

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**COURSE NAME : APPLIED SCIENCE-II (CHEMISTRY)**

**1. RATIONALE :**

Science is the foundation for all technician courses. The basic aim of teaching science is to develop in the student the habit of scientific enquiry, ability to establish the cause and effect relationship and logical development of different disciplines.

Chemistry forms the part of applied science. The study of basic concepts Chemistry like atom, corrosion, lubrication etc. will help the students in understanding engineering subjects where the emphasis is laid on the application of these concepts.

Chemistry is concerned with the changes in structure and properties of matter. Many of the processes, which are involved to bring out these changes; form the basis for engineering activities. Teaching of chemistry should be aimed at developing right type of attitudes in the students and the ability to predict the results under given conditions of chemical activities.

Thus a good foundation in basic sciences will help the students in their self-development, to cope up with the continuous flow of innovation and discoveries in technology.

**2. SCHEME OF TEACHING :**

<b>Sr. No.</b>	<b>Name of Topics</b>	<b>Theory Hours</b>
1.	Atomic & Molecular Structure	4
2.	Ionisation & Electro Chemistry	5
3.	Corrosion of metals & its prevention	5
4.	Water Treatment	4
5.	Lubrication & Lubricants	3
6.	Chemistry of Engineering Materials	7
<b>Total</b>		<b>28</b>

**3. OBJECTIVES :**

1. Understand the atomic model.
2. Understand the ionisation energy, ionisation affinity and chemical bonds.
3. Understand the molecular structure of solid, liquid and gases.
4. Understand the ionisation process and factors affecting the degree of ionisation.
5. Understand the importance of pH.
6. Appreciate the importance and use of buffer solutions.
7. Understand the types of electrolytes and their industrial uses.

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8. Understand the electrolytic conductance of metals & salts.
9. Understand the process of oxidation - reduction and working of electrochemical cell.
10. Understand the terms : Standard conditions, hydrogen, electrode, halfcell potential, electro chemical series.
11. Describe the different types of corrosion.
12. Comprehend the different factors affecting the rate of corrosion.
13. Appreciate the different protective measures to prevent corrosion.
14. Understand the types and degree of hardness of water.
15. Know the effects of hard water when used in boiler and methods of it's prevention.
16. Understand the method for removal of hardness of water.
17. Know the water quality and methods of treatment of water for town supply.
18. Understand the terms lubrications and lubricant.
19. Comprehend different tests of lubricants.
20. Understand the functions of additives to improve properties of lubrications.
21. Appreciate the process of selection of lubricant for gears cutting control and steam turbines.
22. Understand the process of polymerisation.
23. Know the properties and uses of natural and synthetic rubber.
24. Know the different types of adhesives, their characteristics and uses.
25. Know the ingredients of paints and varnish.
26. Know the characteristics and types of refractories.
27. Know the properties and uses of insulating materials.
28. Understand the preparation, properties and use of natural and synthetic rubbers.

#### **4. TOPICS AND SUBTOPICS :**

##### **TOPIC – 1 ATOMIC AND MOLECULAR STRUCTURE**

**04 HRS.**

1. Arrangement of , p and n in atom.
2. Distribution of electrons in shell and subshell.
3. Concept of atomic orbitals.
4. Aufbau's principle and electronic configuration of elements.

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5. Ionisation energy.
6. Electron affinity.
7. Different types of chemical bonds.
8. Motion of molecules.
9. Intermolecular force of attraction.
10. Molecular arrangement in solid, liquid and gases.
11. Structure of solids.

### TOPIC – 2 IONISATION AND ELECTROCHEMISTRY

05 HRS.

1. Introduction
2. Ionisation and degree of ionisation.
3. Factors affecting the degree of ionisation.
4. Ionic equilibrium constant ( $K_w$ ) for water.
5. Definition of pH.
6. Ionisation of acid, base and salts.
7. pH calculations of acid, base and salt solution at different concentration.
8. pH of acid, base and neutral solution.
9. Importance of pH in various fields.
10. Definition of buffer solution.
11. Types of buffer solution.
12. Application of buffer solutions.
13. Metallic conductors and electrolytes.
14. Types of electrolytes.
15. Industrial applications of electrolytes.
16. Electrolytic conductance.
17. Effect of dilution on electrical conductance.
18. Electrical conductivity of elements, e.g., Li, Be, B, c etc.
19. 'N' and 'P' type semiconductors.

### TOPICS - 3 CORROSION OF METALS AND IT'S PREVENTION

05 HRS.

1. Oxidation - reduction process
2. construction and working of electrochemical cell.
3. Interpretation of corrosion.
4. Definition of corrosion.
5. Standard conditions.

