

**COURSE TITLE** : **ENGINEERING CHEMISTRY - II**  
**COURSE CODE** : **2004**  
**COURSE CATEGORY** : **F**  
**PERIODS PER WEEK** : **3**  
**PERIODS /SEMESTER** : **45**  
**CREDITS** : **3**

**TIME SCHEDULE**

<b>Module</b>	<b>Topic</b>	<b>Periods</b>
1	Atomic Structure II and Chemical bonding	11
2	Electrochemistry and Corrosion	12
3	Basic Organic Chemistry and Polymers	9
4	Fuels and Environmental Chemistry	9
Theory		41
Test		4
<b>Total</b>		<b>45</b>

**COURSE OUTCOME**

**Student will be able to**

- Enable the students to understand the latest concepts of atom model.
- Develop the basic theoretical concepts of orbitals and facts related to it. Develop the skill of writing electronics configuration of atoms.
- Introduce the concept of Chemical bonding and distinguish different types of chemical bond.
- Distinguish and justify different materials based on conductivity in Science and Technology
- Illustrate the mechanism of electrolysis with examples and to solve the problems related to electrolysis. Apply the concept of fuel cell in modern technology.
- Summarise the concept of corrosion and its after effects, solve the practical Problems related to it.
- Distinguish different types of refractories and glasses and apply this in industrial field.
- Compare, differentiate, explain, relate and extend the concept of polymers and polymerisation with examples.
- Understand, list and differentiate the concept of fuels, Identify and relate the impact of environmental pollution in daily life and to point out the remedial steps for it.

## **SPECIFIC OUTCOME**

### **MODULE - I:**

#### **1.1.0 ATOMIC STRUCTURE – II AND CHEMICAL BONDING**

- 1.1.1 Explain Bohr model of atom with merits and demerits
- 1.1.2 Explain dual nature of atom, deBroglie relation and Uncertainty Principle
- 1.1.3 Introduce the concept of orbit, orbital and quantum numbers with shapes of s and p – orbitals
- 1.1.4 Explain Aufbau principle, Pauli's exclusion principle and Hund's rule of maximum multiplicity
- 1.1.5 Illustrate Electronic configuration of atoms of elements up to atomic number 20
- 1.1.6 Understand the idea of chemical bonding using octet rule
- 1.1.7 Explain different types of chemical bonds – Ionic bond, Covalent bond, Coordinate bond and Hydrogen bonding with examples.

### **MODULE - II**

#### **2.1.0 : ELECTROCHEMISTRY AND CORROSION**

- 2.1.1. Distinguish between
  - a) Conductors and Insulators
  - b) Metallic and electrolytic Conductors
  - c) Strong and Weak Electrolytes
- 2.1.2 Illustrate electrolysis taking molten NaCl and aqueous NaCl solution as examples
- 2.1.3 Explain qualitative and quantitative statement of Faradays laws of electrolysis.
- 2.1.4 Explain the applications of electrolysis (electroplating and anodizing)
- 2.1.5 Outline schematic representation of galvanic cell
- 2.1.6 Explain the classification of galvanic cell as primary, secondary and fuel cells
- 2.1.7 Illustrate primary cell with Daniel Cell as example
- 2.1.8 Explain the concept of fuel cell taking H<sub>2</sub>-O<sub>2</sub> fuel cell with advantages and applications
- 2.1.9 Introduce the concept of electrode potential and EMF of cell
- 2.1.10 Explain Electrochemical Series with applications
- 2.1.11 Define Corrosion
- 2.1.12 Explain rusting of Iron and mention the conditions of rusting
- 2.1.13 Explain electrochemical theory of corrosion
- 2.1.14 Describe the methods of prevention of corrosion ( Barrier Protection, Sacrificial Protection, Cathodic Protection and Antirust Solutions.)

## **MODULE - III :**

### **3.1.0 CHEMISTRY OF MATERIALS AND POLYMERS**

- 3.1.1 Understand the fundamental ideas of Organic Chemistry
- 3.1.2 List the differences between Organic and Inorganic Compounds
- 3.1.3 Describe Uniqueness of Carbon atom
- 3.1.4 Distinguish between Saturated and Unsaturated Compounds and introduce Concept of functional group
- 3.1.5 Understand the reactivities with the classification and properties
- 3.1.6 Explain general properties and types of glasses – soda glass, Borosilicate glass, safety glass and Insulating glass with their Contents and Uses
- 3.1.7 List the uses and advantages of optical fibres
- 3.1.8 Understand the term polymers, and polymerization
- 3.1.9 Explain the Various Classification of polymers
- 3.1.10 Distinguish between Natural and Synthetic rubber
- 3.1.11 Explain Vulcanisation and its merits
- 3.1.12 Introduce Common polymers- Poly ethene, polypropene, polystyrene, PVC, Neoprene, Teflon, Buna-s, Buna-N, Nylon-6 ,Nylon-66 and Bakelite with their monomers and uses.

