



**Sarvodaya Kelavani Samaj managed,
Shri Manibhai Virani and Smt. Navalben Virani Science College
(Autonomous)**

(Affiliated to Saurashtra University, Rajkot)

Re-Accredited at 'A' Level by NAAC

STAR college Scheme & Status by MST-DBT

UGC-College with Potential for Excellence (CPE)

UGC-DDU KAUSHAL Kendra

GAAA –Grade A-1 by KCG, Government of Gujarat

GPCB-Government of Gujarat approved Environment Audit Center

Nodal Center for capacity building by GSBTM

Department of Chemistry

B.Sc. Chemistry

Syllabi of Semester II

Discipline Specific Course		
For the students admitted from A.Y. 2021-2022 & onwards		
Offering Department: Chemistry	Offered to: B.Sc. Chemistry	
Semester - II		
Course Code	Course Title	Course Credit and Hours
21UCHCC201	Conceptual Inorganic and Analytical Chemistry (F)	4 Credits - 4 hrs/wk

Course Description:

This course provides a key knowledge about inorganic and analytical chemistry. It is based on quantum mechanics and explain the different kind of parameters that affect the crystal structure of a compound. It also covers the key properties of the transition series and the inner transition series elements. It also entails the various types of titration methods and its applications. This course provides basic understanding, occurrence and minimization of errors. This course also develop understanding of water analysis and treatment methods. This course aims to address SDG No-4: Quality education.

Course Purpose:

This course aims to provide introductory knowledge of state of matter, Co-ordination theory and Molecular orbital theory. To comprehend knowledge about transition and the inner transition elements. To enables students to identifying various possible errorsto use significant figures in experimental report. To enhance the scientific skill of conducting experiments and drawing inferences to identify simple organic compounds. To be abreast with physical and chemical methods water treatment.

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	CO Statement	Blooms taxonomy Level(K ₁ to K ₆)
CO ₁	Recognize basic properties of transition and inner-transition elements.	K ₂
CO ₂	Remember and Understand molecular orbital theory of various element.	K ₁ , K ₂
CO ₃	Defineand Comparethe various solid& liquid crystalline compounds.	K ₁ ,K ₂
CO ₄	Identify& Estimate the errors and statistics, calibration of instruments and organic qualitative analysis.	K ₃ , K ₅
CO ₅	Determine& Comparethe various titrimetric analyses of water treatment.	K ₂ , K ₅

Course Content	Hours
Unit-I : Transition and Inner-transition elements	10 hrs
<p>Elements of the First Transition Series</p> <ul style="list-style-type: none"> • Introduction • Reversal of energies of 3d and 4s orbital • Metallic properties • Catalytic properties • Magnetic & Spectral properties • Tendency of Formation of Alloys <p>Lanthanoids and Actinoids elements</p> <ul style="list-style-type: none"> • Electronic configuration • Oxidation states • Color & Magnetic properties • Lanthanide contraction • Separation of lanthanides (ion exchange method only) • Applications 	
Unit-II: Molecular Orbital Theory	14 hrs
<p>Molecular Orbital Theory</p> <ul style="list-style-type: none"> • Introduction • Linear Combination of Atomic Orbital • Bond order • Electronic configuration & Energy level diagram of homo and hetero nuclear diatomic molecules H₂, He₂, Li₂, Be₂, B₂, C₂, N₂, O₂, F₂, Ne₂, NO & CO • Determination of wave function and wave equation • Hybridization and Construction of Hybrid orbital • Derivation of Wave equation and wave function of : sp, sp², sp³ 	
Unit- III: Solid State	12 hrs
<p>Ionic solids</p> <ul style="list-style-type: none"> • Introduction • Characteristics of Ionic solids • Born Haber Cycle • Max Born Equation • Limiting radius ratio • Relation between radius ratio, coordination number and crystal structure • Derivation of r⁺/r⁻ ratio in crystal lattice: <ul style="list-style-type: none"> ➤ Trigonal ➤ Square planar 	

