



वसुधैव कुटुम्बकम्
ONE EARTH - ONE FAMILY - ONE FUTURE



SAURASHTRA UNIVERSITY

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નં.એકે/વિજ્ઞાન/૦૭૦૭ /૨૦૨૩

તા.૨૬/૦૭/૨૦૨૩

રસાયણશાસ્ત્ર

પરિપત્ર:-

આથી સૌરાષ્ટ્ર યુનિવર્સિટીની વિજ્ઞાન વિદ્યાશાખા હેઠળ સ્નાતક કક્ષાનાં B.Sc. (રસાયણશાસ્ત્ર) નાં અભ્યાસક્રમ ચલાવતી સર્વે સંલગ્ન કોલેજોનાં આચાર્યશ્રીઓને સવિનય જણાવવાનું કે, NEP-2020 અંતર્ગતનાં રાજ્ય સરકારશ્રીનાં તા.૧૧/૦૭/૨૦૨૩ નાં ઠરાવ મુજબનાં અભ્યાસક્રમો ચેરમેનશ્રી, રસાયણશાસ્ત્ર વિષયની અભ્યાસ સમિતિ દ્વારા રજુ કરાયેલ B.Sc. (રસાયણશાસ્ત્ર) સેમેસ્ટર-૦૧ અને ૦૨ નાં અભ્યાસક્રમો આગામી શૈક્ષણિક સત્ર જુન-૨૦૨૩ થી અમલમાં આવે તે રીતે રસાયણશાસ્ત્ર વિષયની અભ્યાસ સમિતિ, વિજ્ઞાન વિદ્યાશાખા, એકેડેમિક કાઉન્સિલ તથા સિન્ડિકેટની બહાલીની અપેક્ષાએ મંજૂર કરવા માન.કુલપતિશ્રીને ભલામણ કરેલ, જે માન.કુલપતિશ્રીએ મંજૂર કરેલ છે. જેથી સર્વે સંબંધિતોએ તે મુજબ તેનો અમલ કરવા વિનંતી.

(મુસદ્દો કુલસચિવશ્રીએ મંજૂર કરેલ છે.)

બિડાણ:- ઉક્ત અભ્યાસક્રમ (સોફ્ટ કોપી)

સહી/-
(એ.એસ.પારેખ)
કુલસચિવ

રવાના કર્યું
26/7/23
એકેડેમિક ઓફીસર

પ્રતિ,

- (૧) વિજ્ઞાન વિદ્યાશાખા હેઠળ રસાયણશાસ્ત્ર વિષય ચલાવતી સ્નાતક કક્ષાની સર્વે સંલગ્ન કોલેજોનાં આચાર્યશ્રીઓ તરફ.
- (૨) વિજ્ઞાન વિદ્યાશાખા હેઠળની રસાયણશાસ્ત્ર વિષયની અભ્યાસ સમિતિનાં સર્વે સભ્યશ્રીઓ

નકલ જાણ અર્થે સાદર રવાના:-

૧. માન.કુલપતિશ્રી / કુલસચિવશ્રીનાં અંગત સચિવશ્રી

નકલ રવાના (યોગ્ય કાર્યવાહી અર્થે) :-

૧. ડીનશ્રી, વિજ્ઞાન વિદ્યાશાખા
૨. પરીક્ષા વિભાગ
૩. પી.જી.ટી.આર.વિભાગ
૪. જોડાણ વિભાગ

SAURASHTRA UNIVERSITY



SYLLABUS B.Sc. CHEMISTRY
Semester I & II [CBCS / CCFUP]
Theory and Practical
[From June 2023-24]

Program Learning Outcomes:

The student graduating with the Degree B.Sc. (Honours) Chemistry should be able to acquire

1. **Core Competency:** Students will acquire core competency in the subject chemistry, and in allied subject areas with following competencies:
 - Systematic and coherent understanding of the fundamental concepts in Physical chemistry, Organic Chemistry, Inorganic Chemistry, Analytical Chemistry and all other related allied chemistry subjects.
 - Students will be able to use the evidence based comparative chemistry approach to explain the chemical synthesis and analysis.
 - The students will be able to understand the characterization of materials.
 - Students will be able to understand the basic principle of equipment, instruments used in the chemistry laboratory.
 - Students will be able to demonstrate the experimental techniques and methods of their area of specialization in Chemistry.
2. **Disciplinary knowledge and skill:** A graduate student is expected to be capable of demonstrating comprehensive knowledge and understanding of both theoretical and experimental/applied chemistry knowledge in various fields of interest like Analytical Chemistry, Physical Chemistry, Inorganic Chemistry, Organic Chemistry, Material Chemistry etc. Further, the student will be capable of using of advanced instruments and related software for in-depth characterization of materials/chemical analysis and separation technology.
3. **Skilled communicator:** The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.
4. **Critical thinker and problem solver:** The course curriculum also includes components that can be helpful to graduate students to develop critical thinking ability by way of solving problems/numerical using basic chemistry knowledge and concepts.
5. **Sense of inquiry:** It is expected that the course curriculum will develop an inquisitive characteristics among the students through appropriate questions, planning and reporting experimental investigation.
6. **Team player:** The course curriculum has been designed to provide opportunity to act as team player by contributing in laboratory, field based situation and industry.
7. **Skilled project manager:** The course curriculum has been designed in such a manner as to enabling a graduate student to become a skilled project manager by acquiring knowledge about chemistry project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.
8. **Digitally literate:** The course curriculum has been so designed to impart a good working knowledge in understanding and carrying out data analysis, use of library search tools, and use of chemical simulation software and related computational work.
9. **Ethical awareness/reasoning:** A graduate student requires understanding and developing ethical awareness/reasoning, which the course curriculum adequately provides.
10. **Lifelong learner:** The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability opportunity.

