

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM

Course Title: Basics Chemistry (Group-4)
(Code: 3300011)

Diploma Programmes in which this course is offered	Semester in which offered
Chemical Engineering, Printing Technology, Textile Manufacturing Technology, Textile Processing Technology	First 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, Organic chemistry and different engineering materials like polymers, adhesives, paints, lubricants, 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 competency.

- i. **Apply the basic concepts and principals of Chemistry in various engineering applications.**

3. TEACHING AND EXAMINATION SCHEME

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

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit;
ESE - End Semester Examination; PA - Progressive Assessment.

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Chemical Bandings and Catalysis	<p>1.1 Explain various properties of material depending upon bond formation</p> <p>1.2 Describe the molecular structure of solid, liquid and gases</p> <p>1.3 Comprehend the crystal structure of metal and properties reflected by packing of atoms</p> <p>1.4 Explain the various types of catalysis and catalyst</p>	<p>Introduction</p> <p>1.1 Theory Of Valency</p> <p>1.2 Types of chemical bonds</p> <p>1.2.1 Electrovalent bond,& its characteristics</p> <p>1.2.2 Covalent bond & its characteristics</p> <p>1.2.3 Co- ordinate bond</p> <p>1.2.4 Hydrogen bond, its types and Significance</p> <p>1.2.5 Metallic bond, Explanation of Metallic properties.</p> <p>1.3 Intermolecular force of attraction</p> <p>1.4 Molecular arrangement in solid, liquid and gases.</p> <p>1.5 Structure of solids.</p> <p>1.5.1 Metallic solids- Unit cell- bcc, fcc and hcp packing of metals –examples and properties reflected by the packing of atoms.</p> <p>1.6 Catalysis,</p> <p>1.6.1 Types of catalysis</p> <p>1.6.2 Theory of Catalysis</p> <p>1.7 Types of Catalyst</p> <p>1.7.1 Positive Catalyst</p> <p>1.7.2 Negative Catalyst</p> <p>1.7.3 Auto-catalyst</p> <p>1.8 Catalytic Promoter and Catalytic inhibitor</p> <p>1.9 Industrial Application of Catalyst</p>
Unit– II Concepts of Electro Chemistry	<p>2.1 Describe theory of ionization and factors affecting it.</p> <p>2.2 Describe the importance of pH & and its industrial application.</p> <p>2.3 Describe difference between electrolytes and non- electrolytes.</p> <p>2.4 Describe construction and working of electrochemical cell.</p> <p>2.5 Describe the term: electrode potential and standard condition for its measurement.</p> <p>2.6 Appreciate the application of electrolysis</p>	<p>2.1 Introduction</p> <p>2.2 Arrhenius theory of ionization.</p> <p>2.3 Degree of ionization</p> <p>2.3.1 Factors affecting the degree of ionization</p> <p>2.4 Definition of pH</p> <p>2.4.1 pH of acid, base and neutral solution</p> <p>2.4.2 pH calculations of acid, base and salt solution at different concentration</p> <p>2.4.3 Importance of pH in various fields.</p> <p>2.5 Definition of buffer solution.</p> <p>2.5.1 Buffer Action & Types of buffer Solution.</p> <p>2.5.2 Application of buffer solutions.</p> <p>2.6 Electrolytes and Non-electrolytes</p> <p>2.6.1 Types of electrolytes</p> <p>2.7 Construction and working of electrochemical cell</p> <p>2.8 Standard conditions</p> <p>2.9 Standard hydrogen electrodes</p> <p>2.10 Nernst theory of single electrode potential & Nernst equation</p> <p>2.11 Electrochemical series, galvanic series</p> <p>2.12 Electrolysis, Faradays laws of electrolysis</p> <p>2.13 Industrial application of Electrolysis</p> <p>2.14 conductance of solution</p> <p>(a) Conductivity (b) Specific Conductivity</p>