<ul style="list-style-type: none"> ➤ Body centered ➤ Tetrahedral • Crystal structure of ionic solids : <ul style="list-style-type: none"> ➤ AB type - CsCl and ZnS (Zinc blend) ➤ AB₂ type - CaF₂ and TiO₂ <p>Crystalline state</p> <ul style="list-style-type: none"> • Introduction • Difference between crystalline and amorphous solid • Crystal and crystallography • Three laws of crystallography • Space lattice ,Unit cell & Bravais lattices • Brags equation and lattice structure • Liquid Crystals: <ul style="list-style-type: none"> ➤ Introduction ➤ Classification ➤ Applications of liquid crystals 	
<p>Unit- IV: Fundamentals of Analytical Chemistry-III</p>	<p>12 hrs</p>
<p>Errors and Statistics</p> <ul style="list-style-type: none"> • Introduction • Classification of errors : Determinate and indeterminate errors • Accuracy and precision • Minimization of error • Calibration of Instruments • Significant figure and its laws • Mean and standard deviation , variance and coefficient of variance • Absolute error and relative error mean value, deviation and relative mean deviation. • Gaussian curve, Q – test and T -test (Student T test) • Numerical <p>Organic Qualitative Analysis</p> <ul style="list-style-type: none"> • Introduction • Nature of organic compounds • Unsaturation test • FeCl₃ test • Elemental analysis by lassign test • Functional group tests • Determination of Physical constant 	
<p>Unit- V: Titrimetric Analysis</p>	<p>12 hrs</p>

Complexometric Titrations

- **Complexometric titration**
 - Preparation of standard E.D.T.A. Solution
 - Velcher's law
- **Types of EDTA Titration :**
 - Direct Titration
 - Back Titration
 - Substitution Titration
 - Alkalimetry titration mixture with the help of masking and demasking agent
- Principle of metal ion indicator
- **Structure , Use and characteristics of various indicators :**
 - EBT
 - Calcon
 - Muroxide
- **Precipitation titration**
 - Argentometric titration
 - ✓ Mohr's method
 - ✓ Fajan's method
 - ✓ Volhard method

Water Analysis

- Introduction, Total solid & Volatile solid
- Total Dissolved Solid, Total Suspended Solid
- Non filterable & Filterable solid & Non filterable volatile Solid
- Acidity, Alkalinity & Turbidity
- Determination of Hardness of water
- Dissolve oxygen (DO), Chemical oxygen demand (COD), Biological oxygen demand (BOD)

Pedagogic tools:

- Chalk and Board
- Power point presentation
- Videos

Text books :

- Puri, B. R.; Sharma, L. R. & Kalia, K. C. (2017, 33rd edition) *Principles of Inorganic Chemistry*. New Delhi : Milestone (ISBN No. 978-8192143330)
- Bahl, Arun; Bahl, B. S.; Tuli, G. D. (2020, 28th edition) *Essential of Physical Chemistry*. New Delhi : S. Chand (ISBN No.978-9352836093)

Reference books :

Inorganic Chemistry

- Madan, R. L. (2011, 3rd edition) *Chemistry for degree student First year*. New Delhi: S. Chand (ISBN: 978-8121932301).

- Lee, J. D. (2002, 5th edition) *Concise Inorganic Chemistry*. Hoboken: Wiley-Blackwell Science Ltd. (ISBN: 0-632-05293-7).
- Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller & Fraser Armstrong (2010, 5th edition) *Inorganic Chemistry*. Oxford: Oxford University Press (ISBN: 978-0-19-959960-8).

Analytical Chemistry

- Douglas A. Skoog, West, Holler, Crouch (2004, 8th edition) *Fundamental of Analytical Chemistry*. Mexico: Thomson-Brooks/Cole (ISBN: 81-315-0051-9).
- Sharma, B. K. (2014) *Instrumental Method of Chemical Analysis*. Meerut: GOEL publishing House (ISBN: 978-81-8283-099-8).
- Christian, Gary D.; Dasgupta, Purnendu K.; S. Chug, Kevin A. (2007, 6th edition) *Analytical Chemistry*. Hoboken: Wiley-Blackwell Science Ltd. (ISBN: 978-81-265-1113-6).

Methods of Assessment & Tools:

Components of CIA: 30 marks

Sr. No.	Component	Content	Duration (if any)	Marks	Sub Total
A	Test 1	1 st 2 units	1 ^{1/2} hours	5 (Set for 30)	20
	Test 2	All 5 units	3 hours	15 (Set for 70)	
B	Assignment		2 Assignments	05	10
C	Class activity			05	
Grand Total					30
Assignment		<ul style="list-style-type: none"> • Abstract and executive summary • Case study writing • Concept mapping • Student generated handbook • Essay writing etc... • Short Time-Online Course 			
Class activity		<ul style="list-style-type: none"> • Presentation (PPT, Poster, Chart) • Seminar • Quiz • Model Making • Think Pair Share • Free writing • Class test • Debate/ Group Discussion • Open Book Test • Class test 			

Note: Any other assessment tools or methods can be adopted as per requirement of the course.

