

Master of Science in Analytical Chemistry

Examination April - 2026

Day & Date	Semester	Subject Name	Time	Code	Marks
Friday 24/04/2026	III	Advance Analytical Chemistry & Spect. Method	02.00 pm to 04.00 pm	302101	50

INSTRUCTION:

- All Question Are Compulsory
- Draw Neat Labelled Diagram

Q. 1 Attempt any Five of the following (10)

1. What is GC-MS? State its principle.
2. Name any two types of ion sources used in mass spectrometry.
3. Name the major components of an HPLC instrument.
4. Define size exclusion chromatography.
5. What is the mobile phase commonly used in SFC?
6. Differentiate between ^1H NMR and ^{13}C NMR.
7. What is meant by Rayleigh scattering and Raman scattering?

Q.2 Attempt any two of the following (10)

1. Explain the principle and instrumentation of Gas-Liquid Chromatography (GLC) with a neat diagram.
2. Explain the theory and application of size exclusion chromatography. How does molecular size affect separation?
3. Describe the different types of columns and stationary phases used in gas chromatography.

Q.3 Attempt any two of the following (10)

1. Describe the principle and instrumentation of HPLC with a labeled diagram.
2. Compare SFC with HPLC and GLC, highlighting the advantages and limitations of each technique.
3. Explain the instrumentation and working of supercritical fluid chromatography

Q.3 Attempt any two of the following (10)

1. Describe the principle and instrumentation of ICP-AES and mention its applications.
2. Discuss the environmental effects on NMR spectra - chemical shift, spin splitting, and the rules for interpreting first-order spectra.
3. Explain the principle, ion sources, analyzers, and detectors used in mass spectrometry.

Q.4 Attempt any two of the following (10)

1. Explain the theory and instrumentation of Raman spectroscopy and mention its applications.
2. Describe the principle and working of GC-MS with a neat block diagram. What are its advantages?
3. Write a detailed note on tandem mass spectrometry (MS-MS) — its principle, types, and applications.

Master of Science in Analytical Chemistry

Examination April - 2026

Day & Date	Semester	Subject Name	Time	Code	Marks
Monday 27/04/2026	III	Organic Analysis	02.00 p.m. to 04.00 p.m.	302102	50

Instructions-

- All questions are compulsory.
- Write answers neatly and to the point.

Q. 1 Attempt any Five of the following (10)

1. Name chemicals used for absorption of water and carbon dioxide in Micro-elemental Analysis.
2. Write frequency of Hydroxyl group and carbonyl group in IR spectroscopy
3. Write only the formula to calculate Chemical Shift value of Alkenes in ^{13}C NMR Spectroscopy.
4. Write frequency of Amino group and carbonyl group in IR spectroscopy
5. Write only the formula to calculate Chemical Shift value of Alkane in ^{13}C NMR Spectroscopy.
6. Write the reaction of Wacker process.
7. Give the no. Non-equivalent Carbons in the Phenol and aniline.

Q.2 Attempt any Two of the following (10)

1. Explain identification of 1 $^{\circ}$, 2 $^{\circ}$ & 3 $^{\circ}$ alcohols and Phenols on the basis of suitable IR Spectra.
2. Explain electronic transitions in UV Spectroscopy with suitable examples.
3. Discuss Methyl, alcohol group in IR Spectroscopy with suitable example

Q.3 Attempt any Two of the following (10)

1. Explain spin-spin splitting in ^1H -NMR spectroscopy with the help of suitable examples.
2. Calculate Chemical Shift value for substituted alkanes in ^{13}C -NMR with suitable Examples.
3. Explain H-decoupled and off resonance spectra in ^{13}C -NMR with suitable examples.

Q.4 Attempt any Two of the following (10)

1. Explain any Two preparation method for CNT.
2. Explain nanotechnology in brief with suitable examples.
3. Explain in short any three inorganic Nano Materials and their uses.

Q.5 Attempt any Two of the following (10)

1. Explain method of sampling in organic trace element.
2. Explain in brief Wacker process and Grignard reaction.
3. Write a note on Ziegler Natta process and give its applications.

Master of Science in Analytical Chemistry
Examination: April 2026

Day & Date	Semester	Subject Name	Time	Code	Max. Marks
Friday 24/04/2026	III	Analytical Chemistry Paper - III	2.00 pm to 4.00 pm	315211	50

Instruction:**All Question Are Compulsory****Draw Neat Labelled Diagram.****Q.1. Attempt any Five of the following****10**

1. List two common applications of Gas Chromatography.
2. What is the Principle behind Hydrophobic Interaction Chromatography (HIC)?
3. State the primary Principle of Atomic Fluorescence Spectroscopy.
4. What information does spin-splitting for coupling) provide in an NMR spectrum?
5. State the basic Principle of Photoacoustic Spectroscopy.
6. State the principle of HPLC.
7. State the primary difference in the separation mechanism between HPLC & HIC

Q.2. Attempt any two of the following**10**

1. Explain the Principle of Separation in High-Performance Liquid Chromatography (HPLC)
2. Draw a labelled block diagram of a Gas Chromatography and briefly explain the function of the Detector.
3. Describe the principle and instrumentation of an ion exchange Chromatography.