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit– V Basic Concepts of Organic Chemistry	5.1 Explain the classification of organic compound 5.2 Describe the function group classification of organic compound 5.3 Describe difference between saturated and unsaturated hydrocarbons	5.1 Introduction: Organic chemistry 5.2 Difference between organic and Inorganic compound 5.3 Tetravalency of carbon 5.4 Concept of hybridization-sp,sp ² ,sp ³ type of one hybridization with example of each 5.5 Sigma and pi-bonding 5.6 Classification of Organic compound 5.7 Functional group classification 5.8 Explanation of following terms : Saturated and unsaturated hydrocarbon ,Isomerism, Homologues series, 5.9 Sources of Hydrocarbons a. distillation of coal-tar b. refining of petroleum 5.10 Study of Alkane,Alkene and Alkynes Preparation, properties & uses (Ethane, Ethylene & Acetylene)
Unit– VI Lubricants	6.1 Describe the terms Lubrication and Lubricants 6.2 Comprehend different tests of lubricants 6.3 Appreciate the process of selection of proper lubricants for engineering use 6.4 Explain the properties and uses insulating materials	6.1 Introduction and definition of lubricants and lubrication 6.2 function of lubricants 6.3 Types of lubrication 6.3.1 Fluid film lubrication. 6.3.2 Boundary lubrication 6.4 Classification of lubricants 6.4.1 Solid lubricants 6.4.2 Semi-solid lubricants 6.4.3 Liquid lubricants 6.4.4 Synthetic oils 6.5 Physical Properties of lubricants and their significance like 6.5.1 Viscosity and viscosity index 6.5.2 Flash point and fire point 6.5.3 Pour point and cloud point 6.5.4 oiliness 6.6 Chemical Properties of lubricants like 6.6.1 Soapification value 6.6.2 Neutralization number 6.6.3 Emulsification number 6.7 Selection of lubricants for 6.7.1 Gears 6.7.2 Cutting tools 6.7.3 Steam turbine
Unit– VII Polymer, Elastomers & Adhesives	7.1 Explain the process of polymerization 7.2 Explain the properties and uses of Polymers, elastomers & adhesives.	7.1 Introduction and Definition of Polymer and Monomer 7.2 Classification of Polymer on basis of Molecular structure as Linear, Branch and Cross-linked polymers 7.3 Classification on basis of monomers (homopolymer and copolymer) 7.4 Classification of Polymers on

Unit	Major Learning Outcomes	Topics and Sub-topics
	7.3 Explain the process of vulcanization of rubber 7.4 Explain the different types of adhesives and their application	basis of Thermal behavior(Thermoplastics& Thermosetting) 7.5 Types polymerization Reaction 7.5.1 Addition Polymerization 7.5.2 Condensation Polymerization 7.6 Synthesis, properties and application of 7.6.1 Polyethylene 7.6.2 Polypropylene 7.6.3 Polyvinyl chloride 7.6.4Teflon 7.6.4 Polystyrene 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			
			R Level	U Level	A Level	Total
1	Chemical Bonding and Catalysis	06	3	2	3	08
2	Concepts of Electro Chemistry	07	4	4	4	12
3	Corrosion of metals & its prevention	05	3	2	3	08
4	Water Treatment	06	4	2	4	10
5	Basic concepts of Organic Chemistry	06	3	4	3	10
6	Lubricants	05	3	2	3	08
7	Polymer ,Elastomers & Adhesives	07	4	4	6	14
	Total	42	24	20	26	70

Legends:

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

6. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the list of exercises/practical/experiments for guidance.

S. No.	Unit No.	Experiment/Practical Exercises
1	1	Determine the strength of given acidic solution using standard solution of base.
2	3	Standardize KMnO_4 solution by preparing standard oxalic acid and to estimate ferrous ions.
3	3	Standardize $\text{Na}_2\text{S}_2\text{O}_3$ solution by preparing standard potassium dichromate and to estimate percentage of copper from brass.
4	6	Determine the viscosity of given lubricating oil by using Red-wood Viscometer
5	2	Determine PH-Values of given samples of Solution by using Universal Indicator and PH-meter
6	--	Determination of phenol by iodometric method.
7	7	To Determine molecular weight of a polymer using Ostwald viscometer
8	5	Assign IUPAC names to first five members of Alkane and Alkene series
9	7	Preparation of (any one) polystyrene, urea formaldehyde, phenol formaldehyde and its Characterization
10	6	To Determine Acid Value of given lubricating Oil.
11	--	Determine of percentage of moisture in given sample of coal by proximate analysis
12	6	To Determine of saponification value of an lubricating oil
13	3	Study of corrosion of metals in medium of different pH
14	4	To Determine the COD of given water sample
15	6	Determine Flash & Fire point of given lubricating oil.
16	3	Study of Corrosion of Metals in the different Mediums.
	Note	Minimum Ten Experiments should be performed by the students from the above given list or experiments related to above topics

7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the list of proposed student activities (individual or group-based)

- 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

S.No.	Author	Title of Books	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

. B. List of Major Equipment/ Instrument

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

C. List of Software/Learning Websites: ---

- www.chemistryteaching.com
- en.wikipedia.org/wiki/chemistry
- www.chml.com
- www.em-ea.org
- www.ce.sc.edu
- www2.chemistry.msu.edu

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

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

Co-ordinator and Faculty Member from NITTTR Bhopal

- **Dr. Anju Rawley** , Professor Applied Science Dept. NITTTR, Bhopal
- **Dr. C.K.Chug** ,Professor & Head Dept of electronic media , NITTTR, Bhopal