GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Science
Level: Under Graduate
Branch Name: Honors/ Honors With Research (Biotechnology)
Course / Subject Code: BS01001051
Course / Subject Name: Chemistry

W.e.f. Academic Year:	2024-25
Semester:	1
Category of the Course:	Multidisciplinary Course

Prerequisite:	Students should have basic knowledge of chemistry and thermodynamics. Students may be aware about the basics of analytical chemistry and Stereochemistry.
Rationale:	Chemistry as a subject is the soul of life. Chemistry deals with the kinetics of reaction that in terms of biochemistry are enzymatic reactions. Chemistry as a subject also deals with the structure of biomolecules, the concentration concepts deal with formation of buffers and solutions required in practical work of Biotechnology.

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
3	0	2	4	70	70	30	30	200

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
1	Preparations of solution and to learn concentration units.	UN,AP,AN
2	To understand some of the basics of analytical chemistry.	UN,RM
3	To learn fundamentals of thermodynamic chemistry and chemical kinetics.	AP,RM,UN
4	To apply theoretical concepts in order to solve numerical problems	AP,UN,AN

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage
1	**Chemical Kinetics** Introduction, Rate of reaction, Rate constant, Half life time, Determination of Half life time of reaction, Order of reaction Derivation	9	20

	of First law, second order rate reaction constant for (a=b) and (a≠b). Derivation of third order. Mathematical problems. Catalysis characteristics of catalysis, Types of catalysis, homogeneous and heterogeneous catalysis, and enzyme catalysed reaction and derivation mechanism.		
2	**Ionic equilibrium in aqueous solutions** Acids & Bases, Arrhenius theory of Acids and Bases, The Lowry – Bronsted Concept, Strength of Acids and Bases, The Lewis concept, pH Scale, pH and Buffers Structure and physical properties of water, Self-Ionization of water, Hydrolysis, Buffer Solutions, Indicator, Sparingly Soluble Salts, Common ion effect, Selective Precipitation, acid-base titration and use of indicator. Intermolecular bonding forces-ionic bonds, hydrogen bonds, Van der Waals interactions, Dipole-dipole and Ion-dipole interactions, Repulsive interactions, water, and hydrophobic interactions –Importance of these effects in biological systems.	9	20
3	**General Introduction of analytical chemistry** Introduction, Qualitative and Quantitative analysis, Types of titrations. Requirements for titrimetric analysis. Concentration systems: molarity, formality, normality, wt %, ppm, milliequalence and millimoles-problems. Primary and Secondary standards, criteria for primary standards. Preparation of standard solutions, standardization of solutions. Limitation of volumetric analysis, endpoint and equivalence point. Applications of Chemical Analytical Chemistry, Sampling of Solid, Liquid and Gas, Stages of Analysis, Interferences, Selection of Methods, limitations of Analytical Methods.	9	20
4	**Thermodynamics** Terminology of thermodynamics, First law of thermodynamics, internal energy, enthalpy of a system, heat capacity, spontaneous process, Second law of thermodynamics, concept of entropy, entropy of mixing, standard entropies, criteria for reversible and irreversible process, Gibbs-Helmholtz equation, Third law of thermodynamics, determination of absolute entropies	9	20
5	**Stereochemistry** Elements of symmetry centre, plane and axis of symmetry Isomers and classification of isomers. Configuration, conformational isomers. Separation of enantiomers. Absolute configuration (R and S).Conversion of projection formulas.	9	20

	Stereochemistry of compounds containing two asymmetric carbon atoms. Conformations around a C-C bond in acyclic compounds. Structure of cycloalkanes, Cyclohexane conformations. Stereochemistry of disubstituted cyclohexanes.		

Textbook:

1. Biophysical chemistry, Principles and Techniques. Upadhyay, Upadhyay and Nath, Himalaya Publishing House, 2019.
2. Physical Chemistry by Puri, Sharma &Pathania, Vikas Publications, New Delhi, 2021.

Reference Books:

1. Vogel's Text book of Quantitative Chemical Analysis by J. Mendhan, R. C. Denney, M. Thomas, B. Sivasankar. 6th Ed. Pearson 2009.
2. Basic concept of Analytical Chemistry. S. M. Khopkar, New age International Publishers, 2004.

List of Experiments: (Minimum 6 experiments need to be performed)

1. To determine the enthalpy of neutralization of strong acid (HCl) with a strong base (NaOH)
2. To Study the shift in equilibrium in the reaction of ferric ions and thiocyanate ions by changing the concentration of any one of these ions.
3. Estimation of carbonate and bicarbonate in a given mixture
4. Separation of ions Pb2+ and Cd2+ in a mixture of compounds using chromatographic technique.
5. Study the presence of oxalate ions in guava fruit at different stages of ripening
6. To determine the solubility product (Ksp) of a sparingly soluble salt, such as calcium sulfate.

List of Laboratory/Learning Resources Required:

1. https://nptel.ac.in/courses/104106119
2. https://onlinecourses.swayam2.ac.in/ugc19_ch01/preview

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