

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM

Course Title: Applied Chemistry (Group-1)
(Code: 3300009)

Diploma Programmes in which this course is offered	Semester in which offered
Civil Engineering, Ceramic Engineering, Environment Engineering, Mining Engineering, Transportation Engineering	Second Semester

1. RATIONALE

Science is the foundation for all technician courses. The Basic aim of teaching science is to develop in the students the habit of scientific inquiry, ability to establish the cause and effect, relationship.

Chemistry forms the part of applied science .the study of basic concepts of chemistry like chemical bonding, corrosion, water treatment, and different engineering materials like polymers, paints ,glasses, cement, Refractories etc. and awareness of pollution in chemical industries etc. will help the students 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 process which are involved to bring out this changes forms the basis of engineering activities. Teaching of chemistry should be aimed at developing the right type of aptitude in the students and the ability to predict the result under given condition

Thus good foundation in basic science will help the students in their self development, to cope up with continuous flow of innovations.

2. LIST OF COMPETENCIES

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies

- To Develop the habits of identifying the problems related to the engineering materials.
- Ability to establish the cause and effects of Chemical phenomenon.
- To help students to cope up with continues flow of Development in Engineering Chemistry.

3. TEACHING AND EXAMINATION SCHEME

Teaching Hours (In Hours)			Total Credits (L+T+P)	Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

Legends: L-Lecture; T ó Tutorial/Teacher Guided Student Activity; P - Practical; C ó Credit;; ESE - End Semester Examination; PA - Progressive Assessment.

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Chemical Bondings and Catalysis	1a. Know various properties of material depending upon bond formation 1b. Understand the molecular structure of solid, liquid and gases 1c. Comprehend the crystal structure of metal and properties reflected by packing of atoms 1d. Learn the various types of catalysis and catalyst	Introduction 1.1 Theory Of Valence 1.2 Types of chemical bonds 1.2.1 Electrovalent bond, & its characteristics 1.2.2 Covalent bond & its characteristics 1.2.3 Co- ordinate bond & its characteristics 1.2.4 Hydrogen bond, its types and Significance 1.2.5 Metallic bond, Explanation of Metallic properties 1.3 Intermolecular force of attraction 1.4 Molecular arrangement in solid, liquid and Gases. 1.5 Structure of solids. 1.5.1 Metallic solids- Unit cell- bcc, fcc and hcp packing of metals óexamples and properties reflected by the packing of atoms 1.6 Catalysis, 1.6.1 Types of catalysis 1.6.2 Theory of Catalysis 1.7 Types of Catalyst 1.7.1 Positive Catalyst 1.7.2 Negative Catalyst 1.7.3 Auto-catalyst 1.8 Catalytic Promoter and Catalytic inhibitor 1.9 Industrial Application of Catalyst
Unit– II Ionization And pH	2a. Understand theory of ionization and factors affecting it.	2.1 Introduction 2.2 Arrhenius theory of ionization. 2.3 Ionic Equilibrium of water 2.3 Degree of ionization