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6. Standard hydrogen electrode.
7. Half cell potential.
8. Electrochemical series and its significance.
9. Atmospheric corrosion
10. Pitting corrosion.
11. Water line corrosion.
12. Crevice corrosion.
13. Nature of film.
14. pH of solution.
15. Area of cathode and anode.
16. Temperature.
17. Moisture
18. Purity of the metal.
19. Modification of environment.
20. Modification of the properties of metal.
21. Use of protective coatings.
22. Anodic and cathodic protection.
23. Modification in design and choice of material.

### **TOPIC - 4 WATER TREATMENT**

**04 HRS.**

1. Hard water and soft water.
2. Types of hardness of water and its units.
3. Salts producing hardness of water.
4. Method to express the hardness of water.
5. Scale and sludge formation and its prevention.
6. Priming and foaming and its prevention.
7. Caustic embrittlement and its prevention.
8. Corrosion and its prevention.
9. Chemical reactions involved in permutit and regeneration of permutit.
10. Chemical reactions involved in ion-exchange process and regeneration of acidic and basic-resins.
11. Purification of water by screening, sedimentation, co-agulation and filtration.
12. Sterilisation / Disinfection of water by boiling and chlorination by using chlorine and Bleaching - powder.

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## **TOPIC – 5 LUBRICATION AND LUBRICANTS**

**03 HRS**

1. Introduction and definition of lubricants and lubrication.
2. Functions of lubricants
3. Types of Lubrication
  - (a) Fluid film lubrication
  - (b) Boundry lubrication
4. Classification of lubricant
  - (a) Solid lubricants
  - (b) Semi-solid lubricants
  - (c) Liquid lubricants
  - (d) Synthetic oils
5. Test of lubricants and their significance like
  - (a) Viscosity and viscosity index
  - (b) Volatility
  - (c) Flash point and fire point
  - (d) Pour point and cloud point
  - (e) Neutralisation No. and acid value
  - (f) Saponification number
  - (g) Emulification number
  - (h) Corrosion test and copper strip test.
6. Additives to improve the quality of lubricants.
7. Purpose for the use of additives like
  - (a) Anti oxidants
  - (b) Corrosion inhibitors
  - (c) Antiwear agents
  - (d) Detergents and foam inhibitors
8. Selection of lubricants for
  - (a) Gears
  - (b) Cutting tools
  - (c) Steam turbine.

## **TOPIC - 6 CHEMISTRY OF ENGINEERING MATERIALS**

**07 HRS.**

1. Outline of polymer and polymerisation
2. Classification of polymers with suitable examples

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3. Thermoplastic and thermosetting
4. Properties and uses of thermosetting like Bakelite, melamine, epoxy and silicones
5. Properties and uses of thermoplastics like PVC, polyethelene.
6. Preparation and uses of elastomers.  
(Chemical, Structural aspects, should be avoided)
7. Comparision of properties of natural and synthetic elastomers.
8. Vulcanisation of rubber
9. Application of elastomers in industry.
10. Definition, characteristics, and examples of adhesives.
11. Classification of adhesives and their uses.
12. Purpose of using oil paint.
13. Characterisation of oil paint.
14. Ingredients of oil paint
15. Function and examples of each ingredient like ,
  - (i) Drying oil
  - (ii) Pigments
  - (iii) Thinner
  - (iv) Driers
  - (v) Extenders and plasticizers
16. Varnish and its types.
17. Difference between paint and varnishes.
18. Definition & application of refractories.
19. Characteristics of refractories like :-
  - (i) Refractoriness
  - (ii) Strength
  - (iii) Thermal expansion
  - (iv) Thermal conductivity
  - (v) Porosity
  - (iv) Thermal shock resistance
20. Classification of refractories like :-
  - (i) Acid refractories
  - (ii) Basic refractories
  - (iii) Neutral refractories

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21. Uses of alumina and magnesia refractories.
22. Properties of ideal insulating materials.
23. Types of insulating materials :
  - (i) Natural insulating materials,
  - (ii) Insulating foils.
  - (iii) Insulating wool.
  - (iv) Manufactured insulating materials.
24. Properties and use of insulating materials like :-
  - (i) Glass wool.
  - (ii) Thermocole (foamable polystyrene)

### 5. REFERENCES :

- |                                                       |             |
|-------------------------------------------------------|-------------|
| 1. Engineering Chemistry                              | Jain        |
| 2. A Text Book of Polytechnic Chemistry               | V.P. Mehta. |
| 3. A Text Book of Applied Chemistry<br>(Vol.- I & II) | J. Rajaram. |
| 4. Engineering Chemistry                              | M.M. Uppal  |
| 5. Polytechnic Chemistry                              | Saxena.     |