• **Graduate attributes for FOUR YEAR UNDER GRADUATE PROGRAM**

- **Academic excellence:** Ability to identify key questions, research and pursue rigorous evidence-based arguments
- **Critical Thinking and Effective communications:** Analysis and evaluation of information to form a judgement about a subject or idea and ability to effectively communicate the same in a structured form.
- **Global Citizenship:** Mutual understanding with others from diverse cultures, perspectives and backgrounds
- **Research-related skills:** the ability to understand basic research ethics and skills in practicing/doing ethics in the field/ in personal research work, regardless of the funding authority or field of study.
- **Leadership qualities and Teamwork abilities:** The graduates should be able to demonstrate the capability for mapping out the tasks of a team and setting direction and inspiring vision, and building a team that can help achieve the goals
- **Life Long Learning:** Open, curious, willing to investigate, and consider new knowledge and ways of thinking

PROGRAM EDUCATIONAL OUTCOMES (PEO):

This program will produce Graduates who will attain the following PEOs after a few years..

PEO ₁	Core competency	Understand and apply the fundamental core of chemistry to a broad variety of chemical problems.
PEO ₂	Breath of knowledge	Competent chemistry graduates with strong fundamental knowledge to cater the needs of GOs and NGOs related to chemical science domain.
PEO ₃	Preparedness	Demonstrate ability to use necessary tools & techniques of applied chemistry domain.
PEO ₄	Professionalism	Graduates who can work individually or in teams to interpret chemical literature and propose solutions for problems significant to industries and society as a whole.
PEO ₅	Learning environment	Inculcate the aptitude to engage in life- long learning from social, economic, and scientific activities of the time.

PROGRAM OUTCOMES (PO):

After completion of the FYUGP Chemistry, the Graduate will be able to:

PO ₁	Foundational Knowledge	Understand major concepts, theoretical principles and experimental findings in chemistry.
PO ₂		Conduct experiments, analyze data, and interpret results, while maintaining responsible and ethical scientific conduct.
PO ₃	Scientific Aptitude	Employ critical thinking and efficient problem-solving skills in the four basic areas of chemistry - organic, inorganic, analytical, and physical.
PO ₄		Exhibit awareness about safety and chemical hygiene regulations and good laboratory practices.

PO₅	Modern Tool Usage	Apply classical and minor instruments for chemical analysis and separation.
PO₆		Able to use computers and electronic resources for data management and retrieval.
PO₇		Communicate effectively in written and oral forms to transmit technical information in a clear and concise manner.
PO₈	Lifelong Learning	Comprehend and exhibit fundamental aspects of chemical sciences facilitating placement into PG programs, professional organizations, or other related job.
PO₉		Effectively work in diverse teams in all curricular, co-curricular and extra-curricular activities.
PO₁₀	Global Citizenship	Appraise and demonstrate Universal brotherhood

PROGRAM SPECIFIC OUTCOMES (PSO):

After completion of the program, the Graduate will...

PSO₁	Acquire knowledge on the fundamentals aspects of chemistry leading to functional understanding of emerging concepts and technologies in chemical sciences.
PSO₂	Able to pursue higher education and research in the institutes of national and international repute.
PSO₃	Apply conceptual knowledge of Chemistry to identify practical & innovative solutions for socio-economically relevant issues.
PSO₄	Demonstrate ability to skillfully utilize the chemical literature to identify existing problems and employ tools & techniques of applied chemistry for finding sustainable & ethical solutions.
PSO₅	Acquire the ability to engage in life- long learning in the broadest context of socio-technological changes.

B.Sc. CHEMISTRY

Semester I & II [CBCS/CCFUP]

Theory and Practical [Effective from June 2023-24 & onwards]

IMPORTANT GENERAL INSTRUCTIONS:

- The medium of instruction and examinations shall be English, except for courses in Languages other than English
- The syllabi / content of Theory & Practical courses of Minor &/or Multi/Inter -Disciplinary Course (MDC/IDC) will remain same as that of Major Core courses as the Nature, Level and credit Weightages of First year/ Certificate year are equal; for First Year only. A candidate admitted in other specialization/ other science discipline may select any one of the major courses- Theory & Practical as Minor &/or MDC/IDC courses based on the expertise and resources available in the college.
- Credits for Semester (15 Wks.) – I & II
 - Theory Course: 3 Credit (1 Credit = 1 Hr/Wk.)
 - Practical Course: 1/2 Credit (1 Credit = 2 Hr/Wk.)
- FYUGP Chemistry Theory Syllabus for Semester I & II consists of FIVE units each
- Total Marks for Chemistry Theory 100 i.e. 70 Marks Semester End Evaluation & 30 Marks Internal Assessment
- Equal Weightage is given to all the Units/Modules
- The Question paper should be drawn assigning equal weightage to all the Units
- Total marks for Chemistry Practical 50 i.e. 35 Marks Semester End Evaluation & 15 Marks Internal Assessment (IA= Assessment based on Attendance & Performance, Record Book & Journal and Experimental Results)
- The minimum passing standard for both the components is 40% i.e. Internal and Semester End Evaluation
- After successful completion of First Year B.Sc. and earning Minimum Credits including additional 04 credits as recommended by the University the UG Certificate in Chemistry be awarded; if Student takes exit as per UGC's CCFUP-Dec.2022 and KCG's CCCF.

