Swami Ramanand Teerth Marathwada University,
Nanded

Faculty of Science
B.Sc. I (First) Year (Semester I & II)

Analytical Chemistry

Course Structure, Semester-I & II (w.e.f.2013-14)
Swami Ramanand Teerth Marathwada University, Nanded  
Faculty of Science  
B.Sc. I, II & III Year (Semester I To VI)  
Analytical Chemistry  
Course Structure (w.e.f.2013-14)  
(Skeleton)

### B.Sc. I (First) Year (Semester I) (w.e.f.2013-14)

<table>
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Theory Papers 50 Marks: (External 40 + Internal 10)
Swami Ramanand Teerth Marathwada University, Nanded
Faculty of Science
B.Sc. I (First) Year (Semester I )
Analytical Chemistry
Course Structure, Semester-I (w.e.f.2013-14)

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Swami Ramanand Teerth Marathwada University, Nanded
Faculty of Science
B.Sc. I (First) Year (Semester II )
Analytical Chemistry
Course Structure, Semester-II (w.e.f.2013-14)

<table>
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Theory Papers 50 Marks: (External 40 + Internal 10)
UNIT-I
Scope and Importance of Analytical Chemistry: 10 Periods

Introduction to analytical chemistry, Role of analytical chemistry in sciences. Chemical analysis: Qualitative analysis, Quantitative analysis; major, minor and trace constituents. Quantitative methods of analysis- classification of analytical methods according to property, parameter measured, size of the sample with explanation. Steps in typical quantitative analysis. Types of analysis –complete analysis, partial analysis and assay of ingredients, the analytical chemist and analyst.

Unit-II
Preliminary Operations in Quantitative Analysis: 12 Periods

Introduction, sampling: definitions, purpose of sampling, theory of sampling, types of sampling, sampling of solids, liquids and gases. Preparation of laboratory samples: crushing and grinding of laboratory samples; moisture in samples and drying, determination of water in sample, decomposition and dissolution of samples, some general considerations. Acid treatment, decomposition by flux treatment, decomposition of organic matter (Organic compounds) for elemental analysis and preparation of solution of sample.

Unit-III
Mole Concept and Concentration Units: 13 Periods

Mole Concept, molecular weight, formula weight, and equivalent weight. Concentration units: Molarity, Formality, Normality, Molality, Mole fraction, Percent by weight, Percent by volume, Parts per thousand, Parts per million, Parts per billion, pX, pH, pOH, pM, milliequivalents, Milli moles and titer. Numericals.
Unit-IV

Aspects of Co-ordination Compounds in Chemical Analysis: 10 Periods

Unit – I
Measurement of Mass :
14 Periods

Unit-II
Measurement of Volume :
7 Periods
Units of volume, effect of temperature on volume measurement. Apparatus for precise measurement of volume; pipette, burette and volumetric flask & their calibration.

Unit – III
Principles of Volumetric Analysis – I : 12 Periods
Definition of terms: Titrant, titrand, analyte, end point and equivalence point, indicator, standard titrant, titration. Acid-base titration: Theory of acid base indicators, Theory of acid-base titration, titration of strong acid-strong base, weak acid-weak base, strong acid-weak base with titration curve and choice of indictors.
Unit-IV  
Principles of Volumetric Analysis-II : 12 Periods

**Redox Titration:** Theoretical basis of volumetric analysis involving (i) Potassium Permanganate (ii) Potassium dichromate and (iii) Iodine.

**Precipitation titration:** Titration curve for precipitation reaction, end point detection, Mohr’s method and Volhard’s method.

**Complexometric Titration:** Theory of complexometric titration, indicators for EDTA titration, Types of EDTA titration-direct and back titration.
Swami Ramanand Teerth Marathwada University, Nanded  
Faculty of Science  
B.Sc. I (First) Year; Semester - II (w.e.f.2013-14)  
Analytical Chemistry; Paper - III  
General Concepts of Analytical Chemistry-II  
Paper Code – CHAC-103  

Periods: 45 per semester; 03 per week  
Marks-50  

Unit – I  
Errors in Chemical Analysis : 10 Periods  
Replicate analysis, reliability of analytical data, mean and median & range precision and accuracy, methods of expressing precision and accuracy: deviation, mean deviation, relative mean deviation, and standard deviation. Errors, absolute error, relative error. Determinate errors, classification of determinate errors and their minimization, indeterminate error and normal frequency distribution curve.  

Unit-II  
Statistical Treatment of Analytical Data: 13 Periods  
Statistical treatment of analytical data, confidence limits, students T-test, rejection of data: Q test, 4d rule and 2.5d rule. Graphical representation of results, methods of averages, methods of least squares. Significant figures, Reporting of analytical data, Numericals.  

