



## B.Sc. Honours/ Honours with Research in Chemistry

(NCrF Level- 4.5 First Year – Certificate in Chemistry)

### Semester I

Course Category	<b>Minor-1</b> In addition to courses mentioned in SOP basket; Recommended for Physical Science, Mathematical Science, Life science Programs
Title of the Course	<b>Chemistry -1: Fundamental Chemistry-1</b>
Course Credit	<b>03</b>
Teaching Hours per Sem.	<b>45</b>
Total Marks	<b>75</b>

### Course Outcomes - COs

This course will provide abroad foundation in chemistry that stresses scientific reasoning and analytical problem solving capability with a molecular perspective.

**On completion of this course, the students will be able to understand;**

- Atomic Structure and Periodic Properties in general and Characteristics of S & P block elements
- This course gives a broader theoretical picture in multiple stages in an overall chemical reaction
- Reactive intermediates, transition states and states of all the bonds broken and formed.
- Basic principles of Organic chemistry and functional group base reactivity.
- Stereochemistry concepts like Configuration, Fischer projection formula, homomers and enantiomers, geometrical isomerism: cis–trans, C.I.P rules with E/Z notations.
- Chemistry & characteristic of Hydrocarbons
- Basic concept of Analytical chemistry

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ?				Yes/No	
2	Value added Courses Imparting Transferable and Life Skillsના ગુણો ધરાવે છે?				Yes/No	
3	Major	Yes/No	Minor		Yes/No	
	Skill Enhancement Courses	Yes/No	Ability Enhancement Courses		Yes/No	
	Value Added Courses	Yes/No	Exit/ Vocational Courses		Yes/No	
4	Holistic Education	Yes/No	Multidisciplinary	Yes/No	Interdisciplinary	Yes/No
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસંગિક જોગવાઈ કરાયેલ છે ?				Yes/No	
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?				Yes/No	
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ?				Yes/No	
8	ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?				Yes/No	



Unit No.	Topics	Hrs	Mks
1	<b>Unit-I : Atomic Structure and Periodic Properties:</b> Dual nature of electron: de-Broglie's equation, Heisenberg's Uncertainty Principle, quantum numbers, Aufbau Principle, Pauli's Exclusion Principle and Hund's Rule for electron configuration. Periodicity in atomic properties and its causes, explanation of general trends of Periodic Properties in detail: Atomic size, Covalent & van der Waals radius, Atomic & Ionic radii, Ionization Potential, Electro negativity and Electron Affinity.	9	15
2	<b>Unit-II: Chemistry of s and p block elements:</b> Electronic configuration of s and p block elements, Special characteristics such as Metallic character, Electropositive character, Oxidizing & Reducing property, Polarizing power, Hydration energy, Inert pair effect, Relative stability of different oxidation state. Diagonal relationship of (1) lithium with magnesium (2) boron with silicon and (3) beryllium with aluminium. Anomalous behaviour of Li, Be, Formation of complex compounds, catenation, allotropy (diamond and graphite-their structure, properties and its uses)	9	15
3	<b>Unit-III: Basic Organic Chemistry and Aliphatic Hydrocarbons containing <math>\sigma</math>-bond:</b> Nomenclature of organic compounds (Only Acyclic-IUPAC-1993) Electronic displacements: Inductive effect, electromeric effect, mesomeric effect and hyper-conjugation. Applications of inductive effect to bond length, dipole-moment, reactivity of alkyl halides, relative strength of acid, basicity of amines Homolytic and heterolytic fission, curly arrow rules. Reaction Intermediates: Carbocation, carbanion, free radical, carbenes and benzynes (Formation by cleavage type, structure, relative stabilities, generation) Types of organic reagents: Nucleophiles and electrophiles. Types of organic reactions: Substitution, addition, elimination and rearrangement. Nucleophilic substitution reaction mechanism ( $SN^1$ & $SN^2$ ) for alkyl halides Introduction to stereochemistry: Configuration, Fischer projection formula, homomers and enantiomers, geometrical isomerism: cis-trans, C.I.P rules with E/Z notations.	9	15



