1.4   APPLIED CHEMISTRY-I

L T P
3 - 2

RATIONALE

Every branch of engineering is expanding greatly. The contributions of chemicals and chemical products are playing important role in the field of engineering, biotechnology, agriculture and pharmacology etc. The numbers of such chemical products are exponentially increasing each successive year. This results in enhancing the responsibility of engineers while choosing engineering materials for converting them into finished products. Now a days, choosing engineering material is not only based on conventional qualitative and quantitative testing of their chemical composition and behavior under service conditions, but also based on environmental and eco-friendly factors. To achieve such objectives it is essential to know applied aspects of chemistry. Applied chemistry for diploma students in various engineering and technology courses is designed to develop scientific temper and appreciation of physical and chemical properties of engineering materials, which are used in their professional career. Best efforts should be made to teach and train the engineers by imparting essential knowledge required from this subject through demonstrations, and minor projects.

Note:- Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles.

DETAILED CONTENTS

1. Basic Concepts of Chemistry   (06 hrs)

    1.1 S.I. Units of pressure, volume, density, specific gravity, surface tension, viscosity and conductivity.
    1.2 Matter, element, compound and mixtures, atoms, molecules, ions, symbols and formulae, Atomic mass (A), atomic number (Z) isotopes, isobars, isotone (recapitulation only)
    1.3 Chemical equations, thermo-chemical equations, balancing of chemical equations

2. Atomic Structure, Periodic Table and Chemical Bonding   (10 hrs)

    2.1 Fundamental particles- electrons, protons and neutrons
    2.2 Orbit & orbital, electronic configuration of elements (upto Z=30)
    2.3 Modern periodic law and periodic table, groups and periods.
    2.4 Chemical bond and cause of bonding- Ionic bond, covalent bond, and its types

3. Water   (10 hrs)

    3.1   Sources of water
    3.2   Types of water based on dissolved salts.
          3.2.1   Hard water, soft water
          3.2.2   Units to measure water hardness in ppm (mg/l) & simple numericals, degree Clark & degree French
    3.3   Disadvantages of use of hard water in domestic and industrial applications (mainly boiler feed water)
    3.4   Methods to remove water hardness by
          3.4.1   Ion exchange process
          3.4.2   Lime-soda process
          3.4.3   Reverse Osmosis method
    3.5   Quality criteria of drinking water as per BIS. (with special emphasis on hardness, total dissolved solids (TDS), Chloride, alkalinity present in water)

4. Solutions   (08 hrs)

    4.1   Concept of homogenous solution, brief introduction of the terms (i) Ionization (ii) Acidity (iii) Basicity (iv) equivalent weight and gram equivalent weight with suitable examples
    4.2   Strength of a solution (i) Normality (ii) Molarity (iii) Molality as applied in relation to a solution.
    4.3   Definition of pH, simple numericals and different industrial applications of pH.
    4.4   Buffer solution and applications of buffer.

5. Electrolysis   (08 hrs)

    5.1   Definition of the terms: Electrolytes, Non-electrolytes with suitable examples
    5.2   Faraday's Laws of Electrolysis and simple numericals
    5.3   Different industrial applications of 'Electrolysis'
    5.4   Applications of redox-reactions in battery technology such as (i) Dry cell (ii) lead acid battery and (iii) Ni-Cd battery

6. Environmental Chemistry   (06 hrs)

    6.1   Brief introduction to Environmental Chemistry & Pollution
    6.2   Causes and effects of air, water & soil pollutions
    6.3   Role of chemistry in controlling air, water & soil pollutions

LIST OF PRACTICALS

1. Volumetric analysis and study of apparatus used therein. Simple problems on volumetric analysis equation

2. Preparation of standard solution of oxalic acid or potassium dichromate

3. Determine the strength of solution of HCl with the help of a solution of NaOH and an intermediate solution of standard oxalic acid

4. Find the amount of chlorides in mg per liter in a sample of H_2O with the help of a solution of $AgNO_3$

5. Determine the degree of temporary hardness of water by EDTA titration

6. Estimation of total dissolved solids (TDS) in water sample gravimetrically

7. Estimation of total alkalinity of water volumetrically

8. Determine conductance, pH of water sample using conductance bridge and pH meter

9. Determine the percentage purity of commercial sample like blue vitriol, 12.5 g. of which have been dissolved per litre. Given $M/20$ $Na_2S_2O_3$.

10. Determination of solubility of a solid at room temperature

11. To verify the first law of electrolysis (electrolysis of copper sulphate solution using copper electrode)

INSTRUCTIONAL STATREGY

Teacher may take help of various models and charts while imparting instructions to make the concepts clear. More emphasis may be laid on discussing and explaining practical applications of various chemical processes and reactions. In addition, students should be encouraged/motivated to study those processes in more details, which may find practical applications in their future professional life.

RECOMMENDED BOOKS

1. Chemistry in Engineering by J.C. Kuriacose and J. Rajaram; Tata McGraw-Hill Publishing Company Limited, New Delhi

2. Engineering Chemistry by Dr. S. Rabindra and Prof. B.K. Mishra ; Kumar and Kumar Publishers (P) Ltd. Bangalore-40

3. A Text Book of Applied Chemistry-I by SS Kumar; Tata McGraw Hill, Delhi

4. Progressive Applied Chemistry –I and II by Dr. G.H. Hugar; Eagle Prakashan, Jalandhar

5. Engineering Chemistry by Jain PC and Jain M, Dhanpat Rai Publishers, Delhi

6. Chemistry of Engineering by Aggarwal CV

7. Chemistry for Environmental Engineers by Swayer and McCarty, McGraw Hill, Delhi

8. A Text Book of Applied Chemistry-I by Sharma and Others; Technical Bureau of India, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	14
2	10	20
3	10	20
4	08	16
5	08	16
6	06	14
Total	**48**	**100**