GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMISTRY (Modified on 4th Feb 2014)
SUBJECT CODE: 2110001
B.E. 1st YEAR

Type of course: Engineering Science

Prerequisite: Zeal to learn the subject

Rationale: Chemistry is considered as basic subject for Engineering.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE Viva (V)	PA (I)	
3	0	2	5	70	30*	30#	20	150

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

Content:

Sr No	Topic	Teaching Hrs.	Module Weightage
1	**General Chemistry:** Introduction to Chemical Sciences, Development of Chemistry through ages and particularly in relevant field of Engineering, Then and Now Chemistry in Industries {Impact on nature & everyday life and further modification through Green approaches (Green Chemistry)}, Approach to Chemical Bonding, Lewis Representations of Simple Molecules and Ions, Types of Bonds, Importance of Organic Molecules, Structural Representation of Organic Molecules, Classification & Nomenclature of Organic molecules.	3	25%
2	**Water Technology:** Introduction, Sources of water Impurities, Hard and Soft Water, Degree of Hardness, Types of Hardness, Scale and Sludge Formation in boiler and its prevention. Caustic embrittlements, Softening of water, Properties of drinking water, Break-point chlorination, Desalination of Brackish water.	4	
3	**Metals, Alloys and Corrosion:** Introduction, Physical properties of metals, Definition and purpose of alloy, Classification of alloys. Alloys Steel and its applications. Non-Ferrous alloys and its industrial applications. Introduction to Corrosion, Theories of corrosion, Protection of metals from corrosion – organic and inorganic materials, Inhibitors, Cathodic protection.	6	20%
4	**Cements:** Introduction, Classification of cement and properties, chemical composition of cement, Standards, Manufacturing of Portland cement, chemical constituents of Portland cement, Setting and hardening of cement, PCC & RCC.	4	35%
5	**Polymers and Fibres** Introduction, classification based on	6	

	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- PVC, Polypropene, polystyrene and their uses. Types of fibres – Natural, semi synthetic, synthetic fibres. Physical properties of fibres and uses of Cellulose acetic, Viscose Rayon, Nylon, Polyesters acrylic, Glass fibres, Liquid Crystals.		
6	**Fuel and Combustion:** Definition, types of fuel and their advantages and disadvantages. Calorific Value, Characteristics of good fuel. Analysis of coal – ultimate and proximate analysis, LPG, Natural gas, Biogas, Refining of Petroleum by Fractional distillation.	5	
7	**Chemical aspect of Biotechnology:** Definition, Benefits through biotechnology – Agriculture, Food quality, Medicines, Fermentation processes, Enzymes and its application in industries	3	20%
8	**Refractory, Abrasives and Insulators:** Definitions of Refractory, Abrasives and Insulators. Properties of refractory. Classification of refractory. Classification, properties and uses of abrasives. Classification, properties and uses of Insulators.	3	
9	**Part of Lab Work – Analytical Techniques:** Introduction Types of analysis – Physical, Chemical and instrumentation. Physical analysis – Specific gravity, Melting point, Boiling point, Crystallization. Purification of compounds etc. Chemical analysis – Quantitative and Qualitative analysis of organic and inorganic compounds. Instrumental analysis – Spectroscopic, Chromatographic PH measurement, Conductivity, Turbidity etc.	2	

Reference Books:

1. Engineering Chemistry by Jain and Jain Publisher, DhanpatRai Publishing Co.
2. Engineering Chemistry by Dr. O.P. Agrawal, Khanna Publishers Delhi.
3. Engineering Chemistry Willey India Publisher
4. Engineering Chemistry by Marry Jane &Shult, Cencage Learning Publisher
5. Organic Chemistry by Bahl and Bahl., S Chand & Co. Ltd, New Delhi
6. Engineering Chemistry by N. Krishnamurthy, P. Vallinaygam and D. Madhavan Publisher, Prentice Hall of India Pvt. Ltd. New Delhi.
7. Engineering Chemistry by B. Sivsankar, Tata Macgrawhill Companies, New Delhi.
8. Essential of Physical Chemistry by Bahl and Tuli., S Chand & Co. Ltd, New Delhi.
9. Inorganic Chemistry by P.L. Soni and Katyal., Sultan Chand & Sons, New Delhi.
10. Laboratory Manual of Engineering Chemistry.By S K. Bhasin&Sudha Rani, Dhanpat Rai Publishing Company Ltd.

Course Outcome:

After learning the course the students should be able

1. To build a basic knowledge of the structure of chemistry.
2. To analyze scientific concepts and think critically.
3. To review the importance and relevance of chemistry in our everyday life.
4. To be able to utilize the methods of science as a logical means of problem solving.

List of Experiments and Open Ended Projects:

Minimum 5 practicals to be performed and remaining Open-ended Projects / Study Reports / Latest outcomes in technology study **:-**

1. In the beginning of the academic term, faculties will have to allot their students at least one Open-ended Projects / Study Reports / Latest outcomes in technology.
2. Literature survey including patents and research papers of basic chemistry
   - Design based small project **or**
   - Study report based on latest scientific development **or**
   - Technology study report/ modeling/ simulation/collection report **or**
   - Computer based simulation/ web based application/ analysis presentations of applied science field which may help them in their branches.
3. These can be done in a group containing maximum **Three** students in each.
4. Faculties should cultivate problem based project to enhance the basic mental and technical level of students.
5. Evaluation should be done on **approach of the student on his/her efforts** (not on completion) to study the design module of given task.
6. In the semester student should perform **minimum 5 set of experiments** and complete **one small open ended dedicated project** based on engineering applications. This project along with any performed experiment should be **EVALUATED BY EXTERNAL EXAMINER.**

PRACTICALS(ANY FIVE):

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 Na_2CO_3 & $NaHCO_3$.
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 NH_3 Solution.
9. To determine Alkalinity of a given Water Sample.
10. Determination of Saponification Value of Oil.
11. Study of decomposition reaction of $ZnCO_3$ by Gravimetric analysis.
12. To determine the moisture content in coal.

Major Equipments:

1. Spectrophotometer.
2. Laboratory Oven.
3. Melting Point Instrument.

Open Ended Project fields:-

Students are free to select any area of science and technology based on their branches to define projects.

Some suggested projects are listed below:

1. Laboratory set up of bench reagents.

2. Environmental related issues and concurrent methods for analysis. .
3. Product profile and its manufacturing product like soda ash, urea, ammonia etc.

List of Open Source Software/learning website:

1) Literature available in any laboratory manual of chemistry.
2) Vogel's book of chemistry.
3) NPTL
4) World Wide Web. etc.

*PA (M): 10 marks for Active Learning Assignments, 20 marks for other methods of PA

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus of Chemistry is covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should be sent to achievements@gtu.edu.in.

ESE Pr (V):10 marks for Open Ended Problems, 20 marks for VIVA.

Note: Passing marks for PA (M) will be 12 out of 30.
Passing marks for ESE Pract(V) will be 15 out of 30.