



SHREE H. N. SHUKLACOLLEGE OF SCIENCE

(AFFILIATED TO SAURASHTRA UNIVERSITY)

Shree H.N. Shukla College Campus Nr. Lalpari lake, Behind old Marketing Yard,
Amargadh, Bhichari, Rajkot-360001, Ph. No-9727753360



SAURASHTRA UNIVERSITY



FACULTY OF SCIENCE

Course Structure and Syllabus for Science FYUGP

B.Sc. Honours/ Honours with Research in Chemistry

Based on

UGC's guidelines NEP-2020 "Curriculum and Credit Framework for
Undergraduate Programmes- CCFUP" and

Education Department, Government of Gujarat's
Uniform Credit Structure for all HEIs of Gujarat State and
Implementation of the Common Curriculum and Credit Framework under the
National Education Policy-2020

(No: KCG/admin/2023-24/0607/kh.1 Sachivalaya, Gandhinagar dated 11/07/2023) and

Standard Operating Procedure for Implementation of NEP-2020 for the State of
Gujarat- HEIs of Gujarat

(No: KCG/admin/2023-24/865/ dated 26/07/2023) and

Additional content to be added to SOP published by KCG

(No: KCG/NEP-2020/2023-24/893/ dated 28/07/2023)

General Guidelines for Implementation of **Four Year Under Graduate
Programmes** for Saurashtra University (16 pages) published in August 2023

(E-mail from Academic Section Saurashtra University dated Oct 11, 2023)

Effective from November –2023 & onwards

(Submitted on 23/11/2023)



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

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	Major (Core)-3 (Chemistry)	Chemistry -3: Fundamental Chemistry-3 (4- Credit Course including Theory & Practical components)	3	1	4	3	2	25	25	50	-	100	
2	Major (Core)-4 (Chemistry)	Chemistry -4: Fundamental Chemistry-4 (4- Credit Course including Theory & Practical components)	3	1	4	3	2	25	25	50	-	100	
3	Minor(Elective)*-2	(As per GoG- NEP- SOP July 2023& additional content 28/7/23 – Clause 3.3.2) Any One from Basket (As per the expertise and resources available in the college) (4- Credit Course including Theory & Practical components)	3	1	4	3	2	25	25	50	-	100	
4	Multi/Inter - Disciplinary Course -2 (MDC/IDC-1) (Elective)** 4- Categories: Natural & Physical Science/ Maths.,Stat.and Comp. Appl./Lib.,Info.and Media Sci./Comm. and Mgt./Huma., and Social Sci./ Sanskrit etc...	(As per GoG- NEP- SOP July 2023& additional content 28/7/23 – Clause 3.3.3) Any One from Basket (As per the expertise and resources available in the college) (4- Credit Course including Theory & Practical components)	3	1	4	3	2	25	25	50	-	100	
5	Ability Enhancement Course -2 (AEC-2)	(As per GoG- NEP- SOP July 2023& additional content 28/7/23 – Clause 3.3.4) English Language	2	-	2	2	-	25	-	25	-	50	



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6	Skill Enhancement Course-2 (SEC-2)	(As per GoG- NEP- SOP July 2023& additional content 28/7/23 – Clause 3.3.5) Skill based Practical Course-2: Analysis of Oils & Fats	-	2	2	-	4	-	25	-	25	50
7	Common Value Added Course-2 (C-VAC-2)*** NSS/NCC/ Sports & Fitness/ Ethics and Culture/ Culture and Communication/ Ethics and Values in Ancient Indian Traditions/ Human Values and Ethics/IPDC	(As per GoG- NEP- SOP July 2023& additional content 28/7/23 – Clause 3.3.6) Any One from Basket VAC based on IKS: NSS/NCC/Sports & Fitness/Human Values and Ethics	-	2	2	-	4	-	25	-	25	50
Total Credits and Marks (Semester-II)			14	08	22	14	16	125	150	225	50	550

* Any one course from the basket is to be selected as a Minor elective course as per the expertise and resources available in the college. The same course will continue as a Minor in the semester-II as well.

** Any one course from the basket is to be selected as Multi/Inter disciplinary elective courses (MDC/IDC) as per the expertise and resources available in the college. The same MDC/IDC course as selected in Sem.- I will be continued in the semester-II as well.

*** Common Value Added Elective Courses (C-VAC-2) common to all is to be selected from University Basket for semester 2, as per the expertise and resources available in the college.

