

Instrumental Techniques of Analysis

Full Marks : 100

GROUP-A

1. Visible and Ultraviolet Spectroscopy:

7

- a) Introduction and elementary theory.
- b) Instrumentation, measurement and sample handling.
- c) Applications: 1) Chromophores- Isolated functional groups. 2) Quantitative studies concentration, rate measurements and acid/base dissociation.

2. Infrared Spectroscopy:

5

- a) Introduction and elementary theory.
- b) Instrumentation and sample handling.
- c) Applications: i) Identification ii) Purity iii) Kinetic Studies.

3. Flame Emission Spectroscopy:

5

- a) Introduction and elementary theory of flame photometry.
- b) Instrumentations.
- c) Applications: Qualitative and Quantitative.

4. Atomic Absorption Spectroscopy:

5

- a) Introduction and elementary theory.
- b) Principle and instrumentation.
- c) Applications: Qualitative and Quantitative.

5. Absorption Flame photometry:

5

- a) Introduction and elementary theory.

b) Instrumentation and preparation of samples.

c) Applications: Qualitative and Quantitative.

6. Conductometry Titrations:

5

a) Introduction and principle.

b) Applications: i) Acid/base titrations ii) Dissociation constant of an acid.

7. pH Titrations:

5

a) Introduction and determination of pH.

b) Hydrogen electrode, Quinhydrone electrode and Glass electrode.

c) Applications: i) Preparation of Buffer solutions and determination of pH ii) Acid/base titrations.

8. Potentiometric Titrations:

5

a) Introduction and principle.

b) Instrumentation and different types of potentiometric titrations.

c) Applications: Determination of the end points in redox titrations and precipitation reaction.

9. Refractometry:

5

a) Introduction, specific and molecular refractivity and factors affecting refractive index measurement.

b) Instrumentations.

c) Applications: Qualitative and Quantitative analysis, Molecular refractivity and Chemical constituents.

10. Chromatography:

7

a) Introduction and classification.

b) Principles-Techniques and Instrumentation and applications.

c) Paper chromatography, TLC, Column chromatography and Gas chromatography, HPLC.

11. ELISA Technique: Introduction, instrumentation, applications.

3

12. Nuclear Magnetic resonance: Introduction, construction and instrumentation, principle, applications. 3

13. Electrophoresis: Introduction, types, construction and instrumentation, principle, applications. 7

14. Amino acid Analyser: Introduction, construction and instrumentation, principle, applications.

4

15. Electric & Electronic balance: Introduction, construction and instrumentation, principle, applications. 3

16. Polarography: Introduction, construction and instrumentation, principle, applications.

4

17. ESR: Introduction, construction and instrumentation principle, applications.

3

18. NQR: Introduction, construction and instrumentation, principle, applications.

3

GROUP-B

19. Solutions:

6

a) Introduction and types of solutions.

b) Theory of fractional distillation and experimental details.

c) Theory of steam distillation and experimental details.

20. Theory of Dilute Solutions:

4

a) Introduction and colligative properties.

b) Experimental determinations of molecular weight & calculations.

21. Distribution Law:

4

- a) Nernst's law and explanation and modification.
- b) Henry's Law and explanation and its applications.

22. The phase rule:

3

- a) Introduction and derivations.
- b) One component and two component systems and their applications.

23. Chemical Kinetics:

6

- a) Introduction and explanations.
- b) Order of reactions with examples and calculations.

24. The colloidal state:

3

- a) Classification and preparations.
- b) Properties and applications.

Practicals:

1. Acid/base titrations by using pH-meter.
2. Redox titrations by using potentiometer.
3. Use of electric and electronic balance.
4. Determination of concentration of unknown solution by using colorimeter.
5. Acid/base titrations by using conductimeter.
6. Separation of mixture by TLC and column chromatography.
7. Separation of mixture by paper chromatography.
8. Separation of mixture by fractional distillation.
9. Purification of crude sample by steam distillation.
10. Determination of total soluble solid and sugar by refractometer.

11. Determination of Na, K and Ca by flame photometer.
12. Determination of molecular weight by Buckman's method.
13. Determination of order of reaction.
14. Drawing of solubility curve of two immiscible liquids.
15. Preparation of colloidal solutions.
16. Estimation of oil Soxhlet extraction method.

Textbooks:

1. Willand Merit and Dean. *Instrumental methods*.
2. Sylvestein. *Spectroscopy*.
3. Chatwal & Anand. *Instrumental analysis*.
4. R. I. Stock. *Chromatographic method*.
5. Camp. *Spectroscopy*.
6. A.I. Vogel. *Experimental inorganic chemistry*.
7. A.I. Vogel. *Experimental organic chemistry*.