EVALUATION

Components	Continuous Internal Assessment (CIA)	Semester End Evaluation (SEE)
Theory Courses	30 %	70 %
Practical Courses	30 %	70 %

Curriculum & Credit Framework

NCrF- Level 4.5: First Year FYUGP: Semester I & II (UG Certificate in Chemistry)

Semester – I							
SN	Course Category	Course Title	Credit	Hours	Exam Marks		
					IM	EM	Total
1	Major (Core) – 1 Chemistry	Chemistry-I	3	3	30	70	100
2	Major (Core) – 2 Chemistry	Chemistry-II	3	3	30	70	100
3	Major (Core) Practical – 1 Chemistry	Chemistry-P-I	1	2	15	35	50
4	Major (Core) Practical – 2 Chemistry	Chemistry-P-II	1	2	15	35	50
5	Minor (Electives) -1* Industrial Chemistry/ Maths/ Physics/ Computer Science/ Statistics/ Biochemistry/ Biotechnology/ Botany/ Zoology/Microbiology etc.	Any One (as per the expertise and resources available in the college)	3	3	30	70	100
6	Minor (Electives) Practical *-1 Industrial Chemistry/ Maths/ Physics/ Computer Science/ Statistics/ Biochemistry/ Biotechnology/ Botany/ Zoology/Microbiology etc.	Practical of the Course selected as Minor	1	2	15	35	50
7	Multi/Inter -Disciplinary Course** MDC/IDC - 1 – Industrial Chemistry/ Maths/ Physics/ Computer Science/ Statistics/ Biochemistry/ Biotechnology/ Botany/ Zoology/Microbiology etc	Any One (as per the expertise and resources available in the college)	3	3	30	70	100
8	Multi/Inter -Disciplinary Course** MDC/IDC Practical - 1 Industrial Chemistry/ Maths/ Physics/ Computer Science/ Statistics/ Biochemistry/ Biotechnology/ Botany/ Zoology/Microbiology etc	Practical of the Course selected as MDC/IDC	1	2	15	35	50
9	AECC –CS - English – 1	CS English-I	2	2	0	50	50
10	SEC- 1	Common Adulterants Testing in Food	2	4	50	0	50
11	CVAC-1***	IKS	2	2	50	0	50
TOTAL CREDITS			22	28			750

C = Credit, IM = Inter Exam Marks, EM = External Exam Marks

* Any one course is to be selected as **Minor course** as per the expertise and resources available in the College. The same course will continue as a **Minor** course in semester – II as well.

Any one course is to be selected as a **Multi/ Inter disciplinary courses (MDC/IDC) as per the expertise and resources available in the college. The same course will have to be continued as the MDC in semester II.

*** University will prepare a basket of **Value Added Courses (c-VAC)** common to all, from which the

college/department shall select the one for which the expertise and resources are available in the college.

Semester – II							
SN	Course Category	Course Title	Credit	Hours	Exam Marks		
					IM	EM	Total
1	Major (Core)– 3 Chemistry	Chemistry-III	3	3	30	70	100
2	Major (Core)– 4 Chemistry	Chemistry-IV	3	3	30	70	100
3	Major (Core) Practical – 3 Chemistry	Chemistry-P-III	1	2	15	35	50
4	Major (Core) Practical – 4 Chemistry	Chemistry-P-IV	1	2	15	35	50
5	Minor (Electives) -2* Industrial Chemistry/ Maths/ Physics/ Computer Science/ Statistics/ Biochemistry/ Biotechnology/ Botany/ Zoology/Microbiology etc.	Any One (as per the expertise and resources available in the college)	3	3	30	70	100
6	Minor Stream (Electives) Practical* –2 Industrial Chemistry/ Maths/ Physics/ Computer Science/ Statistics/ Biochemistry/ Biotechnology/ Botany/ Zoology/Microbiology etc.	Practical of the Course selected as Minor	1	2	15	35	50
7	Multi/Inter -Disciplinary Course** MDC/IDC - 2 – Industrial Chemistry/ Maths/ Physics/ Computer Science/ Statistics/ Biochemistry/ Biotechnology/ Botany/ Zoology/Microbiology etc	Any One (as per the expertise and resources available in the college)	3	3	30	70	100
8	Multi/Inter -Disciplinary Course** MDC/IDC Practical - 2- Industrial Chemistry/ Maths/ Physics/ Computer Science/ Statistics/ Biochemistry/ Biotechnology/ Botany/ Zoology/Microbiology etc	Practical of the Course selected as MDC	1	2	15	35	50
9	AECC –CS English – 2	CS English-II	2	2	0	50	50
10	SEC- 2	Analysis Oils & Fats	2	4	50	0	50
11	CVAC-2***	VAC	2	2	50	0	50
TOTAL CREDITS			22	28			750
Vocational Course/s for Exiting Students			04				

C = Credit, IM = Inter Exam Marks, EM = External Exam Marks

* Any one course is to be selected as **Minor course in Sem.-I** as per the expertise and resources available in the College. The same course will continue as a **Minor** course in semester – IV as well.

