



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
**UNIVERSITY VILLAGE, PLOT 91 CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESS WAY, JABI - ABUJA.**  
**FACULTY OF SCIENCES**  
**DEPARTMENT OF PURE AND APPLIED SCIENCES**  
**SEPTEMBER 2020\_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 three questions.

- 1a) What is Infrared spectroscopy? 2 marks
- 1b) Explain briefly the principle of Infrared spectroscopy. 6 marks
- 1c) State two (2) applications of IR spectroscopy. 2 marks
- 1d) When X-rays of wavelength  $1.54 \times 10^{-8}$  cm is passed through NaCl, an intense cone is formed at  $\theta = 15.87^\circ$ . Determine its spacing, d between the planes, If this is taken as first order reflection.  $4 \frac{1}{2}$  marks
- 1e) Define Fourier transform spectroscopy. 2 marks
- 1f) Enumerate four (4) advantages of Fourier Transform Infra-Red (FTIR) spectrophotometer. 2 marks
- 1g) Write short notes on the basic Principle of Polarimetry.  $6 \frac{1}{2}$  marks
- 2ai) Define x-ray spectroscopy. 2 marks.
- 2a ii) Enumerate three (3) common sources of x-rays. 2 marks
- 2bi) Draw and label a block diagram of an X-ray emission spectrometer. 3 marks
- 2bii) Give a brief account on how X-ray emission spectrometer operates. 3marks

- 2ci) List any two applications of X-ray spectroscopy. 2 marks
- 2cii) Enumerate three (3) types of x-ray detectors. 3 marks
- 3ai) What is Nuclear Magnetic Resonance (NMR) spectroscopy? 2 marks
- 3aii) Outline the six (6) basic components of an NMR spectrometer. 3 marks
- 3b) Explain the pattern of an NMR spectrum. 5 marks
- 3c) What is the effect of the following on the fluorescence spectroscopy?
- i. Temperature and solvent 2 marks
  - ii. Concentration 3 marks
- 4a) Define voltammetry and give its two major subdivisions. 3 marks
- 4bi) Give an illustration of a polarogram. 3 marks
- 4bii) From (bi), explain the meanings of:
- (I) halfway potential 4 marks
  - (II) diffusion current. 2 marks
- 4c) Enumerate three (3) applications of polarography. 3 marks
- 5ai) What is Interferometer? 2 marks
- 5aii) In an FTIR analysis, a wavelength of 100  $\mu\text{m}$  was used. Express this in terms of:
- i. wave number 2½ marks
  - ii. frequency 3½ marks
- 5b) Distinguish between dextrorotatory and laevorotatory. 3 marks
- 5c) List (four) 4 uses of Polarimeter. 4 marks