Unit	Major Learning Outcomes	Topics and Sub-topics
	2b. Understand the importance of pH & its industrial application	2.3.1 Factors affecting the degree of ionization 2.4 Definition of pH 2.4.1 pH of acid, base and neutral solution 2.4.2 pH calculations of acid, base and salt solution at different concentration 2.4.3 Importance of pH in various fields.
Unit- III Metal corrosion and its control	3a. Describe the different types of corrosion 3b. Comprehend the different factors affecting rate of corrosion 3c. Appreciate the different protective measures to prevent the corrosion	3.1. Explanation of corrosion 3.2 Types of corrosion 3.2.1 Dry corrosion: Oxidation corrosion mechanism corrosion-mechanism, Nature of oxide film 3.2.2 Wet corrosion-mechanism 3.2.3 Concentration cell corrosion 3.3 Pitting corrosion 3.4 Waterline corrosion 3.5 Crevice corrosion 3.6 Factors affecting the rate of corrosion, 3.7 Corrosion Control Modification of environment, Modification of the properties of metal, Use of protective coatings. Anodic and Cathodic protection, Modification in design and choice of material
Unit- IV Water Treatment	4a. Understand the types and degree of Hardness 4b. Comprehend the ill effect of hard water in boiler operation 4c. Understand the different methods for removal hardness in water 4d. Appreciate the water quality and treatment of drinking water	4.1. Hard water and soft water. 4.2 Types of hardness of water 4.2.1 Salts producing hardness of water. 4.2.2 Method to express the hardness of water. 4.3 Estimation of total hardness by EDTA Method 4.3.1 Examples to calculate the hardness 4.4 Effect of hard water in Boiler operation 4.4.1 Scale and sludge formation and its Prevention 4.4.2 Priming and foaming and its prevention. 4.4.3. Caustic embrittlement and its prevention. 4.4.4 Corrosion and its prevention. 4.5 Softening of Water 4.5.1 Soda-Lime process 4.5.2 Permutit process 4.5.3 Ion Exchange process 4.5.4 Reverse Osmosis process 4.6 Treatment of Drinking water 4.6.1 Sedimentation 4.6.2 Coagulation 4.6.3 Filtration 4.6.4 Sterilization of water by chlorination 4.6.5 Break-point chlorination 4.7 Treatment of waste water

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit- V Cements, Glasses & Refractories	<p>5a. Know the constituents of cements</p> <p>5b. Understand setting and hardening chemistry of cement</p> <p>5c. Describe variety of glass and their application</p>	<p>5.1 Cement, Constituting compound in cement</p> <p>5.2 Composition of Portland cement</p> <p>5.3 Manufacture of Portland cement</p> <p>5.4 Setting and Hardening of cement</p> <p>5.5 Glass and its general properties</p> <p>5.6 Manufacture of glass</p> <p>5.7 Variety of Glasses and their application</p> <p>5.8 Definition & application of refractories.</p> <p>5.9 Characteristics of refractories</p> <p>5.10 Classification of refractories like</p> <p>5.10.1 Acid refractories</p> <p>5.10.2 Basic refractories</p> <p>5.10.3 Neutral refractories</p>
Unit- VI Paints, Varnishes & Insulators.	<p>6a. Understand term paints and varnishes</p> <p>6b. Comprehend different Ingredients of paints and their function</p> <p>6c. Appreciate the difference between paints and varnishes</p> <p>6d. Know the properties and uses of insulating materials</p>	<p>6.1 Definition of paints and Varnishes</p> <p>6.2 Purpose of oil paint</p> <p>6.3 Characteristics of oil paints</p> <p>6.4 Ingredients of paints</p> <p>6.5 Function and Examples of each ingredients</p> <p>6.6 Varnish and its types</p> <p>6.7 Difference between paints and varnishes</p> <p>6.8 Definition Of Insulators</p> <p>6.9 Characteristics of Insulators</p> <p>6.10 Classification of insulators</p> <p>6.11 Properties and Application of</p> <p>6.11.1 Glass wool</p> <p>6.11.2 Thermocole</p>
Unit- VII Polymer, Adhesives & Elastomers	<p>7a. Understand the process of polymerisation</p> <p>7b. Know the properties and uses of Polymers, elastomers & adhesives.</p> <p>7c. Understand the process of vulcanization of rubber</p> <p>7d. Know the different types of adhesives and their application</p>	<p>7.1 Introduction and Definition of Polymer and Monomer</p> <p>7.2 Classification of Polymer on basis of Molecular structure as Linear, Branch and Cross-linked polymers</p> <p>7.3 Classification on basis of monomers (homopolymer and copolymer)</p> <p>7.4 Classification of Polymers on basis of Thermal behavior (Thermoplastics & Thermosetting)</p> <p>7.5 Types of polymerization Reaction</p> <p>7.5.1 Addition Polymerization</p> <p>7.5.2 Condensation Polymerization</p> <p>7.6 Synthesis, properties and application of</p> <p>7.6.1 Polyethylene</p> <p>7.6.2 Polypropylene</p> <p>7.6.3 Polyvinyl chloride</p> <p>7.6.4 Teflon</p> <p>7.6.4 Polystyrene</p>