Unit-III  
Introduction to Chromatographic Techniques: 10 Periods  
Introduction, general principle of chromatography, classification of chromatographic techniques. Principle, technique and applications of paper and thin layer chromatographic techniques.  

Unit-IV  
Purification Methods used in Organic Chemistry: 12 Periods  
Theory of distillation, fractional distillation & Crystallisation
Swami Ramanand Teerth Marathwada University, Nanded
Faculty of Science
B.Sc. I (First) Year; Semester - II (w.e.f.2013-14)
Analytical Chemistry; Paper - IV
Basic Analytical Chemistry-II
Paper Code – CHAC-104

Periods: 45 per semester; 03 per week
Marks-50

Unit – I
Gravimetric Methods of Analysis-I : 12 Periods
Introduction to gravimetric analysis, general principle, entire gravimetric procedure and gravimetric steps. Gravimetric Conversion Factor (GCF) - illustrations with reference to sulfate, chloride, ferric, calcium and phosphate as analyte ions.
Precipitation: Saturation, super saturation, nucleation and crystal growth. Properties of precipitates-partical size, colloidal state; types of precipitates-crystalline, curdy and gelatinous precipitates.

Unit-II
Gravimetric Methods of Analysis-II : 12 Periods

Unit – III
Types of Precipitants and Their Applications : 11 Periods

Unit-IV
Solvents and Reagents: 10 Periods
Solvents: Solute, Solvent & Solution, classification of solvents (i) Protic and aprotic (ii) Acidic, basic amphiprotic and neutral (iii) Aqueous and non-aqueous (iv) Polar and non-polar. Each type to be explained with at least one example.
Reagents: Classification of reagents according to their action; (i) acids (ii) bases (iii) salts (iv) complexing agents (v) oxidizing and reducing agents (vi) precipitating agents (vii) chelating agents. Each type to be explained with at least one suitable example. Primary and secondary standards: Definition, characteristics, uses, examples for different types of reactions.
Swami Ramanand Teerth Marathwada University, Nanded
Faculty of Science
B.Sc. I (First) Year; Semester – I & II (w.e.f.2013-14)
Analytical Chemistry; Paper – V
Laboratory Course-I
Paper Code – CHAC-105

Periods: 120 per year; 04 per week
Marks-100

Note: Out of 23 experiments 16 experiments should be completed.
3. Preparation of standard solution of $\text{K}_2\text{Cr}_2\text{O}_7$ and standardization of given $\text{FeSO}_4$ solution.
4. Preparation of standard solution of $(\text{COONa})_2$ and standardization of given $\text{KMnO}_4$ solution.
5. Preparation of $\text{Na}_2\text{S}_2\text{O}_3$ solution and its standardization using standard $\text{K}_2\text{Cr}_2\text{O}_7$ / $\text{KIO}_3$ solution.
6. Preparation of standard solution of $\text{NaCl}$ and standardization of given $\text{AgNO}_3$ solution.
7. Separation of metal ions ($\text{Cu}^{2+}$, $\text{Pb}^{2+}$ and $\text{Cd}^{2+}$) / ($\text{Zn}^{2+}$, $\text{Co}^{2+}$ & $\text{Ni}^{2+}$) by paper chromatography.
8. Assay of commercial sodium hydroxide/ barium hydroxide.
9. Assay of $\text{H}_2\text{O}_2$ solution.
10. Assay of formaldehyde.
11. Determination of alkalinity of water sample.
12. Determination of free chloride in a sample of water.
13. Determination of acetic acid content in a commercial sample of vinegar.
15. Estimation of $\text{HCl}$ and $\text{CH}_3\text{COOH}$ in mixture using acid base indicators.
16. Estimation of iodine in the given solution using standard $\text{Na}_2\text{S}_2\text{O}_3$ solution.
17. Preparation of EDTA solution and its standardization using standard $\text{Zn}^{2+}$ solution.
18. Estimation of $\text{Al}^{3+}$ in the given solution using standard EDTA solution (Back Titration).
19. Estimation of calcium in the given sample of Lime stone or Dolomite or Calcite using standard EDTA solution.
20. Estimation of ester by hydrolysis.
22. Determination of Calcium in Calcium Gluconate.
23. Determination of iron as iron (III) oxide by Gravimetry.
Reference Books:
3. College analytical chemistry: Joshi, Baliga and Shetty, Himalaya Publishing house.
4. Qualitative analysis: Day and Underwood.
5. Qualitative inorganic analysis: A. I. Vogel.
10. Advanced pratical organic chemistry: Vishnoi.
20. Introduction to chromatography: Srivastava and Srivastava.
22. Practical Chemistry (for B.Sc.I, II & III Year Students of All Indian Universities) Dr.O.P. Panday, D.N. Bajpai & Dr. S. Giri, S.Chand & Company, New Delhi.