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	Minor (Elective)-2 (Chemistry) (In addition to courses mentioned in SOP basket; Recommended for Physical Science, Mathematical Science, Life science Programs)	Chemistry-2: Fundamental Chemistry-2 (4- Credit Course including Theory & Practical components)	3	1	4	3	2	25	25	50	-	100
2	Multi/Inter - Disciplinary Course -2 (MDC/IDC-2) (Elective) (In addition to courses mentioned in SOP basket; Recommended for Physical Science, Mathematical Science, Life science Programs)	Chemistry: Introduction to Basic Chemistry-2 (4- Credit Course including Theory & Practical components)	3	1	4	3	2	25	25	50	-	100

SU-B.Sc.- H/HR in Chemistry Sem-2 S & S based on GoG SOP on NEP-2020 from 2023-24 & onwards

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Evaluation Scheme: (As per GoG- NEP-SOP July 2023& additional content 28/7/23 – Chapter-7: Evaluation Reforms)

The evaluation process should be formulated to make a systematic evaluation of students' progress based on UGC guidelines. The evaluation must be designed with learner attributes in mind. These attributes have clear linkages to Programme Education Objectives and Outcomes. The evaluation consists of the following two components:

1. Continuous and Comprehensive Evaluation (CCE)- Formative
2. Semester End Evaluation (SEE)- Summative

CCE carries 50% of the total marks allotted to a subject and the other 50% being assigned to the SEE.

In each course, every credit carries 25 marks, of which 50% marks is assigned for CCE and rest 50% marks for SEE. The 50% marks assigned to the CCE is distributed between the continuous classroom evaluation and mid-term evaluation. The pattern may be as follow:

SN	Evaluation	*T-3 + P-1 = Total 4 credit subjects (Marks)	2 credit subjects (Marks)
1	CCE (50%)		
	Classroom & Mid-Term Evaluation	T-25 + P- 25	25
2	SEE (50%)	50	25
	Total	100	50

*T = Theory; P= Practical

Continuous and Comprehensive Evaluation (CCE)

Subject-wise CCE will be undertaken by the concerned faculty member. The mode of evaluation will be decided by the faculty member concerned with the subject. Normally CCE consists of class participation, case analysis and presentation, assignment, tutorials, slip tests (announced/ surprised), quizzes, attendance etc. or any combination of these. The students are expected to submit their answer scripts/ reports of internal evaluation within the stipulated time. Failure to do so may result in the script not being valued. Another part of CCE consists of mid-term written evaluation, which is compulsory for all students. It can be done in a scheduled manner. The duration of the mid-term evaluation shall be one hour.

Semester End Evaluation (SEE)

The SEE carries 50% of the marks assigned to a course. SEE shall be of 2 ½ hours for 3/4 credit course and 2 hours in case of 1/2 credit courses. The controller of the examination will conduct these examinations. Paper setting and evaluation will be done by the external examiners to an extent of 50% of the evaluation process. This examination shall be conducted as per a schedule which shall be notified in advance.

The backlog exam will be conducted twice a year just after the result declared of the semester evaluation. Students shall have a second chance to clear their backlog and avoid the burden to carry forward the backlog with the next semester exam.



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Appearance in all the evaluations is mandatory and no exemption can be granted except in the following case:

1. In case of inability to attend the exam due to reasons considered genuine by the controller of examination in consultation with the Director/Board.
2. In case of medical emergency, a certificate from the registered medical practitioner must be produced before the commencement of exams. The evaluation board will then take final decision on the recommendation for exemption.

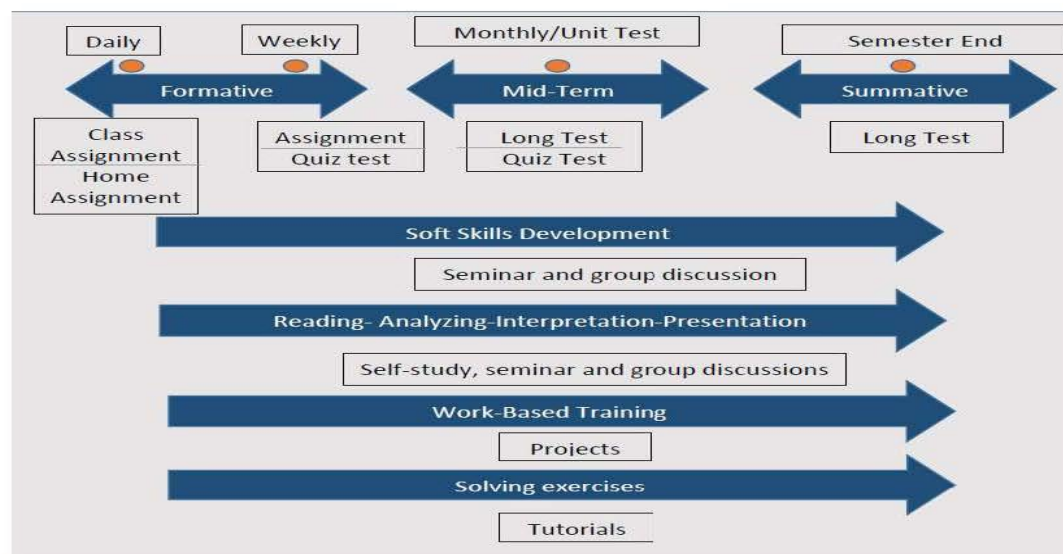
Eligibility Criteria to appear in SEE

To be able to appear for the SEE, a student must comply with the following conditions:

1. Should have at least 75% of attendance in all the courses put together.
2. Should have at least 70% of attendance in each course/subject.
3. Should not have any disciplinary proceedings pending against him/her.
4. Should have no pending due.

