



ADIKAVI NANNAYA UNIVERSITY:: RAJAHMENDRAVARAM
B.Sc Chemistry Syllabus (w.e.f: 2020-21 A.Y)

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 6B	Analytical Methods in Chemistry-1	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of solvent extraction and ion exchange method.
2. Acquire knowledge on the basic principles of volumetric analysis and gravimetric analysis.
3. Demonstrate the usage of common laboratory apparatus used in quantitative analysis.
4. Understand the theories of different types of titrations.
5. Gain knowledge on different types of errors and their minimization methods.

Syllabus:

(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)

Unit-1: Quantitative analysis-1

8 hours

1. A brief introduction to analytical methods in chemistry
2. Principles of volumetric analysis, concentration terms- Molarity, Molality, Normality, v/v, w/v, ppm and ppb, preparing solutions- Standard solution, primary standards and secondary standards.
3. Description and use of common laboratory apparatus- volumetric flask, burette, pipette, beakers, measuring cylinders.

Unit-2: Quantitative analysis-2

12hours

1. Principles of volumetric analysis: Theories of acid-base (including study of acid-base titration curves), redox, complex metric, iodometric and precipitation titrations-choice of indicators for the saturations.
2. Principles of gravimetric analysis: precipitation, coagulation, peptization, co precipitation, post precipitation, digestion, filtration, and washing of precipitate, drying and ignition.

Unit-3: Treatment of analytical data

8hours

Types of errors- Relative and absolute, significant figures and its importance, accuracy - methods of expressing accuracy, errors- Determinate and indeterminate and minimization of errors, precision-methods of expressing precision, standard deviation and confidence interval.

Unit-4: separation techniques

12 hours

1. Solvent Extraction: Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Synergism. Application-Determination of Iron (III).
2. Ion Exchange method: Introduction, action of ion exchange resins, applications.

UNIT-5: Analysis of water

10hours

Determination of dissolved solids, total hardness of water, turbidity, alkalinity, Dissolved oxygen, COD, determination of chloride using Mohr's method.



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References

1. Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M.West and Douglas A.Skoog, Ninth edition, Cengage.
2. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and Kevin A.Schug, Seventh edition, Wiley.
3. Quantitative analysis by R.A.Day Jr. And A.L.Underwood, Sixth edition, Pearson.
4. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
5. Text book of Environmental Chemistry and Pollution Control by S.S.Dara and D.D.Mishra, Revised edition, S Chand & Co Ltd.



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B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6B	Analytical methods in Chemistry-1 Lab	Hrs/Wk:2

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Estimate Iron(II) using standard Potassium dichromate solution
2. Learn the procedure for the estimation of total hardness of water
3. Demonstrate the determination of chloride using Mohr's method
4. Acquire skills in the operation and calibration of pH meter
5. Perform the strong acid vs strong base titration using pH meter

c) Practical (Laboratory)Syllabus:(30hrs)

(Max.50 Marks)

1. Estimation of Iron(II) using standard Potassium dichromate solution (using DPA indicator)
2. Estimation of total hardness of water using EDTA
3. Determination of chloride ion by Mohr's method
4. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.
5. Preparation of buffer solutions of different pH (i) Sodium acetate-acetic acid, (ii) Ammonium chloride-ammonium hydroxide.
6. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.
7. Determination of dissociation constant of a weak acid.

d) Lab References:

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

e) Co-Curricular Activities:

a) Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):

8. **For Teacher:** Training of students by the teacher in laboratory and field for not less than 15 hours on the field techniques/skills of calibration of pH meter, Strong acid vs strong base titration using pH meter, determination of chloride ion, estimation of water quality parameters and estimation of Iron(II).
9. **For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe various methods used for the analysis of water. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
10. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).

b) Suggested Co-Curricular Activities

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.



MODEL QUESTION PAPER (Sem-end. Exam)

B. Sc DEGREE EXAMINATIONS
Semester - III

Course 6B: Analytical methods in Chemistry-1

Time: 3Hrs.

Max.Marks:75

SECTION – A

5 x 5 = 25 M

Answer any **FIVE** questions. Each question carries 5 Marks

1. Define Molarity and normality.
2. Write note on choice of indicators in titrations.
3. Explain Coagulation and peptization.
4. Define relative and absolute errors.
5. Explain the methods of expressing accuracy.
6. Explain the factors affecting Solvent extraction.
7. Write any two applications of solvent extraction.
8. How will you determine total hardness of water.

SECTION – B

5 x 10 = 50 M

Answer **ALL** the questions. Each question carries 10 M

9. a) What is Primary and Secondary standards. How will you prepare standard solution. Give an example.

(OR)

- b) Explain Common laboratory apparatus used in quantitative analysis. Define Molality, ppm and ppb.

10. a) Explain redox, complexometric and iodometric titrations.

(OR)

- b) What is Gravimetric analysis. Write principle & Explain the terms involved in it.

11. a) What are Significant figures. Explain its calculation and importance.

(OR)

- b) What are determinate and indeterminate errors. Write the techniques for minimization of errors.

12. a) Explain Batch extraction, continuous extraction and counter current extraction.

(OR)

- b) Write an essay on Ion exchange method and its applications.

13. a) How will you determine chloride using Mohr's method.

