ENGINEERING CHEMISTRY
Course Code: SH 103

Lecturer: 3
Tutorial: 1
Practical: 2

Year: I
Semester: I
Course Credit: 3

Course Description

This course provides an overview of chemistry in Bachelor of Engineering. The students will be able to strengthen their knowledge on general chemistry, corrosion, electrochemistry, water analysis and treatments and polymers.

Objectives of the Course

- To strengthen the fundamental concept of chemistry.
- To introduce the application of chemistry in engineering field.
- To familiarize the students with chemistry and its usage in daily life of household and industry.

Unit-1 Ionic Equilibrium (5Hrs)

1.1 Ostwald's Dilution Law
1.2 pH and pH-scale
1.3 Buffer solution: Acidic Buffer, Basic Buffer and their mechanism
1.4 Derivation of Henderson's equation for pH calculation of buffer solution
1.5 Related Numerical Problems

Unit-2 Electrochemistry (6Hrs)

2.1 Electrolytic and Galvanic Cell
2.2 Standard Hydrogen Electrode
2.3 Nernst's equation
2.4 Determination of pH using glass electrode
2.5 Corrosion of metal, electrochemical series and Prevention of rusting
2.6 Related Numerical Problems

Unit-3 Catalysis (4Hrs)

3.1 Catalysis, Positive, Negative, Auto and Induced Catalysis
3.2 Types of Catalysis: Homogeneous and Heterogeneous catalysis

3.3 Characteristics of a catalyst
3.4 Action of catalyst (Catalytic promoter and catalytic poisoning)
3.5 Criteria for Choosing a Catalyst for Industrial Applications
3.6 Theories of Catalysis: Intermediate Compound Formation Theory and Adsorption Theory

Unit-4 Transition Metals (3d Series-4Hrs)

4.1 Periodic Properties of Transition Metals
4.2 Characteristics and properties of Transition metals
4.3 Variable Oxidation States
4.4 Complex formation and Magnetic properties.
4.5 Colour formation
4.6 Alloy Formation
4.7 Applications of 3-d transition elements

Unit-5 Coordination Complexes (4Hrs)

5.1 Introduction of Co-ordination complexes and Double salts
5.2 Differences between Co-ordination complexes and Double salts
5.3 Werner's co-ordination theory
5.4 Sidgwick model
5.5 Nomenclature of co-ordination complex(Neutral type, simple cation and complex anion and complex cation and simple anion type, complex anion and complex cation type)
5.6 Valence bond the theory (VBT)
5.7 Structure and magnetic properties of tetrahedral complexes, square planar complexes and octahedral complexes (inner and outer complex, high spin and low spin complexes)

Unit-6 Organic Reactions (4Hrs)

6.1 Substitution Reactions (SN1 and SN2 Reactions)
6.2 Elimination Reactions (E1 and E2 Reactions)
6.3 Addition Reactions
6.4 Re-arrangement Reactions with examples

Unit-7 Engineering Polymers (5Hrs)

7.1 Polymers and their type
7.2 General Properties of Inorganic Polymers
7.3 Preparation and applications of Chalcogenide glasses, Silicones and Polyphosphazines
7.4 Synthetic Polymer :, Polystyrene, Nylon6.6, PTFE , Bakelite, Fiber reinforced Plastics (FRP)- Preparation and their uses
7.5Introductions to Conducting Polymers and Bio-degradable Polymers
7.6 Natural Rubber and Synthetic rubber, neoprene, buna rubber and vulcanization of rubber

Unit-8 Explosives, Paints and Lubricants (4Hrs)

8.1 Introduction to explosives,
8.2Their characteristics and types (Low explosives and High explosives)

8.3 Preparation, properties and action of TNT, TNG, RDX, PETN and Nitrocellulose, Nitroglycerin.
8.4 Paints their Types, properties and applications
8.5 Lubricants, their Types, properties and applications

Uni- 9 Environmental Chemistry (4Hrs)

9.1 Air Pollution
9.2 Air Pollutants (Particulates and Gaseous) and their sources (SPM,Fly Ashes,dust,SO_x, NO_x, CO, CO_2 and O_3)
9.3 Impacts of air pollutants and their control measure
9.4 Acid Rain, Global Warming(Green House Effect) Ozone depletion & its photochemistry
9.4 Water Pollution and Types of Water Pollutants
9.5 Sources of water pollution, their impacts and possible remedies for their control.
9.6 Soil Pollution and soil pollutants. Sources of soil pollution, their impacts and solutions for their control measures.

Unit-10 Water Analysis and Treatment (4Hrs)

10.1 Introduction, Sources of Water, Soft water, Hard water
10.2 Physical and Chemical Analysis of water: Colour, Odour, TDS,pH, Alkalinity, Total Hardness, Free Residual Chlorine, Iron, Ammonia, Lead, Arsenic, Dissolved Oxygen, COD, BOD.
10.3 Water Treatment for Municipal Supply
10.4 Waste Water Treatment and Disposal

References

1. Engineering Chemistry by Jain and Jain
2. A Text Book of Engineering Chemistry by SS Dara and SS Umare
3. A New Concise Inorganic Chemistry by J.D. Lee
4. A Text Book of Engineering Chemistry by BP Panthi and RK Sharma
5. Organic chemistry by Morrison and Boyd
6. Selected Topics in Physical Chemistry by Moti Kaji Sthapit
7. Environmental Chemistry by AK De
8. Engineering Chemistry by Arjun Paudel & Arun Pd. Chaudhary
9. Engineering Chemistry by PR Vijaysarathi
10. A Core Experimental Chemistry by PN Yadav, NM Khadka, SD Gautam

Laboratory Works (2 Periods/week)

Students are supposed to perform at least five practical out of provided syllabus.

1. To determine the alkanity of the given sample of water (sample A and B)
2. To determine the total hardness of water sample.
3. To determine the amount of Free Residual Chlorine in the given sample of water.
5. To determine the Iron from Mohr's salt.
6. To determine percentage of Alumina (Al_2O_3) in Aluminum Sulphate(Alum).
7. To Prepare distemper paint and test its properties.
8 .To Estimate the amount of COD in the given sample of water.
9. To Prepare Bakelite/nylon 6,6
10. To Prepare and determine the pH of unknown buffer by using standard buffer solution.

Evaluation Scheme

Credit Hours	**Teaching Schedule Hours/Week**			**Evaluation Scheme**				
				Internal Evaluation		**Final Evaluation**		**Total**
	Lecture	Tutorial	Practical	Theory	Practical	Theory	Practical	125
Cr	4	1	2	40	10	60	15	

There will be questions covering all the chapters in the syllabus. The evaluation scheme for the question is indicated in the table below.

Chapter	**Lecturer Hours/Week**	**No. of Questions**	**Total Marks**
1	5	1	5
2	6	2*	10
3	4	1	5
4	4	1*	5
5	5	2	10
6	4	1	5
7	5	1	5
8	4	1*	5
9	4	1	5
10	4	1	5
Total	**45**	**12**	**60**

Note: All questions should be attempt. However, one alternate question will be asked from chapter two, four and eight as shown by asterisk in the above table.

*Slight variation may in Questions number in above table.