Continuum of Evaluation

Evaluation must be continuous which may include both formative and summative components in a timely manner for continuous feedback as follow:





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Model for Theory Courses- Theory-3+Practical-1 = 4 Credit Course	
CCE-50% (50 Marks) SEE-50% (50 Marks)	
Exam Pattern	Marks
Class Test (Average of TWO tests)	T-25 + P-25
Quiz (Average of TWO quiz)	
Home Assignment	
Active Learning- PBL/CSBL/Seminar/Flipped Class Room etc. OBE evaluation tools.	
Class Assignment	
Attendance	
Continuous and Comprehensive Evaluation	
Semester-End Evaluation	T-50

Model for Practical Courses-1 Credit Course	
CCE-100% (25 Marks)	
Exam Pattern	Marks
Lab work assessment	10
Viva voce/Lab quiz	10
Attendance	05
Continuous and Comprehensive Evaluation	25

Model for Skill Enhancement Course - Skill based Practical Course -2 Credit Course	
CCE-50% (25 Marks) SEE-50% (25 Marks)	
Exam Pattern	Marks
Lab work assessment or Project based Assessment	10
Viva voce/Lab quiz	10
Attendance& Performance	05
Continuous and Comprehensive Evaluation	25
Semester-End Evaluation	25



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

Semester II

Course Category	Major-3
Title of the Course	Chemistry -3: Fundamental Chemistry-3
Course Credit	03
Teaching Hours per Sem.	45
Total Marks	CCE- 25+ SEE- 50

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ?	Yes/No				
2	Value added Courses Imparting Transferable and Life Skillsનું 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				

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.
- Preparation, Properties and Reactions of Alkyl & Aryl Halides
- Principle, mechanism and applications of Named Organic Reactions and Reagents
- 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: Definition and types of buffersolutions, Buffer action

The course will also strengthen the problem solving capacity of students.



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Unit No.	Topics	Hrs	Mks
1	UNIT-1: Chemistry of elements of 3d series Introduction, definition, electronic configuration, reversal of energies of 3d and 4s orbitals, 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. Calculation of spin only magnetic momentum of inner orbital and outer orbital complexes $[\text{NiCl}_4]^{-2}$, $[\text{Ni}(\text{CN})_4]^{-2}$, $[\text{FeF}_6]^{-4}$, $[\text{Fe}(\text{CN})_6]^{-4}$	9	10
2	UNIT- 2: Basics of Co-ordination Chemistry Werner theory, types of ligands (simple ligands, π -acid ligands, according to number of donating electrons, chelating ligands) with definition and examples Co-ordination number and geometry related to co-ordination number. Isomerism and its classification (structural & stereo isomerism) Structural isomerism: (a) ionization (b) hydration (c) co-ordination (d) co-ordination positions Geometric/cis-trans-isomerism in ML_4 and ML_6 types of complexes	9	10
3	UNIT-3: Alkyl and Aryl Halides Alkyl Halide: Nomenclature & 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 & AgCN, Potassium hydrogen Sulphide, Alkali metal sulphides, Metallic Alkynides Dihaloalkanes : Gem & Vicinal, Preparation of Gem Dihalide from Alkynes & Carbonyl compounds, Preparation of Vicinal Dihalide From Alkynes & Vicinal Diols Introduction of Polyhaloalkanes : Haloforms, Tetrahaloalkanes & Chlorofluoro Carbons (CFS's) Acidic Character of Haloform & Relative acidity of Haloforms Reaction of Haloform - Hydrolysis, Addition reaction with Ketones, Reaction with Alkali (Dichlorocarbene preparation), Reduction, Oxydation	9	10



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	<p>Introduction to Unsaturated Halides : Vinyl Halide & Allyl Halides</p> <p>Aryl Halide: Preparation (by direct halogenation, from diazonium salts) Physical Properties of Aryl Halides; Chemical Reactions of Aryl Halides: Nucleophilic aromatic substitution S_NAr (Benzyne mechanism or Elimination- Addition mechanism) Reactions of Aryl halides: Formation of Organometallic Compounds Relative reactivity of alkyl halides vs allyl, vinyl, and aryl halides towards nucleophilic substitution reactions.</p>		
4	<p>UNIT-4: Name Reactions and Reagents</p> <p>Name Reactions: Principle, Mechanism and 02 Applications</p> <ul style="list-style-type: none">• Wurtz Reaction & Wurtz-Fittig Reaction• Ullmann reaction• Haloform Reaction• Diels-Alder Reaction <p>Oxidizing Reagents (Oxidants) - Only Formula and 02 Applications</p> <ul style="list-style-type: none">• Manganese Oxidants : $KMnO_4$, MnO_2• Chromium Oxidants : Chromic Acid, Na or K-Dichromates• Other Oxidants : Hydrogen Peroxides, Selenium Dioxide, Osmium Tetroxide, Periodic acid & Nitric acid	9	10
5	<p>UNIT-5: Ionic Equilibrium</p> <p>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 of OH^- ions (NH_4Cl+NH_4OH) and H^+ ions (H_2S+HCl), Solubility and solubility products of sparingly soluble salts. Applications of solubility product principle (solubility, whether precipitate out, salt out, and inorganic qualitative analysis) Hydrolysis of salts: Definition of hydrolysis of salts, Salts of strong acids and bases. Relation among K_h, K_a, or K_b and K_w. 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. Buffer solutions: Definition and types of buffer solutions, Buffer reaction, Derivation of Henderson-Hassel Balch equation Numerical</p>	9	10