Q.3. Attempt any two of the following**10**

1. Explain the Principle of Hydrophobic Interaction Chromatography (HIC) and outline the key steps involved in the separation of a mixture.
2. Compare all the types of Chromatography in detail
3. Compare 3-level and 4-level laser systems with examples.

Q.4. Attempt any two of the following**10**

1. Explain the theory and instrumentation of AFS?
2. Write a detailed note and working of ICP-AES.
3. Discuss the principle and working of IC- MS.

Q.5. Attempt any two of the following**10**

1. Discuss chemical shift, spin splitting, and factors affecting NMR spectra.
2. Explain photoacoustic spectroscopy with principle and instrumentation.
3. Discuss the principle and applications of Spectro electrochemistry.

M.Sc. ANALYTICAL CHEMISTRY
Examination November - 2025

Day & Date	Semester	Subject Name	Time	Code	Marks
Wednesday 26/11/2025	III	Analytical Chemistry Paper III	11.00 a.m. To 01.00 p.m.	315211	50

INSTRUCTION: ALL QUESTIONS ARE COMPULSORY

Q.1) Attempt any Five of the following (10)

1. Draw a block diagram for Ion exchange chromatography.
2. What are the factors affecting chemical shift.
3. Define spectroelectrochemistry.
4. Define chemiluminiscence.
5. State the application for HIC.
6. Name the types of laser.
7. State the principle for AFS.

Q.2) Attempt any two of the following (10)

1. Write a short note on spectroelectrochemistry.
2. Explain ORD and CD in detail.
3. Write a short note on PAS.

Q.3) Attempt any two of the following (10)

1. What is fine nine gas and explain carrier gas in GC.
2. What is classification and nature of source in ion chromatography.
3. Explain the principle and types of detectors in HPCL.

Q.4) Attempt any two of the following (10)

1. Explain in detail ICP-AES.
2. Define atomic line width factors affecting spectral width effect of temperature in OAS.
3. Explain in detail ICP-MS.

Q.5) Attempt any two of the following (10)

1. Differentiate between chromatographic techniques in detail.
2. Explain principle and working on HIC.
3. Explain each type of laser in detail.

Master of Science in Analytical Chemistry
Examination: November -2025

Day & Date	Semester	Subject Name	Time	Code	Max. Marks
Friday 28/11/2025	III	Organic Analysis	11:00 AM To 01:00 PM	315212	50

Instruction:

All Questions are compulsory

Q.1 Attempt any Five of the following

10

1. Calculate the λ_{max} for a simple acyclic conjugated diene with one alkyl substituent using the Woodward-Fieser rules?
2. In a ^{13}C NMR experiment using a 100 MHz spectrometer, a carbon signal is observed 125 Hz downfield from TMS. Calculate the chemical shift in ppm?
3. How does Pascal's Triangle relate to the multiplicity of signals in ^1H NMR spectroscopy?
4. Explain General features of Nano-composites?
5. How many grams of Vanadium are required to prepare a 250 ppm standard V solution in a 500 ml. volumetric flask? (Given Molecular weight of V is 50.94 g/mol and $NHVO$; 116.98 g/mol)
6. What are Nucleophiles and Nucleophilic agent with examples?
7. Explain Sharpless Asymmetry Reaction?

Q.2 Attempt any two of the following

1. Wavelength of absorption associated with C-H band in stretching vibration of methyl group. $K = 5 \times 10^5 \text{ dynes/cm}$ masses of C & H $2 \times 10^{-23} \text{ g}$ & $0.167 \times 10^{-23} \text{ g}$ respectively. Calculate the wave number?
2. Explain Principle of UV-visible spectroscopy and describe concept of

electronic transitions in UV-Visible spectroscopy

3. Describe the key steps in interpreting an IR spectrum, Explain with example?

Q.3 Attempt any two of the following 10

1. Draw the expected ^1H NMR spectrum for each isomers of Bromo-butane. Label each peak with its corresponding chemical shift, multiplicity, and integration?
2. Draw the expected ^1H and ^{13}C NMR spectrum for 4 methyl Benzaldehyde, Label each peak With its corresponding chemical shift, multiplicity, and intergration?
3. Describe the NOESY (Nuclear Overhuser Effect spectroscopy) experiment with two examples?

