



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
**UNIVERSITY VILLAGE, PLOT 91 CADASTRAL ZONE, NNAMDI AZIKIWE**  
**EXPRESSWAY, JABI - ABUJA.**  
**FACULTY OF SCIENCES**  
**DEPARTMENT OF CHEMISTRY**  
**2025\_1 EXAMINATION**

**COURSE CODE:** CHM 306  
**COURSE TITLE:** Instrumental Methods of Analysis  
**COURSE UNIT:** 2  
**TIME:** 2 Hours  
**INSTRUCTION:** Answer question one and any other two questions.

1a. Highlight the components of x-ray emission spectrometer. 6marks

- b. Explain the following:
  - i. Molecular emission 6mks
  - ii. Atomic absorption 3 ½ mks
- c. Briefly describe the usefulness of x-ray diffraction method. 3mks
- d. A molecule has 17 atoms in it. Find its fundamental mode of vibration, if its atomic molecule is non-linear. 3mks
- e. Define the term Coulometry. 2mks
- f. Discuss the importance of solvent purity to conductivity analysis. 4mks
- g. State with reason the impact of concentration on specific conductance and molar conductance. 2 ½ mks

2a. With respect to infrared spectrophotometer, discuss on:

- i. A Detector 5mks
- ii. A monochromator 4mks
- b. Explain the term chemical interference. Give an example. 6mks
- c. Mention why you may not recommend the application of x-ray fluorescence. 5mks

3a. Write on the application of polarography. 5mks

- b. With appropriate samples, explain the current efficiency requirements in a Coulometry analysis. 9mks
- c. Write on the application of coulometric procedure. 6mks

4a. Explain the term interference with respect to flame spectroscopy. 4mks

- b. What factors could influence the degree of rotation of plane polarized light. 6mks
- c. The X-ray powder pattern of sodium chloride shows a cone of  $\theta = 16.38^\circ$  using x-rays of wavelength  $1.55 \times 10^{-8}$  cm. What would be the spacing between the planes if it is a second order reflection? 5mks
- d. How is refractive index determined? 5mks

5a. Write short note on Beer's law. 4 ½ mks

- b. Highlight the focus of each type of optical methods of analysis. 7 ½ mks
- c. Write in detail the effect of x-ray diffraction on the arrangement of atom. 8mks