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Reference books

1. UGC Inorganic Chemistry– Volume-III.H.C.Khera (Pragati Prakashan)
2. Coordination Chemistry-Gurdeep Chatwal and M.S.Yadav
3. Advanced Inorganic Chemistry by S.K.Agarwala & KeemtiLal (APragatiEdition)
4. Concise of Inorganic Chemistry-J. D. Lee
5. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli and ArunBahl, S. Chand & Co.New Delhi
6. Elements of Physical Chemistry, B. R. Puri, L. R. Sharma and Madan Pathania, Vishal Publishing Co. Jalandhar.
7. Physical Chemistry, B. K. Sharma, Goel Publication House, Meerut.
8. Organic Reaction Mechanism, including Reaction Intermediates, V.K. Ahluwalia, Ane's Chemistry active series.
9. Organic Chemistry, Vol-1, by Sultanat, Ane's Student Edition, Ane Book Pvt Ltd
10. Undergraduate Organic Chemistry, Vol-1, Jagdamba Singh, L.D.S.Yadav, Pragati Prakashan, 8th edition-2013

Pedagogic tools:

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

Suggested MOOCs: SWAYAM-NPTEL



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Semester II

Course Category	Major Practical -3
Title of the Course	Chemistry -3P: Fundamental Chemistry-3 Practical
Course Credit	01
Teaching Hours per Sem.	30
Total Marks	CCE- 25

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				
2	Value added Courses Imparting Transferable and Life Skills ના 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				



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Major Practical-3

Exercise-I: Water Analysis

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

Exercise-II: Complexometric Analysis

- Quantitative estimation of Cu^{2+} in a given $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ solution using 0.01M EDTA solution
- Quantitative estimation of Ni^{2+} in a given $\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$ solution using 0.01M EDTA solution
- Quantitative estimation of Zn^{2+} in a given ZnCl_2 solution using 0.01M EDTA solution
- Quantitative estimation of 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



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Semester II

Course Category	Major-4
Title of the Course	Chemistry -4: Fundamental Chemistry-4
Course Credit	03
Teaching Hours per Sem.	45
Total Marks	CCE- 25+ SEE- 50

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:

- Structure and forms of solids, various laws of crystallography and analytical methods of crystalline solids.
- Occurrence, Importance, Isolation, Electronic configuration, Physical & Chemical properties of Lanthanides
- Functional group based Organic chemistry wrt Alcohol, Phenol, Epoxides & Ethers
- Principle, mechanism and applications of Named Organic Reactions and Reagents
- Physical properties viz., Surface tension, Viscosity, Parachor, RI, Optical activity & Dipole moment

The course will also strengthen the problem solving capacity of students.

1	Employability/Entrepreneurship/Skill Development પરકેન્દ્રિતથયેલછેકેનહિ ?	Yes/No				
2	Value added Courses Imparting Transferable and Life Skillsનાગુણોધરાવેછે?	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	દિવ્યાંગમાટેવિષયઅંતર્ગતઆનુસાંગિકજોગવાઈકરાયેલછે ?	Yes/No				
6	New India Literacy Programme (NILP) મુજબનોવિષયછે?	Yes/No				
7	Swayam પ્લેટફોર્મપરના MOOC વિષયપરઆધારિતઆવિષયછે ?	Yes/No				
8	ઇન્ડિયનનોલેજસીસ્ટમ (IKS) પરઆધારિતવિષયછે ?	Yes/No				