Q.4 Attempt any two of the following 10

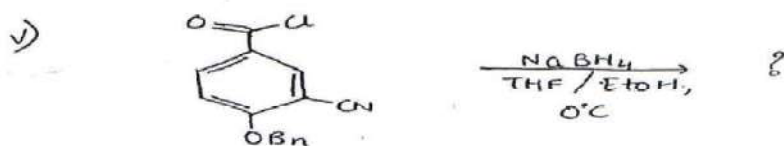
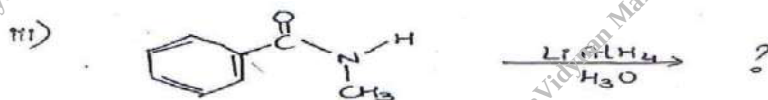
1. Define nanomaterials, Explain in detail the following methods for synthesizing nanomaterials:
A) Sol-gel method B) Ball milling method?
2. Explain the principles and Instrumentation of Kjeldahl's Methods?
3. Define Nanotechnology and explain in detail classification of Nanotechnology

Q.5 Attempt any two of the following 10

1. Explain Parkin Reaction and Wurtz Reaction?
2. Explain in detail Any Two coupling Reaction with mechanism
3. Complete the Reactions:-



Quinoline.



End of Paper

Master of Science in Analytical Chemistry
Examination April -2026

Day & Date	Semester	Subject Name	Time	Code	Marks
Wednesday 29/04/2026	III	Microbiological Methods of Analysis	02.00 p.m. to 04.00 p.m.	325211	50

Instruction: 1) All Questions are compulsory.

- Q.1** Attempt any FIVE of the following. **(2 Marks each)** **10**
1. What is the significance of bacterial physiology in microbiology?
 2. Define virulence and pathogenicity?
 3. Name two special staining techniques used for bacterial structure and state their purpose.
 4. Differentiate between active and passive viral infections?
 5. What are the limitations of sterilization by dry heat?
 6. Define hapten and adjuvant with one example each?
 7. List two reasons why microbial control is critical in industrial manufacturing.
- Q.2** Attempt any TWO of the following. **10**
1. Discuss environmental and nutritional factors influencing bacterial growth and survival.
 2. Compare the principle, reagents, and diagnostic value of Gram's stain, acid fast stain, and endospores stain.
 3. Evaluate the importance of bacterial physiology in understanding pathogenic mechanisms?
- Q.3** Attempt any TWO of the following. **10**
1. Describe the structure and replication of viruses, highlighting differences between bacteriophages and animal viruses?
 2. Discuss modern methods for virus cultivation and their applications in vaccine development?
 3. Explain the mechanism of action of antiviral agents and give examples of clinically useful ones?
- Q.4** Attempt any TWO of the following. **10**
1. Elaborate the classification, mechanism, and evaluation of disinfectants and antiseptics used in microbiology laboratories?
 2. Explain methods for quality control and preparation of different types of culture media?
 3. Discuss the classification of culture media?

Q.5 Attempt any TWO of the following.

10

1. Explain the innate and adaptive branches of the immune system and their coordinated functions?
2. Discuss types, structures, and biological significant of antibodies natural immunity?
3. Describe the etiology, transmission, and control of bacterial diseases transmitted through water?

Master of Science in Analytical Chemistry**Examination: December 2025**

Day & Date	Semester	Subject Name	Time	Code	Max. Marks
Friday 5/12/2025	III	Microbiological Methods of Analysis	11:00 A. M TO 01:00 P.M.	325211	50

Instruction- ALL QUESTIONS ARE COMPULSORY**Q. 1 Attempt any Five of the following (10)**

1. What about function and composition of cell wall of bacteria?
2. Write types of flagella in bacteria any 4?
3. What is the antigenic shift of viruses?
4. What is antigenic drift of virus?
5. Sterilization gases and dyes?
6. Define sterilization process?
7. Write role of a Antigen b. Hapten?

Q. 2 Attempt any two of the following. (10)

1. Explain classification of bacterial with a neat labeled diagram?
2. Explain in detail about capsule staining?
3. Explain in detail about flagella staining and its types?

Q. 3 Attempt any two of the following (10)

1. What are the antiviral agents?
2. Write a short note on 1) HIV/AIDS 2) Corona virus 19 with a neat labeled diagram?
3. Explain techniques of virus cultivation 1) Animal Inoculation 2) Inoculation into embryonated egg?

Q. 4 Attempt any two of the following. (10)

1. Write a note on preparation and composition of culture media?
2. Explain aerobic and anaerobic culture methods?
3. Explain in detail about the action mechanism of antibiotic drugs with examples?

Q. 5 Attempt any two of the following. (10)

1. Explain airborne disease with prevention?
2. Explain the Artificial & specific Immune Mechanisms?
3. Write a note:- a) Adjuvant b) Antibody c) Complement System?

**** END OF PAPER****