



Seat No. : _____

NG-137

November-2025

M.Sc., Sem.-III

**CHE(A) 502 : Analytical Chemistry
(Trends in Analytical Science)**

Time : 2:30 Hours]

[Max. Marks : 70

1. (i) Compare Discrete and Continuous flow instruments in automatic instruments. 7
(ii) Discuss Spectrophotometric determination of Chloride and Phosphate by flow injection analysis. 7

OR

1. (i) Define and compare inline, offline, at-line and on-line analysis. 7
(ii) State the principle of flow injection analysis and how it is applicable in automated instrumentation. 7
2. (i) Explain the principle of a mass spectrometer and describe in detail the major steps involved in mass spectrometry analysis. 7
(ii) What are soft and hard ionization techniques in mass spectrometry ? Explain the principles of any two soft ionization methods, including detailed diagrams. 7

OR

2. (i) Name any two analyzers used in High Resolution Mass Spectrometry (HRMS) and explain working of quadrupole mass analyzer in detail. 7
(ii) What are the differences between EI, CI, and ESI ionization techniques ? Write a brief note on the ESI technique and explain why it is preferred in LC-MS. 7
3. (i) Discuss in detail the available modes for efficient transfer of components from an HPLC system to an NMR spectrometer for spectral analysis. 7
(ii) Describe the steps involved in the operation of LC-MS/MS, accompanied by a suitable diagram. 7

OR

3. (i) What is a triple quadrupole mass spectrometer ? Explain the function of each quadrupole, supported by a diagram. 7
- (ii) Explain the working principle of an Inductively Coupled Plasma (ICP) torch, accompanied by a neat and labelled diagram. 7
4. (i) Give an Introduction of the GAPI Method for Analytical Methods Greenness Evaluation. 7
- (ii) Give an Overview of Sample Preparation Strategies and their impact on Analytical Methods Greenness. 7
- OR**
4. (i) Explain the significance of AGREE Metric and its contribution in GAC. 7
- (ii) Discuss the characteristics of Green Method in Analytical Chemistry and explain how it leads to sustainable development. 7
5. Answer any **seven** out of **twelve** (each question carries **2** marks) 14
- (i) Represent feedback mechanism control loop in block diagram.
- (ii) Mention the factors which affect the peak height of dispersion curve in FIA.
- (iii) Justify the role of artificial intelligence in analytical science.
- (iv) What is the difference between Spectrometry and Spectroscopy ?
- (v) Which analyzer is generally coupled with MALDI ?
- (vi) What are some limitations of Mass spectrometry ?
- (vii) What is a Hyphenated technique ?
- (viii) Name two Soft Ionization techniques.
- (ix) What is Skin effect in a Plasma flame ?
- (x) If input data of in-situ measurements is on-line, what will be its score in AGREE metrics ?
- (xi) In RGB additive colour model, the “RED” stands for
- (xii) What is the full form of NEMI ?
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