V- SEMESTER

Course Code 12 A: ANALYTICAL METHODS IN CHEMISTRY-

QUANTITATIVE ANALYSIS

Credits: 03

ANALYTICAL METHODS IN CHEMISTRY- QUANTITATIVE ANALYSIS

SKILL ENHANCEMENT COURSE (ELECTIVE)

I. 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 the minimization methods.

II. Syllabus:

Unit-1: Quantitative analysis-1 (9 hours)

A brief introduction to analytical methods in chemistry. 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.. Description and use of common laboratory apparatus- volumetric flask, burette, pipette, beakers, measuring cylinders.

Unit-2: Quantitative analysis-2 (9 hours)

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. Principles of gravimetric analysis: precipitation, coagulation, peptization, coprecipitation, post precipitation, digestion, filtration, and washing of precipitate, drying and ignition.

Unit-3: Treatment of analytical data (9 hours)

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 (9hours)

Solvent Extraction: Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, Continuous extraction and counter current extraction. Synergism.

Application-Determination of Iron(III). Ion Exchange method: Introduction, action of ion exchange resins, applications.

UNIT-5: Analysis of water (9 hours)

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

III. Suggested Co-Curricular Activities:

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

IV. List of Reference Books:

1) Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, DonaldM.West and Douglas A. Skoog, Ninth edition, Cengage.
2) Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and KevinA. Schug, Seventh edition, Wiley.
3) Quantitative analysis by R.A.DayJr.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.

V- SEMESTER

Course Code 12 A: Analytical Methods in Chemistry – Quantitative analysis:

Credits: 01

Analytical Methods in Chemistry – Quantitative analysis:

V. 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

VI. Laboratory course Syllabus:

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.

VII. Co-Curricular Activities:

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 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).

2) **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 exceeding10pages in the given format to the teacher.

3) Max marks for Field work / projectwork 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).

VIII. List of Reference books:

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