11.1. Discipline Specific Courses (DSC)

SEMESTER 1

11.1.1. Course Code: DSC1: ANALYTICAL CHEMISTRY1 (AC1)
Course Title: Basic Principles and Laboratory Operations
Total Credits: 04 (Credits: Theory-02, Practical-02)
(Total Lectures: Theory- 30, Practical-60)

Objectives: The objective of this course is to make students aware about the SI Units, concentration terms, various analytical methods, and safe usage of chemicals and its waste.

Learning Outcomes:

By the end of the course, the students will be able to:

- Understand about SI units
- Learn use of analytical equipments

- Know types of errors in chemical analysis
- Handle statistical tests of data
- Know safety with chemicals and waste.

Unit 1: Basic Concepts

A. SI Units
- Definitions of the Seven Base Units
- Derived units
- Conversion between units
- Significant figures

B. Chemical concentrations
- Mole, molar mass (calculations in grams and moles)
- Solutions and their concentrations
- Molar concentration
- Analytical molarity
- Equilibrium molarity of a particular species
- Percent concentration
- Parts per million/billion (ppm, ppb)
- Volume ratios for dilution procedures
- p-functions.

(Lectures: 5)

Unit 2: Introduction to Analytical Chemistry and Analytical Methods

General steps in chemical analysis
Introduction to methods of detecting analytes
a) Physical
b) Electromagnetic radiations
c) Electric charge.

(Lectures: 5)

Unit 3: Errors in Chemical Analysis

- Types of errors
- Accuracy and Precision, Absolute and relative uncertainty, propagation of uncertainty
- The Gaussian distribution
- Mean and standard deviation
- Confidence intervals
- Statistical tests of data (F test, t test, Q test for bad data)
- Method of least squares
- Calibration curve
- Safety with chemicals and waste

(Lectures: 20)

PRACTICALS (Credits: 02, Laboratory Periods-60)

1. Description, Use and Calibration of Common Laboratory Apparatus I: Glassware: Volumetric flasks, Burettes, Pipettes, Weighing bottles, Drying ovens.
2. Description, Use and Calibration of Common Laboratory Apparatus II: Different types of Funnels, Chromatographic columns, Chromatographic jars, Desiccators, Filter crucibles, Rubber policeman.
3. Preparing Solutions: Standard solutions (acids and bases), primary standards and secondary standards, and to find out their concentration by any suitable methods.
4. Determination of strength of given strong acid using strong base volumetrically
5. Estimation of sodium carbonate by titrating with hydrochloric acid.
6. Use and maintenance of pH meter. Determination of pH of given dilute solutions of shampoos, soaps, fruit juices and different soft drinks.
7. Determination of cell constant of a conductometric cell using standard KCl solutions.
8. To check the conductivity of various water samples (*Collect at least four samples*).

REFERENCES:

- Higson, S. P.J. (2003), Analytical Chemistry, Oxford University Press.
- Skoog, D.A.; West, D.M. (2003), Fundamentals of Analytical Chemistry, Brooks/Cole.
- Christian, G.D.(2004), Analytical Chemistry, 6th Edition, John Wiley & Sons, New York.
- Fifield, F.W.; Kealey, D. (2000), Principles and Practice of Analytical Chemistry, Wiley.
- Harris, D. C. (2007), Exploring Chemical Analysis, W.H. Freeman and Co.

Additional References

- Day. R. A.; Underwood, A. L. (1991), Quantitative Analysis, Prentice Hall of India.
- Gordus, A. A. (1985), Schaum's Outline of Analytical Chemistry, Tala McGraw-Hill.
- Dean J. A. (1997), Analytical Chemistry Handbook, McGraw Hill.
- Jeffery, G.H.; Bassett, J.; Mendham, J.; Denney, R.C. (1989), Vogel's Textbook of Quantitative Chemical Analysis, John Wiley and Sons.

Teaching Learning Process:

- Conventional chalk and board teaching
- Visit chemical industries/ Drug industries to get information about the various instruments used in industries
- ICT enabled classes
- Power point presentations
- Interactive sessions
- To get recent information through the internet.

Assessment Methods:

- Class Tests at Periodic Intervals.
- Written assignment (s) / Presentation by individual students
- End semester University Theory and Practical Examination

Keywords: SI Units, Concentrations terms, Analytical methods, Laboratory operations, Electromagnetic radiation, Statistical methods, Errors.