Any one course is to be selected as a **Multi/ Inter disciplinary courses (MDC/IDC) as per the expertise and resources available in the college. The same course will have to be continued as the MDC in semester III.

*** University will prepare a basket of **Value Added Courses (c-VAC)** common to all, from which the college/department shall select the one for which the expertise and resources are available in the college.

SEMESTER-I
SEMESTER-I: CHEMISTRY THEORY COURSE [DSC-CH-101]

3 - Credits: 100 Marks

Program/Class: Major (Core)	Year: First	Semester: First
Paper-I: DSC-CH-101	Theory Subject: Chemistry	
Course Code: DSC-CH-101	Course Title: Chemistry-I	

1.	Course Outcomes દરેક વિષયની શરૂઆતમાં દર્શાવેલ છે?: હા
2.	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?: હા
3.	Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
4.	Major: હા Minor: ના, Skill Enhancement Courses: ના, Ability Enhancement Courses: ના Value Added Courses: ના, Exit/Vocational Courses: ના
5.	Holistic Education: હા, Multidisciplinary: ના, Interdisciplinary: ના
6.	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસંગિક જોગવાઈ કરાયેલ છે? : હા
7.	New India Literacy Programme (NILP) મુજબનો વિષય છે?: ના
8.	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે?: હા
9.	ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે?: ના

Course outcomes: 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;

- 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

UNIT-1 : Atomic Structure and Periodic Properties

[9 Hours]

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,

Electronegativity and Electron Affinity.

UNIT-2 : Chemistry of s and p block elements

[9 Hours]

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 aluminum.

Anomalous behavior of Li, Be, Formation of complex compounds, catenation, allotropy (diamond and graphite-their structure, properties and its uses)

UNIT-3: Basic Organic Chemistry and Aliphatic Hydrocarbons containing σ -bond

[9 Hours]

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 benzyne (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 (S_N1 & S_N2) 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.

UNIT-4: Aliphatic Acyclic Hydrocarbons

[9 Hours]

Hydrocarbons containing Carbon-Carbon π 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.

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-Alder reaction.

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.

Nucleophilic addition with hydrogen cyanide and alcohol, hydration to form carbonyl compounds, alkylation of terminal alkynes.

UNIT-5: Basic concepts of Analytical Chemistry

[9 Hours]

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).

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.

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), 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.

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 & Keemti Lal (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, 8th 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, 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.

SEMESTER-I
CHEMISTRY PRACTICAL [DSC- CHP -101]

01-Credit: 50Marks

Program/Class: Major (Core)	Year: First	Semester :First
Paper-1 DSC-CHP-101 Practical	Subject: Chemistry Practical- I	
Course Code: DSC- CHP -101	Course Title: Practical -I	

1.	Course Outcomes દરેક વિષયની શરૂઆતમાં દર્શાવેલ છે?: હા
2.	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?:હા
3.	Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
4.	Major: હા Minor: ના, Skill Enhancement Courses: હા, Ability Enhancement Courses: હા Value Added Courses: ના, Exit/Vocational Courses: હા
5.	Holistic Education: હા, Multidisciplinary: ના, Interdisciplinary: હા
6.	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસંગિક જોગવાઈ કરાયેલ છે? : હા
7.	New India Literacy Programme (NILP) મુજબનો વિષય છે?: ના
8.	Swayamપ્લેટફોર્મ પરના MOOCવિષય પર આધારિત આ વિષય છે?: હા
9.	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે?: હા

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**:

- Calibration of glass wares and preparation & standardization of Solutions
- Determine the strength of various Acids- Bases and Oxidants- Reductants

Practical Examination:

- Total Marks : 50 Marks {35 Marks Semester End & 15 Marks Internal}
- Duration : 03 hrs.
- **Two** exercises to be performed each carrying 15 marks and 5 marks for Vivavoce / MCQ :

Exercise–I: Basic concepts of Volumetric Analysis

- Calibration of Glassware - Pipette, Burette, Measuring cylinder and Volumetric flask
- Preparation and Standardization of Solutions: Succinic acid, Oxalic acid, HCl, H₂SO₄, NaOH, KOH, Na₂CO₃, NaHCO₃, KMnO₄, K₂Cr₂O₇

Exercise–II: Volumetric Analysis - Acid-base titrations

- To prepare a solution by dissolving 'x' g NaHCO₃ /Na₂CO₃ in 100 ml solution and determine its concentration in terms of normality and molarity using 0.1 N HCl solution.
- To determine the normality, molarity and g/lit of NaOH and HCl using 0.1 N Na₂CO₃ solution.
- To determine the normality, molarity and g/lit of each component in a given mixture of NaHCO₃ and Na₂CO₃ using 0.1N HCl solution.

- To estimate Tartaric acid by Acid- base direct titration method.
- To estimate Salicylic acid by Acid- base direct titration method.