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Unit No.	Topics	Hrs	Mks
1	UNIT-1: Solid State Forms of solids, unit cells, crystal systems, Bravais lattices Laws of crystallography:(1)Law of Symmetry,(2)Law of constancy of interfacial angles and (3)law of rational indices, Miller and Weiss indices, Bragg's law X-Ray diffraction methods: Rotating crystal method and Powder method Structures of NaCl and KCl, Numerical	9	10
2	UNIT-2: Basics of Lanthanide Elements Introduction, Position in the periodic table, Occurrence & Important ores, Isolation of Lanthanide Elements from ore, Individual Isolation by (I) Ion Exchange Method (II) Solvent Extraction Method, Electronics Configuration with necessary Explanation, Oxidation State & their Stability, Magnetic properties, Color. Isotopes, Spectral properties, Lanthanide Contraction, Misch Metal, Uses of Lanthanides & their Compounds.	9	10
3	UNIT-3: Alcohols, Phenol, Ethers and Epoxides Alcohols Preparation of Monohydric alcohols: From Grignard reagent; by reduction of aldehydes, ketones, carboxylic acid, and esters. Physical Properties of alcohols and Chemical Reactions: Reaction with sodium, with carboxylic acids (esterification), with acid chloride & anhydride; Reaction with HX, reaction with PX ₅ , PX ₃ , SOCl ₂ Dehydration of alcohols and Oxidation (with alkaline KMnO ₄ , acidic dichromate conc. HNO ₃) Distinction between Primary, secondary & tertiary alcohols: Lucas test, Victor Meyer Test Phenol : Physical properties; Acidity and factors affecting it; Electrophilic substitution Reactions (Nitration, Halogenation & Sulphonation), Ethers : Preparation of Ethers by Williamson Synthesis; Reactions: Substitution Reaction [Reaction with Cl ₂ in dark & Reaction of Cl ₂ in light], Reactions involving C-O bond cleavage [hydrolysis, reaction with H ₂ SO ₄ , cold HI & hot HI] Epoxides : Reactions of epoxides with alcohols, ammonia derivatives and LiAlH ₄ .	9	10
4	UNIT-4: Name Reactions and Reagents Name Reactions: Principle, Mechanism and 02Applications <ul style="list-style-type: none">• Aldol Condensation• Pechmann Condensation• Benzidine Rearrangement• Chinchibabin Reaction	9	10



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	Reducing Reagents - Only Formula & 02 Applications <ul style="list-style-type: none">• LiAlH_4, NaBH_4• Di isobutyl aluminium hydride – DiBAL- H• BH_3• Na or Li – NH_3		
5	UNIT-5: Study of Physical Properties <p>Introduction, Types of Physical Properties: Additive and Constitutive Properties</p> <p>Molar Volume: Kopp's Law, Atomic Volume</p> <p>Surface Tension: Explanation of Surface Tension, Name of Methods to Determine Surface Tension, The Drop Weight Method</p> <p>Parachor: Macleod Equation and $P_1/P_2 = V_1/V_2$, Atomic Parachor, To Determine Structure of (i) Quinine (ii) Benzene (iii) Isocyanides group (iv) Nitro group</p> <p>Viscosity: Explanation (Briefly), Unit and Factors Affecting the Viscosity, Measurement of Viscosity (Derivation of $\eta_1/\eta_2 = d_1t_1/d_2t_2$), Ostwald's Viscometer.</p> <p>Refractive Index and Refractivity: Introduction, Specific and Molecular Refractivity, Abbe Refractometer, Molecular Refractivity and Chemical Constitution.</p> <p>Optical Activity: Polarization of Light, Optical Activity, Factors Affecting Angle of Rotation, Specific Rotation</p> <p>Dipole Moment: Polar and Non-polar molecule</p> <p>The Mosotti Clausious Equation, Kinds of Molar Polarization [Electron & Nuclear Polarization, Orientation Polarization (Permanent Dipole Moment)];</p> <p>Application of Dipole Moment: Identification of Polar and Non- polar molecules,</p> <p>Molecular Structure :(i) Mono-atomic molecules, (ii) Diatomic molecules (iii) Triatomic molecules (CO_2, H_2O, SO_2) (iv) Tetratomic molecules (NH_3, BCl_3) (v) Aromatic Compounds (Benzene) (vi) Resonance Structure (N_2O) (vii) Cis-Trans Isomer (viii) Orientations in Organic Molecules (o, m and p substitution)</p> <p>Numerical</p>	9	10

Reference Books:

1. UGC Inorganic Chemistry– Volume-III.H.C.Khera (Pragati Prakashan)
2. Coordination Chemistry-Gurdeep Chatwal and M.S.Yadav



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3. Advanced Inorganic Chemistry by S.K. Agarwala & Keemti Lal (A Pragati Edition)
4. Concise of Inorganic Chemistry-J. D. Lee
5. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli and Arun Bahl, S. Chand & Co. New Delhi
6. Elements of Physical Chemistry, B. R. Puri, L. R. Sharma and Madan Pathania, Vishal Publishing Co. Jalandhar.
7. Physical Chemistry, B. K. Sharma, Goel Publication House, Meerut.
8. Organic Reaction Mechanism, including Reaction Intermediates, V.K. Ahluwalia, Ane's Chemistry active series.
9. Organic Chemistry, Vol-1, by Sultanat, Ane's Student Edition, Ane Book Pvt Ltd
10. Undergraduate Organic Chemistry, Vol-1, Jagdamba Singh, L.D.S. Yadav, Pragati Prakashan, 8th edition-2013

