

## MSc-II Academic Year: 2024-2025

### Spectroscopic Analysis:

1. Explain in detail Shielding and De-shielding effects in NMR
2. Explain the mechanism of splitting of NMR signal for the below molecule:  
CH3-CH3-CH3-CH3-NH2
3. Write a note on Beer-Lambert's law.
4. Write a note on instrumentation of X-Ray Diffraction Spectroscopy.
5. A Raman spectrum shows scattered light at 450 nm when the incident light has a wavelength of 400 nm. Calculate the Raman shift in  $\text{cm}^{-1}$
6. Discuss the types of Spectroscopy
7. Write a note on principle of NMR Spectroscopy
8. State advantages and limitations of Raman Spectroscopy
9. Describe the electromagnetic radiation and the electromagnetic spectra.
10. Explain the factors affecting the chemical shift.
11. Calculate the frequency of light (in Hz) with a wavelength of 600 nm. The speed of light is  $3 \times 10^8$  m/s.
12. Describe the key differences between IR and Raman Spectroscopy, focusing on their principles and applications in bioinformatics.
13. Explain the types of X-Ray Spectroscopy
14. Explain the applications of IR Spectroscopy in Bioinformatics
15. Explain the types of Spectra and molecular movements associated with them.
16. Describe the properties of Electromagnetic radiation.
17. In an NMR spectrum, the resonance frequency of a sample is observed at 500.5 MHz. The reference frequency is 500 MHz. Calculate the chemical shift in ppm.
18. Explain the working of X-Ray Spectroscopy.
19. Explain Beer-Lambert's Law for Absorption Spectrometry.
20. What is the relationship between wavelength, wave number, and frequency?
21. State advantages and disadvantages of X-Ray Spectroscopy.

### ML with Python:

1. What are the basic steps of a Machine Learning algorithm?
2. Describe in detail Data Preprocessing.
3. Write a short note on Splitting the Data.
4. Discuss the types of learning in ML.
5. Explain the Confusion Matrix with its components.
6. What is label encoding? Give example.
7. Define Overfitting and Underfitting.
8. Explain Numpy in detail.
9. Discuss Model Evaluation Metrics.
10. Give any 3 examples of ML models and state their usage in Bioinformatics
11. Discuss Model Training in ML.
12. Discuss steps involved in implementing a basic ML project.
13. What are Ensemble models?
14. Discuss any 4 challenges in the ML project in Bioinformatics.
15. Discuss the steps involved in Exploratory Data Analysis (EDA).

16. What is the difference between Supervised and Unsupervised Learning?
17. Write Python code to perform Linear Regression on a dataset.
18. Write Python code to model a Decision Tree on a dataset.
19. Discuss the confusion matrix and its components.
20. Discuss the use of ML in Bioinformatics.
21. What is the purpose of train-test split in machine learning?
22. Explain the concept of Feature Scaling and how it affects machine learning algorithms.