



### Courses Offered by BoS - Chemistry to other FYUGP- B.Sc. Program in Semester-II

SN	Course Category As per GoG- NEP- SOP - July 2023 & additional content 28/7/23	Course Title	Credit			Hrs./ Wk.		Evaluation - Weightage CCE: SEE = 50:50				
			T	P	Total	T	P	CCE Marks		SEE Marks		Total Marks
								T	P	T	P	
1	<b>Minor (Elective)-2</b> (Chemistry) (In addition to courses mentioned in SOP basket; Recommended for Physical Science, Mathematical Science, Life science Programs)	<b>Chemistry-2:</b> Fundamental Chemistry-2 (4- Credit Course including Theory & Practical components)	3	1	4	3	2	25	25	50	-	100
2	<b>Multi/Inter - Disciplinary Course -2</b> (MDC/IDC-2) (Elective) (In addition to courses mentioned in SOP basket; Recommended for Physical Science, Mathematical Science, Life science Programs)	<b>Chemistry:</b> Introduction to Basic Chemistry-2 (4- Credit Course including Theory & Practical components)	3	1	4	3	2	25	25	50	-	100

### B.Sc. Honours/ Honours with Research in Chemistry (NCrF Level- 4.5 First Year – Certificate in Chemistry) Semester II

Course Category	<b>Minor-2</b> In addition to courses mentioned in SOP basket; Recommended for Physical Science, Mathematical Science, Life science Programs
Title of the Course	<b>Chemistry -2: Fundamental Chemistry-2</b>
Course Credit	<b>03</b>
Teaching Hours per Sem.	<b>45</b>
Total Marks	<b>CCE- 25 + SEE- 50</b>

#### Course Outcomes - COs

**Course out comes:** This course will provide a broad 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:**

- Electronic configuration, physical, spectral, magnetic and catalytic properties of first transition element 3D-series.
- Coordination complex theory, various ligands, geometry of complex and structural/stereo isomerism in complexes



- Water quality, type, effect and treatment.
  - Preparation , Properties and Reactions of Alkyl & Aryl Halides
  - Types of electrolytes, degree of dissociation and factors affecting degree of dissociation Ionic product of water, dissociation constants of weak acids and bases
  - Common ion effect and calculation of concentrations, Solubility and solubility products of sparingly soluble salts and Applications of solubility product principle
  - Hydrolysis of salts: Definition of hydrolysis of salts, Salts of strong acids and bases.
  - Buffersolutions:Definitionandtypesofbuffersolutions,Bufferaction
- The course will also strengthen the problem solving capacity of students.

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	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?				Yes/No	

Unit No.	Topics	Hrs	Mks
1	<p><b>UNIT-1: Chemistry of elements of 3d series</b> Introduction, definition, electronic configuration, reversal of energies of 3d and 4s orbitals,</p> <p>Physical properties such as atomic properties (atomic radii, Ionic radii, and ionization potential), metallic conductivity, reducing properties, tendency of formation of alloys, catalytic properties and magnetic properties.</p> <p>Calculation of spin only magnetic momentum of inner orbital and outer orbital complexes <math>[\text{NiCl}_4]^{-2}</math>, <math>[\text{Ni}(\text{CN})_4]^{-2}</math>, <math>[\text{FeF}_6]^{-4}</math>, <math>[\text{Fe}(\text{CN})_6]^{-4}</math></p>	9	10



2	<p><b>UNIT- 2: Basics of Co-ordination Chemistry</b> Werner theory, types of ligands (simple ligands, <math>\pi</math>-acid ligands, according to number of donating electrons, chelating ligands) with definition and examples</p> <p>Co-ordination number and geometry related to co-ordination number. Isomerism and its classification (structural &amp; stereo isomerism)</p> <p>Structural isomerism: (a) ionization (b) hydration (c) co-ordination (d) co-ordination positions</p> <p>Geometric/cis-trans-isomerism in <math>ML_4</math> and <math>ML_6</math> types of complexes</p>	9	10
3	<p><b>UNIT-3: Alkyl and Aryl Halides</b></p> <p><b>Alkyl Halide:</b> Nomenclature &amp; Classification Preparation of Monohaloalkanes – From Alkene, From Alcohols, From Monocarboxylic acid (Hunsdiecker Reaction), From Alkyl halide (Finkelstein Reaction). Physical Properties of Haloalkane Nucleophilic Substitution reaction of Alkyl halide – Reaction with Moist Silver oxide, Sodium Alkoxides, Ammonia or Amines, Alkaline KCN &amp; AgCN, Potassium hydrogen Sulphide, Alkali metal sulphides, Metallic Alkynides Dihaloalkanes : Gem &amp; Vicinal, Preparation of Gem Dihalide from Alkynes &amp; Carbonyl compounds, Preparation of Vicinal Dihalide From Alkynes &amp; Vicinal Diols Introduction of Polyhaloalkanes : Haloforms, Tetrahaloalkanes &amp; Chlorofluoro Carbons (CFS's)</p> <p><b>3</b> Acidic Character of Haloform &amp; Relative acidity of Haloforms Reaction of Haloform - Hydrolysis, Addition reaction with Ketones, Reaction with Alkali (Dichlorocarbene preparation), Reduction, Oxydation Introduction to Unsaturated Halides : Vinyl Halide &amp; Allyl Halides</p> <p><b>Aryl Halide:</b> Preparation (by direct halogenation, from diazonium salts) Physical Properties of Aryl Halides; Chemical Reactions of Aryl Halides: Nucleophilic aromatic substitution <math>S_NAr</math> (Benzyne mechanism or Elimination- Addition mechanism) Reactions of Aryl halides: Wurtz-Fittig and Fittig reaction, Ullmann reaction, Formation of Organometallic Compounds</p> <p>Relative reactivity of alkyl halides vs allyl, vinyl, and aryl halides towards nucleophilic substitution reactions.</p>	9	10
4	<p><b>UNIT- 4: Water Treatment</b> Introduction, Hard water &amp; Soft water, Type, Method of expression &amp; Units of hardness of hard water.</p>	9	10