Pedagogic tools:

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

Suggested MOOCs: Swayam-NPTEL



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

Semester II

Course Category	Major Practical -4
Title of the Course	Chemistry -4P: Fundamental Chemistry-4 Practical
Course Credit	01
Teaching Hours per Sem.	30
Total Marks	CCE- 25

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:

- Identification of Inorganic salts having TWO radicals
- Preparation of various reagents

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ?	Yes/No				
2	Value added Courses Imparting Transferable and Life Skillsનું 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 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				
8	ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ?	Yes/No				



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Major Practical-4

Exercise:- Qualitative Analysis of Inorganic Salts:

(Minimum 12 / 15 Salts be given –containing TWO radicals)

Inorganic Soluble & Insoluble salts containing Cations viz., Group- I to V & Anions viz., Chloride, Bromide, Iodide, Nitrate, Nitrite, Sulphates, Sulphites, Sulphides, Carbonate, Phosphate (soluble & insoluble), Oxide, Chromate and Dichromate)

Reference Books:

- Vogel's Textbook of Inorganic Chemical Analysis, John Wiley & Sons, 1989.

Pedagogic tools:

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

Suggested MOOCs: SWAYAM-NPTEL



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

Semester II

Course Category	Skill Enhancement Course (SEC)-2 Skill based Practical Course-2; In addition to courses mentioned in SOP basket
Title of the Course	Analysis of Oils & Fats
Course Credit	02
Teaching Hours per Sem.	60
Total Marks	CCE-25 + SEE-25

Course Outcomes - COs

Course outcomes: This course will provide a broad foundation in analytical chemistry that stresses hands-on experiential skill development and analytical problem-solving capability with a laboratory perspective.

On completion of this course, the students will be able to:

- Analyze & evaluate the Oil Quality
- Create Analytical reports
- Outline the theoretical bases of the Analysis
- Compare different methods of Analysis
- Describe the basic principles of Instrument Operation

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ?	Yes/No				
2	Value added Courses Imparting Transferable and Life Skillsનું 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				



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Evaluation of Skill Enhancement Course - Skill based Practical Course:

Model for Practical Courses-2 Credit Course	
CCE-50% (25 Marks) SEE-50% (25 Marks)	
Exam Pattern	Marks
Lab work assessment	10
Viva voce/Lab quiz	10
Attendance	05
Continuous and Comprehensive Evaluation	25
Semester-End Evaluation- TWO/ THREE Exercise from Each Head – 1.5 hrs.	25

Skill Enhancement Course (SEC)-2 Skill based Practical Course-2
Theory & Analysis of Oils and Fats <ul style="list-style-type: none">➤ Determination of Specific Gravity➤ Determination of Refractive Index➤ Determination of Saponification Value➤ Determination of Unsaponifiable Matter➤ Determination of Acid Value➤ Determination of Iodine Value➤ Determination of Reichert Meissl and Polenske Value➤ Test for Sesame Oil (Baudouins Test)➤ Test for Cottonseed Oil (Halphens Test)➤ Test for presence of Rice Bran Oil➤ Test for presence of Linseed oil (Hexabromide Test)➤ Polybromide test for Mustard Oil➤ Detection of Rancidity➤ Detection of Argemone oil➤ Detection of Cottonseed oil➤ Detection of Karanjia Oil➤ Detection of Mineral Oil➤ Detection of Castor oil➤ Detection of mobile oil (Lube) in edible Oil➤ Detection of Adulteration in coconut oil➤ Detection of Vanaspati/Hydrogenated Edible Fat In Ghee

Reference Book/ Manual:

FSSAI- Manual of Methods of Analysis of Foods Oils & Fats, 2016

Pedagogic tools:

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

Suggested MOOCs: SWAYAM-NPTEL



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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	Minor (Elective)-2 (Chemistry) (In addition to courses mentioned in SOP basket; Recommended for Physical Science, Mathematical Science, Life science Programs)	Chemistry-2: Fundamental Chemistry-2 (4- Credit Course including Theory & Practical components)	3	1	4	3	2	25	25	50	-	100
2	Multi/Inter - Disciplinary Course -2 (MDC/IDC-2) (Elective) (In addition to courses mentioned in SOP basket; Recommended for Physical Science, Mathematical Science, Life science Programs)	Chemistry: 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	Minor-2 In addition to courses mentioned in SOP basket; Recommended for Physical Science, Mathematical Science, Life science Programs
Title of the Course	Chemistry -2: Fundamental Chemistry-2
Course Credit	03
Teaching Hours per Sem.	45
Total Marks	CCE- 25 + SEE- 50

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



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- 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.
 - Buffer solutions: Definition and types of buffer solutions, Buffer action
- 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 Skillsનું 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>UNIT-1: Chemistry of elements of 3d series 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 $[\text{NiCl}_4]^{-2}$, $[\text{Ni}(\text{CN})_4]^{-2}$, $[\text{FeF}_6]^{-4}$, $[\text{Fe}(\text{CN})_6]^{-4}$</p>	9	10