## **MODULE- IV**

### **4.1.0: FUELS AND ENVIRONMENTAL CHEMISTRY**

- 4.1.1 Understand the term fuel
- 4.1.2 Define Caloric Value
- 4.1.3 List the qualities of a good fuel
- 4.1.4 Explain the Classification into solid, liquid, gaseous and nuclear fuels with examples.
- 4.1.5 Explain preparation and properties of water gas and producer gas
- 4.1.6 Define cracking and distinguish between thermal and catalytic cracking
- 4.1.7 Introduce different regions of atmosphere
- 4.1.8 Recollect the terms Pollutant and Pollution
- 4.1.9 Understand different types of pollution – Air Pollution, Water Pollution and Soil Pollution
- 4.1.10 Understand the terms – ozone depletion, green house effect and acid rain
- 4.1.11 Explain different types of smog
- 4.1.12 Understand the relevance of Green Chemistry ( Principle and scope in the present scenario)

## **CONTENT DETAILS**

### **MODULE - I :**

#### **Atomic Structure II and Chemical Bonding (11+1=12 hours)**

Bohr Model of atom – Postulates, Merits and Demerits - Dual nature of matter – de Broglie relation – Uncertainty Principle – Concept of Orbit and Orbital – Quantum numbers – Sub energy levels (s,p,d,f) - shape of s and p orbitals.

Electronic Configuration of atom – Aufbau principle, Pauli's exclusion principle, Hund's rule of maximum multiplicity – electronic configuration of elements upto atomic number 20.

Chemical bonding – Octet rule – Electro negativity- Types of Chemical bonds - Ionic (Electrovalent) bond – Covalent bond, Coordinate bond and hydrogen bonding – Definition with two examples for each.

### **MODULE - II:**

#### **Electrochemistry and Corrosion (12+1=13 hours)**

Classification of materials based on conduction – conductors, Semiconductors and Insulators – Definition with two examples each – Types of Conductors – Metallic and electrolytic conductors – Any four differences.

Electrolytes and Non - electrolytes – Definition with two examples – Strong and Weak Electrolytes – Definition with two examples -

Electrolysis – Definition – Electrolysis of molten NaCl and aqueous NaCl solution using Pt electrodes – Faraday's laws of electrolysis (Qualitative and Quantitative Statements only). Applications of electrolysis – Electroplating and Anodising – Any two differences – Electroplating of Nickel on mild steel – Anode, Cathode, electrolyte and half cell reactions – Electrochemical cell – Daniel cell – Representation of the cell – half cell and over all cell reactions – Primary and Secondary cells – definition and examples only – fuel cell – H<sub>2</sub>-O<sub>2</sub> fuel cell – Cell reactions, advantages and applications – Electrode potential – standard electrode potential – EMF of cell – Electrochemical Series and its applications.

Corrosion – Definition and examples – rusting of iron Factors affecting rusting - conditions of rusting – Mechanism of rusting – Electrochemical theory – Types of Corrosion – Chemical and Electro chemical Corrosion – Prevention of Corrosion – Barrier Protection, Sacrificial Protection, Cathodic protection and Anti rust solutions.

### **MODULE - III:**

#### **Chemistry of Materials and Polymers ( 9+1=10 hours)**

Introduction to organic chemistry – Differences between organic and inorganic compounds – Uniqueness of Carbon – Saturated and Unsaturated hydrocarbons –concept of functional group.

Refractories – Classification and properties – Glasses – General properties and types of glasses – Soda glass, Borosilicate glass, Safety glass and Insulating glass – Content and uses – Uses and advantages of Optical Fibres.

Polymers – definition – Classification of Polymers based on nature of monomers origin(source), structure, mode of synthesis and magnitude of intermolecular forces with two examples each – Natural rubber – Vulcanisation – Properties and merits – Common Polymers - monomers and uses – Polythene, Polypropene, Polystyrene, PVC, Neoprene, Teflon, Buna – S, Buna – N, Nylon-6, Nylon-66 and Bakelite.

### **MODULE - IV:**

#### **Fuels and Environmental Chemistry (9+1=10 hour)**

Fuel - Definition – Calorific value – Qualities of a good fuel – classification of fuels – solid, Liquid, gaseous and nuclear fuels with three examples each – water gas and Producer gas – Preparation and Properties –Cracking – Thermal and Catalytic Cracking.

Environmental Chemistry - Regions of atmosphere – Pollutant and Pollution – Definition – Types of pollution – Air pollution, water pollution and Soil Pollution – Mention only major pollutants – Impact of Air Pollution – Ozone depletion, green house effect, acid rain and smog – Types of smog – Elementary ideas of green Chemistry.

### **REFERENCE :**

Jain and Jain	Engineering Chemistry	Dhanpat Rai and Sons
S. S. Dara	Engineering Chemistry	S. Chand Publication
B. K Sharma	Industrial Chemistry	Geol Publication
S. S. Dara	Environmental Chemistry and Pollution Control	S. Chand Publication
	Wiley "All in One"	Wiley India Pvt. Ltd 2012 Editon.