Discipline Specific Course		
For the students admitted from A.Y. 2021-2022 & onwards		
Offering Department: Chemistry	Offered to: B.Sc. Chemistry	
Semester - II		
Course Code	Course Title	Course Credit and Hours
21UCHCC202	Core-4: Conceptual Organic and Physical Chemistry (F)	4 Credits - 4 hrs/wk

Course Description:

This course provides a systematic study of the theories, principles, and techniques of organic chemistry. Topics include nomenclature, structure, properties, reactions, and mechanisms of hydrocarbons, alkyl halides, alcohols and ethers. It also covers the ideas of chemical equilibrium, chemical kinetics, methods of preparation of colloidal state and its application. The course aims to address SDG No-4: Quality education.

Course Purpose:

This course aims to provide basic understanding of various functional groups. This is planned in such a way that students will be able to learn methods for preparation of alkyl and aryl halide, alkenes, dienes, alcohol, phenol and ether. Students will be able to know the different effects like Tindal effect, Brownian movement and properties of colloidal state. It also covers the basic concept of chemical equilibrium and reaction rates, rate laws and transition states.

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	CO Statement	Blooms taxonomy level(K ₁ to K ₆)
CO ₁	Understand physical & chemical properties and plan the preparation of Alkenes, Alkynes, Dienes, Alcohols, Phenols, Ethers and Epoxide, Alkyl halide and Aryl halide.	K ₂
CO ₂	Use concepts of chemical kinetics for making predictions and explanations of type, rate and order of reactions.	K ₃
CO ₃	Understanding aromatic behavior of organic compounds and their typical chemical properties.	K ₂
CO ₄	Recall the concept of Chemical equilibrium and chemical kinetics.	K ₁
CO ₅	Understand and apply properties, application and various methods for preparation of colloidal solution.	K ₂ ,K ₃

Course Content	Hours
Unit-I : Chemistry of aromatic Hydrocarbons	13 hrs
<p>Aromatic Hydrocarbons</p> <ul style="list-style-type: none"> • Molecular structure of benzene and toluene • Electrophilic aromatic substitution with its mechanism: <ul style="list-style-type: none"> ➤ Nitration ➤ Sulphonation ➤ Halogenation ➤ Friedel-Crafts reactions <ul style="list-style-type: none"> ✓ Alkylation ✓ Acylation • Directing effects of the groups <ul style="list-style-type: none"> ➤ o-p directing ➤ m-directing • Aromaticity <ul style="list-style-type: none"> ➤ Huckel rule ➤ Criteria for Aromatic, Non-Aromatic and Anti-Aromatic compounds <p>Polynuclear Aromatic Hydrocarbons</p> <ul style="list-style-type: none"> • Introduction • Classification of poly nuclear aromatic hydrocarbons • Synthesis and properties and application of : <ul style="list-style-type: none"> ➤ Biphenyl ➤ Diphenyl methane ➤ Naphthalene ➤ Anthracene 	
Unit-II: Functional Group Chemistry	12 hrs
<p>Alkenes, Alkynes, Dienes</p> <ul style="list-style-type: none"> • Alkenes : <ul style="list-style-type: none"> ➤ Nomenclature ➤ Preparation <ul style="list-style-type: none"> ✓ Dehydration of Alcohol ✓ Dihydro halogenation of Alkyl Halide ➤ Physical properties ➤ Chemical properties ➤ Polymerization ➤ Markovnikov's – Anti Markovnikov's – Saytzeff rule • Alkynes : <ul style="list-style-type: none"> ➤ Preparation ➤ Physical & Chemical properties ➤ Polymerization 	