Exercise–III: Volumetric Analysis - Redox titrations

- To determine the normality, molarity and g/lit of each component in a mixture of $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ and H_2SO_4 using 0.1 N KMnO_4 and 0.1N NaOH solution.
 - To determine the normality, molarity and g/lit of each component in a mixture of $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ and $\text{K}_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$ using 0.1N NaOH and 0.1 N KMnO_4 solution
 - To determine the normality, molarity and g/lit of KMnO_4 and $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ solution using 0.1 N $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ solution.
 - To determine the normality, molarity and g/lit of $\text{FeSO}_4 (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$ and $\text{K}_2\text{Cr}_2\text{O}_7$ solutions using 0.1 N KMnO_4 solution.
 - To determine Fe^{+2} by $\text{K}_2\text{Cr}_2\text{O}_7$ method.
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SEMESTER-I
CHEMISTRY THEORY COURSE [DSC-CH-102]

3-Credits: 100Marks

Program/Class: Major (Core)	Year: First	Semester: First
Paper-2 : DSC-CH-102	Theory Subject: Chemistry	
Course Code: DSC-CH-102	Course Title: Chemistry-II	

1.	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?:હા
2.	Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
3.	Major: હા Minor: ના, Skill Enhancement Courses: ના, Ability Enhancement Courses: હા Value Added Courses: ના, Exit/Vocational Courses: ના
4.	Holistic Education: હા, Multidisciplinary: ના, Interdisciplinary: ના
5.	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસંગિક જોગવાઈ કરાયેલ છે? : હા
6.	New India Literacy Programme (NILP) મુજબનો વિષય છે?: હા
7.	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે?: હા
8.	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે?: હા
9.	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?:હા

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;

- Basic concepts of ionic compound and relevant equation and relationship between radius ratio, co-ordination number and crystal structure.
 - VB & MO theory of chemical bonding and Stereo chemistry and Energy level diagrams of molecules
 - Synthetic methods of preparation of alkanes and cycloalkanes. Chemical properties and conformational analysis of simple alkanes.
 - Aromaticity and electrophilic aromatic substitution reactions with their mechanism.
- The course will also strengthen the problem solving capacity of students.
- Basic concept and application of adsorption and catalysis

UNIT-1: Basics of Ionic compounds

[9 Hours]

Introduction, characteristics of ionic solids, Born Haber cycle and its application, MaxBornequation, limiting radius ratio.

Relation between radius ratio, co-ordination number and crystal structure

Derivation of r^+/r^- ratio in triangular, planar, square planar, body centered and tetrahedral crystal lattices.

Defects in ionic crystals (stoichiometric and non-stoichiometric), study of N&P types of semi-conductors

UNIT-2: Chemical bonding in covalent compounds**[9 Hours]**

Covalent bond: Valence bond theory and its limitations, Concept of hybridization: sp ($BeCl_2$), sp^2 (BF_3), sp^3 (SiH_4), sp^3d (PCl_5) and sp^3d^2 (SF_6).

Stereochemistry of Inorganic molecules: Sidgwick Powell rule and VSEPR theory,

Structure of molecules: $SnCl_2$, SO_4^{2-} , CO_3^{2-} ,

Basic concept of MO theory, Bonding and Anti-bonding Molecular Orbitals, Gerade & Ungerade Molecular Orbitals, σ - Molecular Orbital and σ^* - Molecular Orbital, π -Molecular Orbital and π^* - Molecular Orbital, Conditions for effective combinations of atomic orbitals

Energy level diagrams of B_2 , C_2 , N_2 , O_2 , F_2 , CO , NO , CO_2 (with s-p mixing and orbital interaction) with calculation of bond order and magnetic moment Comparison of MO theory and VB theory.

UNIT-3 Alkanes and Cycloalkanes**[09Hours]**

Chemistry of alkanes:

Formation of alkanes: Wurtz reaction, Wurtz-Fittig reaction. Free radical substitutions: Halogenation- relative reactivity and selectivity.

Introduction and classification of ring system (monocyclic and polycyclic, size, number of carbon atom common between the two rings)

IUPAC nomenclature of cycloalkanes (including simple spiro compounds, fused ring and bridged ring systems-bicyclic only)

Method of preparation of small ring cycloalkanes: Intra-molecular Wurtz's reaction, Simmons-Smith, Diels-Alder reaction

Chemical Properties of Cycloalkanes: Substitution Reactions, Addition Reactions, Baeyer's Strain Theory and its limitations (puckering)

Conformations, conformational analysis, conformation of ethane, propane and butane

UNIT-4: Aromatic Hydrocarbons**[9 Hours]**

Aromaticity: Criteria for (aromatic, non-aromatic and anti-aromatic), applications of Huckel's rule to simple annulene, cyclic carbocation/anion.

Electrophilic aromatic substitution reactions of benzene with mechanisms, theory of effect of substituents on reactivity and orientation (with resonating structures for activating and deactivating groups)

Electrophilic aromatic substitution reactions with mechanisms: Halogenation, nitration, sulphonation, Friedel-Crafts alkylation, Friedel-Crafts acylation

UNIT-5 Adsorption and Catalysis**[9 Hours]**

Adsorption: Introduction, types of adsorption (physical and chemical), characteristics and factors affecting adsorption, Adsorption isotherm and Freundlich equation, Langmuir theory of adsorption: assumptions, derivation, modification in equation at very low and high pressure and applications of adsorption.