(OR)

- b) Explain the determination of dissolved salts, Dissolved oxygen and COD.



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B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 7B	Analytical Methods in Chemistry-2	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of chromatography in the separation and identification of compounds in a mixture
2. Acquire a critical knowledge on various chromatographic techniques.
3. Demonstrate skills related to analysis of water using different techniques.
4. Understand the principles of spectro chemistry in the determination of metal ions.
5. Comprehend the applications of atomic spectroscopy.

Syllabus : (Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)

Unit-1: Chromatography-Introduction and classification **10 hours**

Principle, Classification of chromatographic methods, Nature of adsorbents, eluents, R_f values, factors affecting R_f values.

Unit-2: TLC and paper chromatography **12 hours**

1. Thin layer chromatography: Principle, Experimental procedure, preparation of plates, adsorbents and solvents, development of chromatogram, detection of spots, applications and advantages.
2. Paper Chromatography: Principle, Experimental procedure, choice of paper and solvents, various modes of development- ascending, descending, radial and two dimensional, applications.

Unit -3: Column chromatography **12 hours**

1. Column chromatography: Principle, classification, Experimental procedure, stationary and mobile phases, development of the Chromatogram, applications.
2. HPLC: Basic principles, instrumentation –block diagram and applications.

Unit -4: Spectrophotometry **8hours**

Principle, Instrumentation: Single beam and double beam spectrometer, Beer-Lambert's law- Derivation and deviations from Beer-Lambert's law, applications of Beer-Lambert's law-Quantitative determination of Fe^{+2} , Mn^{+2} and Pb^{+2} .

Unit -5: Atomic spectroscopy **8hours**

Types, atomizer, atomic absorption and emission and applications.

References

1. Fundamental so Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M.West and Douglas A.Skoog, Ninth edition, Cengage.
2. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and Kevin A.Schug, Seventh edition, Wiley.
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B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7B	Analytical Methods in Chemistry-2 Lab	Hrs/Wk:2

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Perform the separation of a given dye mixture using TLC
2. Learn the preparation of TLC plates
3. Demonstrate the separation of mixture of amino acids using paper chromatography
4. Acquire skills in using column chromatography for the separation of dye mixture

Practical (Laboratory) Syllabus: (30hrs)

(Max.50Marks)

1. Separation of a given dye mixture (methyl orange and methylene blue) using TLC (using alumina as adsorbent).
2. Separation of mixture of methyl orange and methylene blue by column chromatography.
3. Separation of given mixture of amino acids (glycine and phenyl alanine) using ascending paper chromatography.
4. Separation of food dyes using Column Chromatography
5. Separation of triglycerides using TLC
6. Verification of Beer lambert's law. (Using potassium permanganate solution) using colorimeter /spectrophotometer.

Lab References:

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
2. Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.
3. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley- Eastern.
4. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, University press.
5. Mann F.G and Saunders B.C, Practical Organic Chemistry, Pearson Education.

Co-Curricular Activities:

a) Mandatory:(*Lab/field training of students by teacher (lab:10+field:05):*)

1. **For Teacher:** Training of students by the teacher in laboratory and field for not less than 15 hours on the field techniques/skills of determination of hardness of water, using the calorimeter and or Spectrophotometer, preparation of TLC plate, identification of spots in TLC and Paper chromatographic techniques, loading of column, selection of solvent system, separation of amino acids and dyes mixture using chromatographic techniques.
2. **For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the chromatographic techniques used for the separation of compounds. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).



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b) Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.



MODEL QUESTION PAPER (Sem-end. Exam)

B. Sc DEGREE EXAMINATIONS
Semester - III

Course 7B: Analytical Methods in Chemistry-2

Time: 3Hrs.

Max.Marks:75

SECTION – A

5 x 5 = 25 M

Answer any **FIVE** questions. Each question carries 5 Marks

1. What is Chromatography. Define Rf. Write its formula.
2. Explain development of chromatogram in TLC.
3. Explain experimental procedure of Paper Chromatography.
4. Write the Basic principle involved in HPLC.
5. Write the applications of column chromatography.
6. Define Beer – Lambert's law. Write applications of it.
7. Write the derivation and deviations of Beer Lambert's law.
8. What are the types of atomic spectroscopy.

SECTION – B

5 x 10 = 50 M

Answer **ALL** the questions. Each question carries 10 M

9. a) Write note on nature of adsorbents, eluents used in chromatography. Explain factors affecting Rf values.

(OR)

b) Write the principle involved in Chromatography. Write general applications of chromatography.

10. a) Explain various modes of development of Paper chromatogram- ascending, descending, radial and two dimensional chromatography.

(OR)

b) Explain the principle and experimental procedure of TLC.

11. a) Write the Principle, classification and experimental procedure of column chromatography.

(OR)

b) Draw the block diagram of instrument of HPLC. Explain the parts in it. Write its applications.

12. a) Explain the instrumentation of single and double beam spectrometers.

(OR)

b) Explain the quantitative determination of Fe^{2+} and Mn^{2+}

13. a) Write the principle and instrumentation of atomic emission spectroscopy.

(OR)

b) Write about different burners, fuel and oxidants in atomic absorption spectroscopy. Write its applications.