<ul style="list-style-type: none"> ● Dienes : <ul style="list-style-type: none"> ➤ Classification ➤ Preparation ➤ Diels – Alder reaction ➤ Addition reaction (1:2 & 1:4)for 1,3 butadiene 	
Unit- III: Properties of Solution	10 hrs
<p>Dilute Solutions and Colligative Properties</p> <ul style="list-style-type: none"> ● Introduction ● Types of solution ● Factors affecting on solution ● Colligative properties <ul style="list-style-type: none"> ➤ Raoult’s law and its derivation ➤ Determination of molecular mass by: <ul style="list-style-type: none"> ✓ lowering of vapour pressure ✓ Boiling point elevation ✓ Depression in freezing point ✓ Osmotic pressure ➤ Numerical 	
Unit- IV: Chemical Equilibrium & Chemical Kinetics	12 hrs
<p>Chemical Equilibrium</p> <ul style="list-style-type: none"> ● Introduction ● Nature , criteria & Characteristics of chemical equilibrium ● Law of active masses ● Thermodynamic derivation of relations between the various equilibrium constants K_p, K_c and K_x. ● Heterogeneous and homogeneous equilibrium ● Le Chatelier’S principle ● Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. <p>Chemical Kinetics</p> <ul style="list-style-type: none"> ● Introduction ● Order and molecularity of reaction ● Derivation, Characteristics, Half life time & Examples of <ul style="list-style-type: none"> ➤ Zero order reaction ➤ First order reaction ➤ Second order reaction ➤ Pseudo Unimolecular reaction ● Method for determining the order of reaction: <ul style="list-style-type: none"> ➤ Graphical method ➤ Ostwald’s isolation method ➤ Method of half-life period 	

<ul style="list-style-type: none"> ➤ Integration method ➤ Energy of Activation ➤ Numerical • Theories of Reaction Rate <ul style="list-style-type: none"> ➤ Collision Theory of molecule 	
Unit- V: Colloidal State	13 hrs
<p>Colloidal State</p> <ul style="list-style-type: none"> • Introduction • Classification of colloidal solutions • Characteristics of hydrophilic and hydrophobic sols • Emulsification and de-emulsification • Preparation of colloidal solution : <ul style="list-style-type: none"> ➤ Lyophilic solution ➤ Lyophobic solution • Preparation methods: <ul style="list-style-type: none"> ➤ Condensation method: ➤ Double decomposition ➤ Hydrolysis ➤ Reduction ➤ Oxidation Exchange of solvent • Dispersion methods: <ul style="list-style-type: none"> ➤ Bredig's Arc method ➤ Grinding ➤ Peptization. • Purification of colloidal solution : <ul style="list-style-type: none"> ➤ Dialysis ➤ Ultra filtration ➤ Ultra centrifuging • Properties of colloidal solutions: <ul style="list-style-type: none"> ➤ Optical properties ➤ Tyndall effect ➤ Brownian effect • Electrical properties: Electrical Double Layer Charge, Electrophoresis, Electro-osmosis. • The Protective colloid (gold number) • Applications 	

Pedagogic tools:

- Chalk and Board
- Power point presentation
- Seminar
- Videos

Text books:

- Bansal, Raj K. (2009, 5th edition) *A Textbook of Organic Chemistry*. New Delhi: New Age International (ISBN: 978-81-224-2025-8).
- Bahl, Arun; Bahl, B. S.; Tuli, G. D. (2010) *Essential of Physical Chemistry*. New Delhi : S. Chand (ISBN No. 81-219-2978-4)

Reference books:**Suggested reading / E-resources:**

1. <https://www.extension.harvard.edu/academics/courses/introduction-chemistry>
2. <https://libguides.reading.ac.uk/chemistry/e-resources>
3. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=5>
4. <http://library.iiti.ac.in/>

Suggested MOOCs:

1. https://swayam.gov.in/nc_details/NPTEL

Methods of Assessment & Tools:

Components of CIA: 30 marks

Sr. No.	Component	Content	Duration (if any)	Marks	Sub Total
A	Test 1	1 st 2 units	1 ^{1/2} hours	5 (Set for 30)	20
	Test 2	All 5 units	3 hours	15 (Set for 70)	
B	Assignment		2 Assignments	05	10
C	Class activity			05	
Grand Total					30
Assignment		<ul style="list-style-type: none"> • Abstract and executive summary • Case study writing • Concept mapping • Student generated handbook • Essay writing etc... • Short Time-Online Course 			
Class activity		<ul style="list-style-type: none"> • Presentation (PPT, Poster, Chart) • Seminar • Quiz • Model Making • Think Pair Share • Free writing • Class test • Debate/ Group Discussion • Open Book Test • Class test 			

Note: Any other assessment tools or methods can be adopted as per requirement of the course.