	<p>Estimation of hardness of water by EDTA method with example</p> <p>Water Softening Process: 1. Sodalime 2. Permutit 3. Ion exchange 4. Reverse Osmosis.</p> <p>Treatment of Drinking water: 1. Sedimentation 2. Coagulation 3. Filtration 4. Sterilization by Chlorination</p> <p>Numerical related to Interconversion of Units &amp; total hardness</p>		
5	<p><b>UNIT-5: Ionic Equilibrium</b></p> <p>Types of electrolytes, degree of dissociation and factors affecting degree of dissociation</p> <p>Ionic product of water, dissociation constants of weak acids and bases</p> <p>Common ion effect and calculation of concentrations of OH<sup>-</sup> ions (NH<sub>4</sub>Cl+NH<sub>4</sub>OH) and H<sup>+</sup> ions (H<sub>2</sub>S+HCl),</p> <p>Solubility and solubility products of sparingly soluble salts. Applications of solubility product principle (solubility, whether precipitate out, salt out, and inorganic qualitative analysis)</p> <p>Hydrolysis of salts: Definition of hydrolysis of salts, Salts of strong acids and bases. Relation among K<sub>h</sub>, K<sub>a</sub>, or K and K<sub>w</sub>.</p> <p>Degree of hydrolysis and pH of the solution of salts of weak acids and strong bases, salts of weak bases and strong acids and salts of weak bases and weak acids.</p> <p>Buffer solutions: Definition and types of buffer solutions, Buffer reaction, Derivation of Henderson-Hassel Balch equation</p> <p><b>Numerical</b></p>	9	10

## Reference books

- UGC Inorganic Chemistry– Volume-III. C. Khera (Pragati Prakashan)
- Coordination Chemistry- Gurdeep Chatwal and M.S. Yadav
- Advanced Inorganic Chemistry by S.K. Agarwala & Keemti Lal (A Pragati Edition)
- Concise of Inorganic Chemistry- J. D. Lee
- 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.
- 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

### Pedagogic tools:

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

### Suggested MOOCs: SWAYAM-NPTEL



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

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

### Semester II

Course Category	<b>Minor Practical -2</b> In addition to courses mentioned in SOP basket; Recommended for Physical Science, Mathematical Science, Life science Programs
Title of the Course	<b>Chemistry -2P: Fundamental Chemistry-2 Practical</b>
Course Credit	<b>01</b>
Teaching Hours per Sem.	<b>30</b>
Total Marks	<b>CCE- 25</b>

#### Course Outcomes - COs

**Course outcomes:** 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 perform/do independently:**

- Determine various parameters of Water
- Determine the strength of various Redox titrants
- Determine the strength of commercial chemicals Volumetrically

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ?	Yes/No				
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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		
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5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક 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				
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## Minor Practical-2

### Exercise-I: Water Analysis

- pH & Conductivity
- Acidity
- Alkalinity
- Temporary, Permeant and Total Hardness

### Exercise-II: Complexometric Analysis

- Quantitative estimation of  $\text{Cu}^{2+}$  in a given  $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$  solution using 0.01M EDTA solution
- Quantitative estimation of  $\text{Ni}^{2+}$  in a given  $\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$  solution using 0.01M EDTA solution
- Quantitative estimation of  $\text{Zn}^{2+}$  in a given  $\text{ZnCl}_2$  solution using 0.01M EDTA solution
- Quantitative estimation of  $\text{Fe}^{2+}$  by dichromate method (Internal indicator method)

### Exercise-III: Industrial analysis

- Determination of acetic acid in a commercial vinegar using 0.1M NaOH solution
- Determination of alkali in antacid using 0.1M HCl solution
- To Estimate Vitamin C by titrimetric method.
- To determine amount of bleach / bleaching powder by thiosulphate titrimetric method.
- To determine sodium carbonate in soda ash

### Reference Books:

- 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, 7th 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