GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering (Chemical Engineering)
Subject Code: 3130506
Semester III
Subject Name: Applied Chemistry

Type of course: Basic Science**.**

Prerequisite: Zeal to learn the subject.

Rationale: Applied Chemistry is considered as Basic Science subject.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE Pr/Viva (V)	PA (I)	
3	0	4	5	70	30	30	20	150

Contents:

Sr. No.	Content	Total Hrs.
1	**Physical Properties and Chemical Constitution of matter**: Additive & Constitutive properties: Parachor, Viscosity, Dipole Moment, Molar Refraction, Optical activity, Magnetic properties. Preparation and theory of Solution: Mole Fraction, Normality, Molality, Molarity, Lowering of vapor pressure, Elevation of Boiling point, Depression of Freezing point, Osmosis & Osmotic pressure.	4
2	**General Principle of Organic Reactions:**Electronegativity, Electron Displacement Effect, Fission of Covalent Bond, Reactive Intermediate, Organic Species based on Carbon and Nitrogen, Types of Organic reaction and Mechanism.	5
3	**Stereochemistry::** Optical, Geometrical and Conformational Isomerism: Optical activity, Polarimeter, Specific rotation, Enantiomers, Diasteromers, Optical activity in Lactic and Tartaric acid, R and S configuration of Optically active compound and E and Z designation of Geometrical isomers. Resolution of racemic mixture.Conformations of cyclic and acyclic systems.	4
4	**Introduction to quantum theory for chemical systems/Co-ordination Chemistry (Chemical Bonding):** Wave Mechanical approach of atom, Heisenberg Uncertainty Principle, Schrodinger Wave Equation, Applications to Hydrogenatom, Atomic orbitals& MO theory, Types of Hybridisation, Structure-Bonding and shapes of certain molecules. Understanding of different bonds.	6
5	**The Phase Rule:** Introduction, Phase, Components, Degree of freedom, Derivation of Gibb's Phase, Three & Four Phase-One component system like water, sulphur systems, Two component -Eutectic systems like Silver-Lead, Zinc-Cadmium, Ferric Chloride-Water system	5
6	**Chemical Kinetics:** Introduction, Reaction rate, Units of rate, Rate laws, Order of a reaction, Zero order reaction, Molecularity of a reaction, Pseudo-order reaction, first order reaction with numerical, second order reaction, third order reaction, units of rate constant.	5
7	**Thermochemistry:**	5

	Introduction, Internal Energy, Enthalpy of reaction, Endothermic reaction, Exothermic reaction, ΔH and ΔE and numerical. Thermo-chemical equations like heat of reaction, heat of combustion, heat of neutralisation, heat of transition, Hess's Law of constant heat summation and its application, Experimental measurement of heat of reaction.	
8	**Semi&Non-crystalline/amorphous materials**: Classification, structure and configuration of Ceramics, Refractories & Insulators, polymers,copolymers, liquid crystals and amphiphiles: Silicates, glass transition temperature and viscoelasticity.NanoComposites: role of reinforcement-matrix interface. Strength on composite behaviour, Biomaterials, material related to catalyst such as zeolites, silica.	5
9	**Analytical Techniques:** Principles of Electronic, Florescence, NMR & Mass spectroscopy, Surface characterization techniques: SEM and TEM.Introduction to experimental techniques:XRD, PSA, etc. for material characterizationhighlighting links between molecular structure and macroscopic properties.	6

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
07	42	11	10	-	-

Legends: R: Remembrances; U: Understanding; A: Application; N: Analyze; E: Evaluate; C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Essential of Physical Chemistry by B. S, Bahl and Tuli., Publisher: S Chand & Co. Ltd, New Delhi

2. A textbook of Physical Chemistry by A S Negi& S C Anand, Publisher: New Age International Publisher Private Ltd. New Delhi

3.A textbook of Organic Chemistry by ArunBahl& B S Bahl, Publisher: S Chand & Co. Ltd, New Delhi.

4. A textbook of Inorganic Chemistry by P L Soni, Publisher: Sultan Chand & Sons, New Delhi

5. Physical Chemistry, by Peter Atkins, Julio de Paulo, Publisher: W H Freemann, UK

6. Engineering Chemistry by B K. Sharma, Publisher: Krishna Prakashan Media (P) Ltd.

7. A textbook of Engineering Chemistry by Shashi Chawla, Publisher:Dhanpatrai Publishing Co. Ltd.

8. Principle of Instrumental Analysis by Douglas A Skoog, F. James Holler, Stanely R Crouch, Publisher: Cencage.

9. Instrumental Method of Chemical Analysis by B K Sharma, Publisher: Krishna Prakashan Media.

10. Materials Science and Engineering: A First Course, byV. Raghavan5th Edition Prentice HallIndia, 2004.

11. B. S. Mitchell,An Introduction to Materials Engineering and Science for Chemical and Materials Engineers, John Wiley & Sons, 2004.

Course Outcomes:

Sr. No.	CO Statements	Marks % Weightage
1.	Identify and describe reactivity patterns in organic reaction.	**15**
2.	Explain theoretical principles underlying molecular structure, bonding and properties	**20**
3.	Describe the importance and relevance of Hard and soft materials and also their characterization, properties and uses in engineering applications.	**15**
4.	Distinguish the difference between the different orders of reaction and apply accordingly.	**15**
5.	Utilize different thermo dynamical laws to explain course of reactions.	**15**
6.	Apply the different spectroscopic techniques to explain the inner & surface characteristic of molecules.	**20**

List of Experiments : (Minimum 8 to be performed in Physical and 8 to be performed in Inorganic/Organic Chemistry.)

1. Heat of Solution.
2. Ester Hydrolysis (Ist&IInd Order reaction).
3. Measurement of Conductance.
4. Lambert's Beers Law.
5. Turbidity.
6. Potentiometer.
7. Viscosity Measurement.
8. pH Meter.
9. Polarimeter.
10. Inorganic Qualitative Analysis.
11. Inorganic Quantitative Analysis.
12. Organic Qualitative Analysis.
13. Organic Quantitative Analysis.

Reference Books:

1. Experimental Physical Chemistry, by Athawale. V D, Publisher: New Age International Publishing Ltd.
2. Vogel's Textbook of Practical Organic Chemistry by Hannaford, Smith &Tatchell, Publisher: Elbs with Longman
3. Vogel's textbook of Quantitative/ Qualitative Chemical Analysis, by Arthur I Vogel, Revised by Jeffery et al, Publisher: Addison Wesley,Longman Ltd, England
4. Engineering Vogel's Textbook of Quantitative Chemical Analysis by Jeffery. G H Publisher: Addison Wesley Longman/Pearson Education Asia.

Major Equipments:

1. Spectrophotometer, Conductometer, Potentiometer, pH meter, Polarimeter.
2. Laboratory Oven, Stirrer Hot Plate, Hot plates.
3. Turbidity Meter, Viscometer, Temperature Control Bath,
4. Electronic Balance.

List of Open Source Software/learning website:

NPTEL, World Wide Web, etc.