Discipline Specific Course For the students admitted from A.Y. 2021-2022 & onwards		
Offering Department: Chemistry	Offered to: B.Sc. Chemistry	
Semester - II		
Course Code	Course Title	Course Credit and Hours
21UCHCC203	Core Practical 2: Combined Practical	4 Credits - 12 hrs/wk

Course Description:

This course on 'Fundamentals of Chemistry Practical' offers an opportunity to understand the important aspects of qualitative and quantitative chemical analyses through hands-on experiential learning. It assists in strengthening of contextual leanings and developing of experimental skills required to analyze intrinsic properties of organic & inorganic small molecules. The course includes kinetic studies of chemical reactions, analyses of water and food additives & adulterants. The course aims to address SDG No-4& 9: Quality education& Industry, innovation and Infrastructure.

Course Purpose:

This course aims to provide basic understanding of qualitative analyses of organic and inorganic small molecules. The course is designed in such a way that learners will undergo rigorous experimental activities like performing various types of quantitative tests for metal ions and organic compounds. The fundamental purpose of the course is to make learners observe ongoing physico-chemical transformations attentively and infer results from the interweaving of observations with information. Students will be able to identify and quantify adulterations in food as well as water. This course is necessary to intertwine the foundational knowledge base with laboratory techniques to prepare students for careers as professionals in the field of applied chemistry.

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	CO Statement	Blooms taxonomy Level (K₁ to K₆)
CO ₁	Apply chemical tests on organic & inorganic small molecules for their qualitative analysis and identification.	K3
CO ₂	Select & perform titrimetric analysis of metal ions and organic compounds.	K2
CO ₃	Identify adulteration in food stuff and evaluate water quality as per international standards.	K3
CO ₄	Comprehend the rate and order of elementary chemical reactions.	K2
CO ₅	Perform scientific experiments and accurately record observation to infer results of the experiments.	K2

Course Content	Hours
Analytical Chemistry (12 – 16 experiments)	
<ul style="list-style-type: none"> ➤ Water Analysis <ul style="list-style-type: none"> • To determine amount of chlorides in given water sample. • To determine total hardness of water into given water sample. • To determine amount of alkalinity of water into given water sample. • To measure out amount of sulphates into given sample. • Estimation of amount of acidity of water into given water sample • Estimation of the amount of dissolved oxygen into given water sample • To determine chemical oxygen demand in given water sample • Estimation of the amount of calcium into given water sample. ➤ Food Analysis <ul style="list-style-type: none"> • To measure out saponification value of given oil sample. • To measure out iodine value of given oil sample. • To measure out acid value of given sample of oil. • To determine the amount of calcium in milk with EDTA. • To determine the amount of total carbohydrate in sample of beverages. ➤ Complexometric titration <ul style="list-style-type: none"> • To determine the amount of Cu^{+2} in given solution of $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ using 0.01M EDTA solution. • Estimation of the amount of Ni^{+2} in the given solution of $\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$ using 0.01M EDTA solution. • Estimation of amount of Zn^{+2} presents in the given solution of $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ using 0.01M EDTA solution. • Estimation of amount of Mg^{+2} presents in the given solution of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ using 0.01M EDTA solution. • Estimation of amount of Ca^{+2} presents in the given solution of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ using 0.01M EDTA solution. 	
Inorganic Chemistry (10-12 experiments)	
<ul style="list-style-type: none"> ➤ To perform Inorganic qualitative analysis of given unknown salt – Two Radicals. <ul style="list-style-type: none"> • Na^+, K^+, NH_4^+, Zn^{+2}, Mg^{+2}, Ba^{+2}, Sr^{+2}, Ca^{+2}, Ni^{+2}, Al^{+3}, Cl^-, Br^-, I^-, NO_2^-, NO_3^-, $\text{Cr}_2\text{O}_7^{2-}$, CrO_4^{2-}, CO_3^{2-}, SO_4^{2-}, SO_3^{2-}, S^{2-}, PO_4^{3-}, O^{2-}. 	
Organic Chemistry (10 – 12 experiments)	
<ul style="list-style-type: none"> • Organic Qualitative Analysis: Mono-functional ➤ To perform Organic qualitative analysis of given unknown organic substance <ul style="list-style-type: none"> ✓ Acetone ✓ Methanol ✓ Methyl Acetate ✓ Ethyl Acetate ✓ Aniline ✓ Nitrobenzene ✓ Chloro benzene ✓ Bromo benzene 	