Catalysis: Introduction, types of catalysis (homogeneous and heterogeneous), characteristics of catalysis, autocatalysis, negative catalysis (Inhibitor), promoters, and catalytic poisoning Activation energy and catalysis. Theories of catalysis: (1) Intermediate compound formation and (2) Adsorption theory, Active centers, Enzyme catalysis and its characteristics

ReferenceBooks:

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 & 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 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

SEMESTER-I
CHEMISTRY PRACTICAL [DSC- CHP -102]

01-Credit: 50Marks

Program/Class: Major (Core)	Year: First	Semester :First
Paper-2 DSC-CHP-102 Practical	Subject: Chemistry Practical- II	
Course Code: DSC- CHP -102	Course Title: Practical -II	

1.	Course Outcomes દરેક વિષયની શરૂઆતમાં દર્શાવેલ છે?: હા
2.	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?:હા
3.	Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
4.	Major: હા Minor: ના, Skill Enhancement Courses: હા, Ability Enhancement Courses: હા Value Added Courses: ના, Exit/Vocational Courses: હા
5.	Holistic Education: હા, Multidisciplinary: ના, Interdisciplinary: ના
6.	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસંગિક જોગવાઈ કરાયેલ છે? : હા
7.	New India Literacy Program (NILP) મુજબનો વિષય છે?: હા
8.	Swayamપ્લેટફોર્મ પરના MOOCવિષય પર આધારિત આ વિષય છે?: હા
9.	ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે?: હા

Course outcomes: Upon completion of this course, the students will have the **knowledge & skills to perform / do independently:**

- Qualitatively analysis of mono functional Organic solid & liquid compounds.
- The Physical constants determination of the pure organic compounds
- Preparation of various reagents.

Practical Examination:

- Total Marks :50Marks {35 Marks External &15 Marks Internal }
- Duration :3 hrs
- **Exercise:** Organic Qualitative analysis :30 Marks and Vivavoce- 05 marks

Exercise: Organic Qualitative Analysis (Minimum 12 / 15 compounds be given)

Organic **Mono Functional Group** Compounds such as Phenolic, Carboxylic acid, Amide, Nitro, Amines, Aldehyde, Ketone, Alcohol, Ester, Halogen, Anilide, Carbohydrate and Hydrocarbon.

Recommended compounds: Benzoic acid, Cinnamic acid, phenol, α -naphthol, β -naphthol, acetone, ethyl methyl ketone, methyl acetate, ethyl acetate, naphthalene, aniline, nitrobenzene, benzamide, urea, chloroform, MDC acetanilide, carbon tetra chloride, chlorobenzene, bromo benzene etc.

Semester End Examination: Theory Question Paper Pattern

70 Marks for Semester End Examination (External) & 30 marks for Internal Examinations

Instructions:

- All Units/ Module carry equal weightage of 14 Marks each
- There must be One Question from each Unit/ Module
- Each Subtopic/ Chapter must be given due weightage in the Question paper
- Time duration: 2½Hours**

The Theory Question Paper Skeleton is as follows:

Question 1 (Unit/Module 1)		Marks
A	Answer Any Two out of Four	04
B	Answer Any One out of Two	04
C	Answer Any One out of Two	06
Total Marks Question 1		14
Question 2 (Unit/Module 2)		Marks
A	Answer Any Two out of Four	04
B	Answer Any One out of Two	04
C	Answer Any One out of Two	06
Total Marks Question 2		14
Question 3 (Unit/Module 3)		Marks
A	Answer Any Two out of Four	04
B	Answer Any One out of Two	04
C	Answer Any One out of Two	06
Total Marks Question 3		14
Question 4 (Unit/Module 4)		Marks
A	Answer Any Two out of Four	04
B	Answer Any One out of Two	04
C	Answer Any One out of Two	06
Total Marks Question 4		14
Question 5 (Unit/Module 5)		Marks
A	Answer Any Two out of Four	04
B	Answer Any One out of Two	04
C	Answer Any One out of Two	06
Total Marks Question 5		14

Total Unit/Module	Total Questions	Marks per Question	Total Marks
5	5	14	14 X 5 = 70

SEMESTER - I
SKILL ENHANCEMENT COURSE
SEC-CH-101: Common Adulterants Testing in Food

2- Credits: 50 Marks

Program/Class: SEC (Major/ Minor)	Year: First	Semester: First
Paper: SEC-CH-101: Practical Subject: Chemistry		
Course Code: SEC-CH-101	Course Title: Common Adulterants Testing in Food	

1.	Course Outcomes દરેક વિષયની શરૂઆતમાં દર્શાવેલ છે?: હા
2.	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?:હા
3.	Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
4.	Major: ના, Minor: ના, Skill Enhancement Courses: ના, Ability Enhancement Courses:હા, Value Added Courses: ના, Exit/Vocational Courses: હા
5.	Holistic Education: ના, Multidisciplinary: હા, Interdisciplinary: હા
6.	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે? : હા
7.	New India Literacy Programme (NILP) મુજબનો વિષય છે?: હા
8.	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે?: હા
9.	ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે?: હા

Course outcomes: This course aims to provide an understanding of adulterants present in food and their effect on human health.

On completion of this course, the students will be **able to detect** the common adulterants present in:

- Milk & Milk Products
- Spices & Condiments and in Other Foods

1. Milk and Milk Products

1. Detection of Added Water / Added Starch and Cereal Flours/Cellulose/ Gelatin in Milk
2. Detection of Added Cane Sugar (Sucrose)/Added Glucose
3. Detection of Added Urea/Ammonium Salts in Milk/Sulphates in Milk
4. Detection of Sodium Chloride/Vanaspati (Hydrogenated Fat) in Milk
5. Detection of Detergents/ Pulverized Soap in Milk
6. Test for Skimmed Milk Powder in Natural Milk
7. Detection of Preservatives added to Milk
 - Formalin
 - Hydrogen peroxide
 - Boric Acid and Borate
 - Benzoic and Sodium benzoate
 - Salicylic Acid
 - Mercuric chloride