4	<p><b>Unit-IV:Aliphatic Acyclic Hydrocarbons:</b></p> <p>Hydrocarbons containing Carbon-Carbon <math>\pi</math>bonds: Formation of alkene by Elimination reactions, dehydration of alcohol, dehydro halogenation of alkyl halide, dehalogenation of vicinal and geminal dihalides Mechanism of E1, E2, E1cb reactions, Saytzeff and Hofmann eliminations.</p> <p>Electrophilic addition reaction and its mechanism (Markownikov/Anti Markownikov rule)Reactions of alkenes: Hydroboration oxidation, Ozonolysis, Reduction (catalytic), Syn and anti-hydroxylation (oxidation), 1, 2- and 1,4 -addition reactions in conjugated dienes, Diels-Alderreaction.</p> <p>Formation of alkynes: Dehydro halogenation of vicinal and geminal dihalides, Dehalogenation of tetra halides Reactions of alkynes: Acidity, electrophilic addition reactions like halogenation, hydro halogenation, hydration, hydroboration, addition of carbene and catalytic hydrogenation.</p> <p>Nucleophilic addition with hydrogen cyanide and alcohol, hydration to form carbonyl compounds, alkylation of terminal alkynes.</p>	9	15
5	<p><b>Unit-V:Basic concepts of Analytical Chemistry:</b></p> <p>Definitions of analysis, determination, measurement, techniques and methods. Classification of analytical techniques. Choice of an analytical method - accuracy, precision, sensitivity, selectivity, method validation. Figures of merit of analytical methods and limit of detection (LOD), Limit of quantification (LOQ), linear dynamic range (working range).</p> <p>Definitions of Errors and treatment of analytical data: Limitations of analytical methods -Errors: Determinate and indeterminate errors, absolute error, relative error, minimization of errors. Definition of Statistical treatment of finite samples -mean, median, and range, standard deviation variance. Numerical problems.</p> <p>Brief of Basic laboratory practices, Sampling (solids and liquids), weighing, drying, dissolving. Acid treatment, Rules of work in analytical laboratory, General rule for performing quantitative determinations (volumetric and gravimetric).</p> <p>Safety in Chemical laboratory, Rules of fire prevention and accidents, First aid. Precautions to be taken while handling toxic chemicals, concentrated/fuming acids and organic solvents.</p>	9	15



## Reference Books:

- UGC Inorganic Chemistry–Volume-I H.C.Khera (Pragati Prakashan).
- Concise Inorganic Chemistry -J.D.Lee.
- Coordination Chemistry-Gurdeep Chatwal and M.S.Yadav.
- Advanced Inorganic Chemistry by S.K.Agarwal & KeemtiLal(A Pragati Edition)
- Organic Reaction Mechanism, including Reaction Intermediates, , V. K. Ahluwalia, Ane's Chemistry active series
- Organic Chemistry, Vol-1, by Sultanat, Ane's Student Edition, Ane Book Pvt Ltd
- Undergraduate Organic Chemistry, Vol-1, Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan, 8<sup>th</sup> edition-2013
- Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli and Arun Bahl, S. Chand & Co. New Delhi
- Elements of Physical Chemistry, B. R. Puri, L. R. Sharma and Madan Pathania, Vishal Publishing Co. Jalandhar.
- Physical Chemistry, B.K. Sharma, Goel Publication House, Meerut.
- Chemical Kinetics, G.R. Chatwal and Harish Mishra, Goel Publication House, Meerut.
- Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons, 1989.
- Willard, H. H., Merritt, L.L., Dean, J. & Settle, F.A. Instrumental Methods of Analysis, 7<sup>th</sup>Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
- Christian, G.D; Analytical Chemistry, VI Ed. John Wiley & Sons, New York, 2004.
- Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
- Skoog, D. A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed, 2017.

## Pedagogic tools:

- Chalk and Board
- Power point presentation
- Video
- As per facilitator's choice

## Suggested MOOCs: Swayam-NPTEL