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2	<p>UNIT- 2: Basics of Co-ordination Chemistry Werner theory, types of ligands (simple ligands, π-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 & stereo isomerism)</p> <p>Structural isomerism: (a) ionization (b) hydration (c) co-ordination (d) co-ordination positions</p> <p>Geometric/cis-trans-isomerism in ML_4 and ML_6 types of complexes</p>	9	10
3	<p>UNIT-3: Alkyl and Aryl Halides</p> <p>Alkyl Halide: Nomenclature & 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 & AgCN, Potassium hydrogen Sulphide, Alkali metal sulphides, Metallic Alkynides Dihaloalkanes : Gem & Vicinal, Preparation of Gem Dihalide from Alkynes & Carbonyl compounds, Preparation of Vicinal Dihalide From Alkynes & Vicinal Diols Introduction of Polyhaloalkanes : Haloforms, Tetrahaloalkanes & Chlorofluoro Carbons (CFS's) Acidic Character of Haloform & 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 & Allyl Halides</p> <p>Aryl Halide: Preparation (by direct halogenation, from diazonium salts) Physical Properties of Aryl Halides; Chemical Reactions of Aryl Halides: Nucleophilic aromatic substitution S_NAr (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>UNIT- 4: Water Treatment Introduction, Hard water & Soft water, Type, Method of expression & Units of hardness of hard water.</p>	9	10



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	Estimation of hardness of water by EDTA method with example Water Softening Process: 1. Sodalime 2. Permutit 3. Ion exchange 4. Reverse Osmosis. Treatment of Drinking water: 1. Sedimentation 2. Coagulation 3. Filtration 4. Sterilization by Chlorination Numerical related to Interconversion of Units & total hardness		
5	UNIT-5: Ionic Equilibrium 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 of OH ⁻ ions (NH ₄ Cl+NH ₄ OH) and H ⁺ ions (H ₂ S+HCl), Solubility and solubility products of sparingly soluble salts. Applications of solubility product principle (solubility, whether precipitate out, salt out, and inorganic qualitative analysis) Hydrolysis of salts: Definition of hydrolysis of salts, Salts of strong acids and bases. Relation among K _h , K _a , or K _b and K _w . 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. Buffer solutions: Definition and types of buffer solutions, Buffer reaction, Derivation of Henderson-Hassel Balch equation Numerical	9	10

Reference books

12. UGC Inorganic Chemistry– Volume-III. C.Khera (Pragati Prakashan)
13. Coordination Chemistry-Gurdeep Chatwal and M.S.Yadav
14. Advanced Inorganic Chemistry by S.K.Agarwala & KeemtiLal (A Pragati Edition)
15. Concise of Inorganic Chemistry-J. D. Lee
16. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli and ArunBahl, S. Chand & Co. New Delhi
17. Elements of Physical Chemistry, B. R. Puri, L. R. Sharma and Madan Pathania, Vishal Publishing Co. Jalandhar.
18. Physical Chemistry, B. K. Sharma, Goel Publication House, Meerut.
19. Organic Reaction Mechanism, including Reaction Intermediates, V.K. Ahluwalia, Ane's Chemistry active series.
20. Organic Chemistry, Vol-1, by Sultanat, Ane's Student Edition, Ane Book Pvt Ltd
21. Undergraduate Organic Chemistry, Vol-1, Jagdamba Singh, L.D.S.Yadav, Pragati Prakashan, 8th edition-2013

Pedagogic tools:

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

Suggested MOOCs: SWAYAM-NPTEL



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B.Sc. Honours/ Honours with Research in Chemistry

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

Semester II

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

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				
2	Value added Courses Imparting Transferable and Life Skillsનું 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				



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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 Cu^{2+} in a given $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ solution using 0.01M EDTA solution
- Quantitative estimation of Ni^{2+} in a given $\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$ solution using 0.01M EDTA solution
- Quantitative estimation of Zn^{2+} in a given ZnCl_2 solution using 0.01M EDTA solution
- Quantitative estimation of 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.
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Reference Books:

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Pedagogic tools:

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

Suggested MOOCs: Swayam-NPTEL



SHREE H. N. SHUKLACOLLEGE OF SCIENCE

(AFFILIATED TO SAURASHTRA UNIVERSITY)

Shree H.N. Shukla College Campus Nr. Lalpari lake, Behind old Marketing Yard,
Amargadh, Bhichari, Rajkot-360001, Ph. No-9727753360



B.Sc. Honours/ Honours with Research in Chemistry

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

Semester II

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

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
- Functional group based Organic chemistry wrt Alcohol, Phenol & Ethers

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 Skillsનું 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				