8. Detection of Coloring Matter in Milk and Milk Products

- Metanil Yellow
- Annato in Milk
- Coal Tar Dyes (Azo) Dyes in Milk
- Coal Tar Dyes In Ghee, Butter, Khoa, Cheese, Condensed Milk, Milk Powder

2. Spices & Condiments

1. Detection of Lead Salts/ Metanil Yellow/ Aniline Dyes / Chalk Powder in Turmeric Powder
2. Detection of Added Starch in Powdered Spices other than Turmeric Powder
3. Detection of Brick Powder/Oil Soluble Colour/ Sudan Dye III/ Rhodamine B in Chilli Powder
4. Detection of Papaya Seeds in Black Pepper
5. Detection of Common Salt in Coriander Powder
6. Detection of Chalk/ Colophon Residue/ Foreign Resins in Asafoetida

3. Detection of Adulterants in Other Foods

1. Detection of Chalk Powder & Washing Soda in Sugar, Bura Sugar/Wheat Flour/Ice Cream
2. Detection of Lead Chromate in Pulses/Other Foods
3. Detection of Sand/Dirt in Wheat and Other Flour
4. Detection of Iron Filing in Tea Leaves/Wheat Flour
5. Detection of Artificially Coloured Tea Dust Mixed with Genuine Tea or Used Tea Leave
6. Detection of Malachite Green in Green Vegetables
7. Detection of Artificial Invert Sugar Syrup in Honey (Fieh's Test)
8. Detection of Mineral Acid in Vinegar/Carbonated Beverages
9. Determination of Boric Acid in Maida/Rice Flour

Reference Manual:

1. FSSAI Manual of Simple Methods for Testing of common adulterants in Food
2. FSSAI DART Manual

Reference books:

1. FSSAI Manual of Methods of Analysis of Foods – Milk and Milk Products (2015) Food Safety and Standards Authority of India, Ministry of Health and Family Welfare Government of India New Delhi
FAO (2009).
2. Milk Testing and Payment Systems Resource Book – A Practical Guide to Assist Milk Producer Groups.
FAO, Rome. Pp. 38-43.
3. Roy, N.K. and Sen, D.C. (1994). Rapid Analysis of Milk. In Textbook of Practical Dairy Chemistry.
Kalyani Publishers. New Delhi. Pp. 85-118.
4. Darshan Lal, Raman Seth, Rajan Sharma and Arun Kumar (2005). Approaches for detection of
Adulteration in Milk Fat – An Overview. Indian Dairyman, 57, 10. Pp. 31-43.
5. Gunnery, K.S. (1979). Additives in Milk and Their Detection. Indian Dairyman, 31, 9.Pp. 665-669.
6. BIS (1960). Indian Standard – Methods of Test for Dairy Industry. Part I Rapid Examination of Milk (IS
1479 (Part I): 1960)
7. BIS (1961). Indian Standard – Methods of Test for Dairy Industry. Part II Chemical Analysis of Milk (IS
1479 (Part II): 1961)
8. BIS (2006). Indian Standard: Quick methods for Detection of Adulterants/Contaminants in Common
Food Products – Chemical methods (IS 15642 (Part 2): 2006)
9. Adulteration In Milk Fat A Review Indian J. Dairy Sci. 55: 319-330
10. Methods for detection of common adulterants in milk and milk products (2009), Technews, 83, 1-30 IS:
548 (Part II) 1976 Reaffirmed 2010 “Indian standard methods of sampling and test for oils and Fats Part

II Purity Test (Third Revision) IS 15642 (Parts 1 and 2):2006 (Reaffirmed 2011) Quick Methods for Detection of Adulterants/Contaminants in Common Food Products.

11. Azadmard-Damirchi and Torbati, Adulterations in Some Edible Oils and Fats and Their Detection Methods, Journal of Food Quality and Hazards Control 2 (2015) 38-44
12. Shukla,AK, Dixit, AK and Singh, RP, Detection of Adulteration in Edible oils, Journal of Oleo Science (2005), 54, 317-324
13. Punia, P, and Lokesh, T, Review on Common Adulterants in Food Apparatus, Journal of Biotechnology and Biosafety (2016) 4, 426-430
14. Pearsons' Composition and Analysis of Food 9th Edition, FSSAI Manual of Methods of Analysis of Foods – Spices and Condiments (2015)
15. Food Safety and Standards Authority of India, Ministry of Health and Family Welfare Government of India New Delhi IS 15642 (Parts 1 and 2) :2006 (Reaffirmed 2011)
16. Quick Methods for Detection of Adulterants/Contaminants in Common Food Products Purba MK, Agrawal, N and Shukla, SK, Detection of Non-Permitted Food Colors in Edibles (2015) Journal of Forensic Research S4:3
17. Punia, P, and Lokesh, T, Review on Common Adulterants in Food Apparatus, Journal of Biotechnology and Biosafety (2016) 4, 426-430

SEMESTER-II
CHEMISTRY THEORY COURSE [DSC-CH-201]

3-Credits: 100 Marks

Program/Class: Major (Core)	Year: First		Semester: Second
Paper-3 : DSC-CH-201		Theory Subject: Chemistry	
Course Code: DSC-CH-201		Course Title: Chemistry-III	

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?:હા
2	Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
3	Major: હા Minor: ના, Skill Enhancement Courses: ના, Ability Enhancement Courses: હા Value Added Courses: ના, Exit/Vocational Courses: ના
4	Holistic Education: હા, Multidisciplinary: ના, Interdisciplinary: ના
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસંગિક જોગવાઈ કરાયેલ છે? : હા
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?: હા
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે?: હા
8	ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે?: હા
9	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?:હા

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:Definitionandtypesofbuffersolutions,Bufferaction

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

UNIT-1: Chemistry of elements of 3d series

[9 Hours]

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, melting point & boiling point, density, reducing properties, tendency of formation of alloys, catalytic properties, magnetic and spectral properties.