<ul style="list-style-type: none"> ✓ Carbon tetra chloride ✓ Ethanol ✓ Chloroform ✓ Ethyl methyl ketone ✓ Benzaldehyde ✓ Acetanilide ✓ m-dinitro benzene ✓ Phthalic acid <p>➤ Organic Estimations</p> <ul style="list-style-type: none"> • To determine the amount of $-\text{CONH}_2$ in the given Acetamide solution. • To determine the amount of Aniline in the given solution. • To determine the amount of Ester in the given solution. • To determine the amount of glucose in the given solution. • To determine the amount of $-\text{COOH}$ in the given carboxylic acid. 	
Physical Chemistry (6 – 10 experiments)	
<p>➤ Colloidal solution:</p> <ul style="list-style-type: none"> • To estimate the coagulation force of KCl using FeCl_3 solution. • To estimate the coagulation force of K_2SO_4 using FeCl_3 solution. <p>➤ Chemical Kinetics:</p> <ul style="list-style-type: none"> • To determine the rate constant and kinetic parameters of acid catalyzed hydrolysis of methyl acetate. • To determine the kinetic parameters and the temp. Co-efficient of the reaction between $\text{K}_2\text{S}_2\text{O}_8$ and KI. • To determine the kinetic parameters and the temp. Co-efficient of the reaction between KBrO_3 and KI. • To determine order of the reaction by a fractional change method. • To determine heat and entropy of vaporization of a given liquid by kinetic approach. • To determine the reaction velocity constant for the reaction between acetone and iodine. • To determine the relative strength between HCl and by studying hydrolysis of methyl acetate catalyzed by acid. • To determine the temperature coefficient and energy of activation for the hydrolysis of ester at two different temperatures. <p>➤ Solubility:</p> <ul style="list-style-type: none"> • To determine the solubility of benzoic acid in water at different temperatures and its heat of solution. • To determine the solubility and heat of solution of benzoic acid in toluene. 	

Pedagogic tools:

- Laboratory Experiments
- Chalk and Board
- Video / Interactive E-resources

Text books:

- Jeffery, G. H.; Bassett, J.; Mendham, J.; Denny, R. C. (5th1989) *Vogel's Textbook of Quantitative Chemical Analysis*. Hoboken: John Willey & Sons (ISBN: 0-582-44693-7).
- Svehla, G. (1979, 5thedition) *Textbook of macro and semi micro qualitative analysis*. London: Longman Publishing group (ISBN: 0-582-44367-9)

Reference books:

1. Hassner, A. (2012, 3rdedition) *Organic Syntheses Based on Name Reactions*. Philadelphia: Elsevier Publishing company (ISBN: 978-0-08-096630-4).
2. Jeffery, G. H.; Bassett, J.; Mendham, J.; Denny, R. C. (1989, 5th edition) *Vogel's Textbook of Quantitative Chemical Analysis*. Hoboken: John Willey & Sons (ISBN: 0-582-44693-7).
3. Jerry R. Mohrig (2010, 3rdedition) *Techniques in Organic chemistry*. London: W. H. Freeman & Company (ISBN: 1-4292-1956-4).
4. Svehla, G. (1979, 5thedition) *Textbook of macro and semi micro qualitative analysis*. London: Logman Publishing group (ISBN: 0-582-44367-9).

Suggested reading / E-resources:

1. <https://www.extension.harvard.edu/academics/courses/introduction-chemistry>
2. <https://libguides.reading.ac.uk/chemistry/e-resources>
3. <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=5>
4. <http://library.iiti.ac.in/>

Suggested MOOCs:

1. https://swayam.gov.in/nc_details/NPTEL

Methods of Assessment & Tools:

Components of CIA: 40marks

Sr. No	CIA Component	Content	Duration	Marks	Total Marks
1	Test	After Completion of all Assessable Experiments	6 hrs	60 marks (2 Exercise of 30 marks)	30
2.	Observation book & Record	-	-	10	10
Total					40

Note: Any other assessment tools or methods can be adopted as per requirement of the course.