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Unit No.	Topics	Hrs	Mks
1	UNIT-1: Chemistry of elements of 3d series Introduction, definition, electronic configuration, reversal of energies of 3d and 4s orbitals, 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. Calculation of spin only magnetic momentum of inner orbital and outer orbital complexes $[\text{NiCl}_4]^{-2}$, $[\text{Ni}(\text{CN})_4]^{-2}$, $[\text{FeF}_6]^{-4}$, $[\text{Fe}(\text{CN})_6]^{-4}$	9	10
2	UNIT- 2: Basics of Co-ordination Chemistry Werner theory, types of ligands (simple ligands, π -acid ligands, according to number of donating electrons, chelating ligands) with definition and examples Co-ordination number and geometry related to co-ordination number. Isomerism and its classification (structural & stereo isomerism) Structural isomerism: (a) ionization (b) hydration (c) co-ordination (d) co-ordination positions Geometric/cis-trans-isomerism in ML_4 and ML_6 types of complexes	9	10
3	UNIT-3: Alkyl and Aryl Halides Alkyl Halide: Nomenclature & 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 & AgCN, Potassium hydrogen Sulphide, Alkali metal sulphides, Metallic Alkynides Dihaloalkanes : Gem & Vicinal, Preparation of Gem Dihalide from Alkynes & Carbonyl compounds, Preparation of Vicinal Dihalide From Alkynes & Vicinal Diols Introduction of Polyhaloalkanes : Haloforms, Tetrahaloalkanes & Chlorofluoro Carbons (CFS's) Acidic Character of Haloform & Relative acidity of Haloforms	9	10



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	<p>Reaction of Haloform - Hydrolysis, Addition reaction with Ketones, Reaction with Alkali (Dichlorocarbene preparation), Reduction, Oxydation</p> <p>Introduction to Unsaturated Halides : Vinyl Halide & Allyl Halides</p> <p>Aryl Halide: Preparation (by direct halogenation, from diazonium salts) Physical Properties of Aryl Halides; Chemical Reactions of Aryl Halides: Nucleophilic aromatic substitution S_NAr (Benzyne mechanism or Elimination- Addition mechanism) Reactions of Aryl halides: Wurtz-Fittig and Fittig reaction, Ullmann reaction, Formation of Organometallic Compounds Relative reactivity of alkyl halides vs allyl, vinyl, and aryl halides towards nucleophilic substitution reactions.</p>		
4	<p>UNIT-3: Alcohols, Phenol, Ethers and Epoxides</p> <p>Alcohols Preparation of Monohydric alcohols: From Grignard reagent; by reduction of aldehydes, ketones, carboxylic acid, and esters.</p> <p>Physical Properties of alcohols and Chemical Reactions: Reaction with sodium, with carboxylic acids (esterification), with acid chloride & anhydride; Reaction with HX, reaction with PX_5, PX_3, $SOCl_2$ Dehydration of alcohols and Oxidation (with alkaline $KMnO_4$, acidic dichromate conc. HNO_3)</p> <p>Distinction between Primary, secondary & tertiary alcohols: Lucas test, Victor Meyer Test</p> <p>Phenol :Physical properties; Acidity and factors affecting it; Electrophilic substitution Reactions (Nitration, Halogenation & Sulphonation),</p> <p>Ethers: Preparation of Ethers by Williamson Synthesis</p> <p>Reactions: Substitution Reaction [Reaction with Cl_2 in dark & Reaction of Cl_2 in light], Reactions involving C-O bond cleavage [hydrolysis, reaction with H_2SO_4, cold HI & hot HI]</p>	9	10
5	<p>UNIT- 5: Water Treatment</p> <p>Introduction, Hard water & Soft water, Type, Method of expression & Units of hardness of hard water.</p> <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 & total hardness</p>	9	10



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Reference Books:

- Advanced Inorganic Chemistry by S.K. Agarwal & KeemtiLal (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
- 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
- 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, 7thEd. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
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Suggested MOOCs: Swayam-NPTEL



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

Semester II

Course Category	MDC/IDC Practical -2 In addition to courses mentioned in SOP basket; Recommended for Physical Science, Mathematical Science, Life science Programs
Title of the Course	Introduction to Basic Chemistry Practical-2
Course Credit	01
Teaching Hours per Sem.	30
Total Marks	CCE- 25

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				
2	Value added Courses Imparting Transferable and Life Skillsનું ગુણો ધરાવે છે?	Yes/No				
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	Skill Enhancement Courses	Yes/No	Ability Enhancement Courses	Yes/No		
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MDC/IDC Practical-2

Exercise-I: Water Analysis

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

Exercise-II: Complexometric Analysis

- Quantitative estimation of Cu^{2+} in a given $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ solution using 0.01M EDTA solution
- Quantitative estimation of Ni^{2+} in a given $\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$ solution using 0.01M EDTA solution
- Quantitative estimation of Zn^{2+} in a given ZnCl_2 solution using 0.01M EDTA solution
- Quantitative estimation of 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

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