

# Gujarat Technological University

## Chemistry (Modified on 1<sup>st</sup> July 2018)

### B.E. Semester 1/2

**Type of course:** Basic Science.

**Credits:** 4

**Prerequisite:** Zeal to learn the subject.

**Rationale:** Chemistry is considered as Basic Science subject.

#### Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE Pr/Viva (V)	PA (I)	
3	0	2	4	70	30	30	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; Pr- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment

#### Learning Objectives:

1. It helps to improve the understanding of Chemistry as a basic science subject among the engineering students and will further create interest towards learning it.
2. Basic information will be provided by good foundation in chemical knowledge that will allow engineering students to make qualitative and quantitative inquiries in natural sciences and technology.
3. The content has been distributed in such way that all branches which have "Chemistry as a subject" are covered.

#### Contents:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	<b>General Chemistry:</b> Introduction to Chemical Sciences, Basics includes: Periodic properties, Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries Structure of an Atom, Formation of molecules – Kossel – Lewis approach to	5	40%

	Chemical Bonding, Lewis Representations of Simple Molecules and Ions, Types of Bonds.		
2	<b>Water Technology:</b> Introduction, Sources of water, Impurities in water, Hardness of Water, Boiler Problems, Softening of water (External & Internal treatments), Domestic water treatments, Waste water treatments, Desalination of Brackish water.	5	
3	<b>Metals, Alloys and Corrosion:</b> Introduction, Physical properties of Metals, Definition and purpose of alloy, Classification of alloys. Alloys: Steel, Cu, Al, Pb and its industrial applications. Introduction to Corrosion, Theories of corrosion, Protective measurements against corrosion – organic and inorganic materials, Inhibitors, Cathodic protection.	6	
4	<b>Polymers and Fibers</b> Introduction, Classification based on Source, Structure, Molecular forces. Polymerization and its mechanism. Definition of Rubber, Types of Rubber, Vulcanization of rubber. Application of Rubber. Biodegradable Polymers, Commercially important polymers- PE, PP, PS, PVC, ABS, PMMA, Glyptal and their uses. Types of fibers – Natural, semi synthetic, synthetic fibers. Physical properties of fibers and uses of Cellulose acetate, Viscose Rayon, Nylon, Polyesters acrylic, Glass fibers and Liquid Crystals.	7	
5	<b>Nano material:</b> Introduction, Sources, Properties and application of fullerenes, fulleroles, Metal based nanoparticles, Carbon nanotubes and nanowires. Synthesis: Top down and Bottom up approaches, Nanoelectronics. Applications of nanomaterial in catalysis, textile and medicine.	5	40%
6	<b>Fuel and Combustion:</b> Definition, Types of fuel and their applications. Calorific Value, Characteristics of good fuel. Analysis of coal – ultimate and proximate analysis, LPG, Natural gas, Biogas, Refining of Petroleum by Fractional distillation, Octane and Cetane Number, Unleaded Petrol and Diesel.	5	
7	<b>Chemical aspect of Biotechnology:</b> Introduction, Scope, importance and application, Benefits through biotechnology – Agriculture, Food quality, Medicines, Fermentation processes: Preparation of Ethanol and Acetic acid, Enzymes and its application in industries, Importance of Biofuels, Bio fertilizers, Bio surfactants and Bioreactors.	5	20%
8	<b>Analytical Techniques:</b> Measurement and understanding of pH, Conductance, and Potential, Spectroscopic techniques: Principles of Spectroscopy and Selection rules. UV-Visible Spectroscopy and its Application, Vibrational and Rotational spectroscopy (IR) of diatomic molecules	4	

and its application.		
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**Reference Books:**

1. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Co.
2. Engineering Chemistry Willey India Publisher
3. Engineering Chemistry by Marry Jane & Shultz, Cencage Learning Publisher
4. Engineering Chemistry by N. Krishnamurthy, P. Vallinaygam and D. Madhavan, Prentice Hall of India Pvt. Ltd.
5. Engineering Chemistry by K. Sesha Maheswaramma and Mridula Chugh, Pearson India Education Pvt Ltd.
6. Engineering Chemistry by B K. Sharma, Krishna Prakashan Media (P) Ltd.
7. A textbook of Engineering Chemistry by Shashi Chawla, Dhanpatrai Publishing Co. Ltd.
8. Fundamentals of Biotechnology by B D Singh, Kalyani Publisher. New Delhi.
9. Essential of Physical Chemistry by Bahl and Tuli., S Chand & Co. Ltd, New Delhi.
10. Introduction to Nano Science by N N. Lindsay, Oxford University Press.
11. NANO: The Essentials by T Pradeep Tata McGraw-Hill Publishing Company, New Delhi.

**Course Outcome:**

After learning the course the students should be able

1. Rationalize periodic properties such as ionization potential, oxidation states and electro negativity.
2. Analyze microscopic chemistry in terms of atomic and molecular orbital's and intermolecular forces.
3. Describe the importance and relevance of chemistry in our everyday life
4. Distinguish the difference between the different chemical materials.
5. Utilize the methods of science as a logical means of problem solving.
6. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques

**LIST OF PRACTICALS:** (Minimum 8 to be performed.)

1. Analysis of Steel Sample.
2. Analysis of Pyrolusite Ore.
3. Analysis of Brass Alloy.
4. Estimation of Hardness.
5. Gravimetric Analysis of decomposition of  $\text{Na}_2\text{CO}_3$  &  $\text{NaHCO}_3$ .
6. Determination of Concentration of Unknown Solution Spectrophotometrically.

7. To study Wet Corrosion loss of Steel by weight loss method using electrochemical theory.
8. Stress Corrosion Cracking of Brass in  $\text{NH}_3$  Solution.
9. To determine Alkalinity of a given Water Sample.
10. Determination of Saponification Value of Oil.
11. Determination of chloride content of water
12. Study of decomposition reaction of  $\text{ZnCO}_3$  by Gravimetric analysis.
13. To determine the moisture content in coal.

**Reference Books:**

1. Laboratory Manual of Engineering Chemistry, by S K. Bhasin & Sudha Rani.  
Publisher: Dhanpat Rai Publishing Company Ltd.
2. Engineering Chemistry with Laboratory Experiments, by M S. Kaurav.  
Publisher: PHI Learning Pvt. Ltd. New Delhi.
3. Vogel's textbook of Quantitative Chemical Analysis, by Arthur I Vogel, Revised by Jeffery et al, Publisher: Addison Wesley, Longman Ltd, England
4. Engineering Chemistry with Laboratory Experiments, by R. P. Mani & Mishra,  
Publisher: Cen cage Publisher.

**Major Equipment:**

1. Spectrophotometer.
2. Laboratory Oven.
3. Melting Point Instrument.
4. Electronic Balance

**List of Open Source Software/learning website:**

NPTEL, World Wide Web, etc.