Unit	Major Learning Outcomes	Topics and Sub-topics
		7.6.5 Phenol formaldehyde 7.6.6 Acrylonitrile 7.6.7 Epoxy Resin 7.7 Define the term elastomers 7.8 Natural rubber and its properties 7.9 vulcanization of rubber 7.10 Synthetic rubber, Synthesis, properties and uses 7.10.1 Buna-S Rubber 7.10.2 Buna-N Rubber 7.10.3 Neoprene Rubber 7.11 Definition of adhesives and Examples 7.11.1 Characteristics of adhesives 7.11.2 Classification of adhesives and their uses.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks (Duration –Hours)			
			R Level	U Level	A Level	Total
1.	Chemical Bondings and catalysis	06	3	2	3	08
2.	Ionization and pH	06	2	4	4	10
3.	Metal corrosion & its control	05	3	2	3	08
4.	Water Treatment	06	4	2	4	10
5.	Cements, Glasses & Refractories	07	4	2	4	10
6.	Paints, Varnishes & Insulators.	05	4	2	4	10
7.	Polymer , Adhesives & Elastomers	07	4	4	6	14
	Total	42	24	18	28	70

Legends:

R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

6. SUGGESTED LIST OF EXPERIMENTS

The experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency -

S. No.	Unit No.	Experiment
1	1	To determine the strength of acidic solution by using standard solution of Base.
2	2	To standardize KMnO ₄ solution by preparing standard oxalic acid and to estimate ferrous ions.
3	2	standardize Na ₂ S ₂ O ₃ solution by preparing standard potassium dichromate and to estimate percentage of copper from brass.
4	2	To determine PH-Values of given samples of Solution by using Universal Indicator and PH-meter

5	4	To determine the total hardness of water by EDTA method
6	7	To determine molecular weight of a polymer using Ostwald viscometer
7	7	Preparation of (any one) polystyrene, urea formaldehyde, phenol formaldehyde and its Characterization
8	5	To Determine Calcium from given sample of cement by volumetric method
9	--	Determination of saponification value of an lubricating oil
10	3	Study of corrosion of metals in medium of different pH
11	3	To determine total alkalinity of water sample
12	4	To determine the COD of given water sample
13	-	To determine Flash & Fire point of given lubricating oil.
14	3	Study of Corrosion of Metals in the different Mediums.
15	Note	Minimum Ten Experiments should be performed by the students from the above given list or experiment related to above topics

7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Sr.No.	Title of Books	Author	Publication
1	Engineering Chemistry	JAIN & JAIN	Dhanpat Rai and Sons
2	A Text Book of Polytechnic Chemistry	V.P. Mehta	Jain Brothers
3	A Text Book of Applied Chemistry	J. Rajaram	Tata McGraw Hill Co. New Delhi
4	Engineering Chemistry	S.S.Dara	S.Chand Publication

Following is the list of proposed student activities like:

- Teacher guided self learning activities.
- Course/topic based internet based assignments.
- Library survey regarding Engineering Material used in different industries.
- Industrial Visits of one or Two Industries.
- Quiz & Brain storming session related to Fuel properties & Utilization of fuel for different purposes.
- Sampling & Testing of water collected from different places.
- These could be individual or group-based.

8. SUGGESTED LEARNING RESOURCES

A. List of Books

B. List of Major Equipment/ Instrument

- PH- Meter
- Red wood Viscometer
- Pesky Martin Apparatus / Abel's Apparatus
- Cleveland open cup apparatus.
- Glass wares

C. List of Software/Learning Websites:

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

1. Prof.J.C.Patel, I/C.Head, Science & Humanities Department, Dr.S.& S.S. Ghandhy College of Engineering Technology, Surat
2. Dr. P.R.Patel, Head, Science & Humanities Department, N.G.Patel Polytechnic, Isroli, Bardoli
3. Prof.S.A.Nimakwala, I/C.Head, Science & Humanities Department,Shri.K.J. Polytechnic, Bharuch.
4. Prof.R.R.Patel, I/C.Head, Science & Humanities Department,G.P. Himmatnagar.