. Which elements of symmetry are present in the following molecules? (5)
(i) PCl₅ (ii) C₂H₂
Also give the point groups of these molecules.
5. Show transitions between various rotational levels and spectral lines arising from such transitions for a rigid diatomic molecule. What is the difference between various transitions? (5)
6. (a) Explain the following terms: (3)
(i) Zero point energy
(ii) Fundamental transitions
(iii) First overtone
(b) What is Morse potential? Briefly discuss. (2)
7. Discuss the IR spectrum exhibited by water molecule. Also draw the suitable diagram. (5)
8. Explain the following: (5)
(i) Benzophenone absorbs at 1700 cm⁻¹ while acetone absorbs at 1720 cm⁻¹ in their IR spectra. (5)
(ii) The IR absorptions frequencies of the following compounds are in the order shown below:



9. How do the Stokes, anti-Stokes and Rayleigh lines appear in the Raman spectrum? Explain giving the suitable diagram. (5)

10. Explain the IR bands exhibited by CO₂ and SO₂ in the light of mutual exclusion principle and arrive at the structures of these molecules. (5)
11. Define the following terms: (1×5)
- (i) Auxochrome
 - (ii) Chromophore
 - (iii) Hypsochromic shift
 - (iv) Hypochromic effect
 - (v) Hyperchromic effect
12. Discuss the effect of change of solvent from polar to non-polar on the $\pi \rightarrow \pi^*$ and $n \rightarrow \pi^*$ transitions. (3)
13. Draw the crystal field splitting of *d*-orbitals of metal ions in complexes having different geometries. (5)
14. Briefly explain fluorescence using a suitable diagram. (5)
15. Draw the back diagram of a single beam IR spectrometer. How does a double beam instrument differ from that of the single beam IR spectrometer? (5)
16. Show that the energy difference between two spin states of a nucleus is given by (5)
- $$\Delta E = g_N |B_N B_Z$$
17. Draw and explain the N,M,R spectrum of CH₃CHO molecule. (5)
18. Draw and explain the functioning of an ESR spectrometer. (5)
19. What is simple cleavage? Illustrate it with the fragmentation of a suitable molecule. (5)
20. Explain spectral signals expected in the different spectra of benzyl alcohol. What different units of the molecules are responsible for them? (5)