Calculation of spin only magnetic momentum of inner orbital and outer orbital complexes $[\text{NiCl}_4]^{-2}$, $[\text{Ni}(\text{CN})_4]^{-2}$, $[\text{FeF}_6]^{-4}$, $[\text{Fe}(\text{CN})_6]^{-4}$

UNIT- 2: Basics of Co-ordination Chemistry**[9Hours]**

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 and stereo isomerism)

Structural isomerism: (1) ionization and (2) hydration (3) co-ordination (4) co-ordination positions (5) polymerization and (6) linkage isomerism

Geometric/cis-trans-isomerism in ML_4 and ML_6 types of complexes

UNIT-3: Alkyl and Aryl Halides**[9Hours]****Alkyl Halide: Nomenclature & Classification**

Preparation of Monohaloalkanes – Halogenation of Alkane, 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, Ag-salt of Fatty acids, 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

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.

UNIT-4: Name Reactions and Reagents**[9Hours]****Name Reactions: Principle, Mechanism and 2/3 Applications**

- Wurtz Reaction & Wurtz-Fittig Reaction
- Ullmann reaction
- Haloform Reaction
- Diels-Alder Reaction
- Clemensen Reduction
- Wolf-Kishner Reduction

Oxidizing Reagents (Oxidants) - Only Formula and 02 Applications

- 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

UNIT-5: Ionic Equilibrium

[9 Hours]

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 (NH₄Cl+NH₄OH) and H⁺ions (H₂S+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

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

SEMESTER-II
CHEMISTRY PRACTICAL COURSE [DSC-CHP-201]

01-Credit: 50Marks

Program/Class: Major (Core)	Year: First	Semester: Second
Paper-3 : DSC-CHP-201	Theory Subject: Chemistry Practical-III	
Course Code: DSC-CHP-201	Course Title: Chemistry Practical -III	

1	Course Outcomes દરેક વિષયની શરૂઆતમાં દર્શાવેલ છે?: હા
2	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?:હા
3	Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
4	Major: હા Minor: ના, Skill Enhancement Courses: હા, Ability Enhancement Courses: હા Value Added Courses: ના, Exit/Vocational Courses: હા
5	Holistic Education: હા, Multidisciplinary: ના, Interdisciplinary: હા
6	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે? : હા
7	New India Literacy Programme (NILP) મુજબનો વિષય છે?: ના
8	Swayamપ્લેટફોર્મ પરના MOOCવિષય પર આધારિત આ વિષય છે?: હા
9	ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે?: હા

Course outcomes: 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 perform/do independently:

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

Practical Examination:

- Total Marks : 50 Marks {35 Marks Semester End & 15 Marks Internal}
- Duration : 03 hrs.
- Two exercises to be performed each carrying 15 marks and 5 marks for Viva voce / MCQ :

Exercise-I: Water Analysis:

- pH & Conductivity
- Acidity
- Alkalinity
- Temporary, Permanent 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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SEMESTER-II
CHEMISTRY THEORY COURSE [DSC-CH-202]

3-Credits: 100 Marks

Program/Class: Major (Core)	Year: First	Semester: Second
Paper-4 : DSC-CH-202	Theory Subject: Chemistry	
Course Code: DSC-CH-202	Course Title: Chemistry-IV	

1	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?:હા
2	Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
3	Major: હા Minor: ના, Skill Enhancement Courses: ના, Ability Enhancement Courses: હા Value Added Courses: ના, Exit/Vocational Courses: ના
4	Holistic Education: હા, Multidisciplinary: ના, Interdisciplinary: ના
5	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસંગિક જોગવાઈ કરાયેલ છે? : હા
6	New India Literacy Programme (NILP) મુજબનો વિષય છે?: હા
7	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે?: હા
8	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે?: હા
9	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?:હા

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.

UNIT-1: Solid State

[9 Hours]

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

UNIT-2: Basics of Lanthanide Elements

[9 Hours]

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.

UNIT-3: Alcohols, Phenol, Ethers and Epoxides

[9-hours]

Alcohols Preparation of Monohydric alcohols: from alkyl halides; using Grignard reagent; by reduction of aldehydes, ketones, carboxylic acid, and esters.

Physical Properties of alcohols

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

Diols: oxidation of diols by periodic acid and lead tetra acetate.

Phenol :(Phenol case)

Physical properties; Acidity and factors affecting it;

Reactions: Electrophilic substitution (Nitration, halogenation and 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_2SO_4 , cold HI & hot HI]

Epoxides: Reactions of epoxides with alcohols, ammonia derivatives and $LiAlH_4$.

UNIT-4: Name Reactions and Reagents

[9 Hours]

Name reactions

- Aldol Condensation
- Pechmann Condensation
- Benzidine Rearrangement
- Chinchibabin Reaction
- Hofmann Isonitrile Synthesis (Carbyl amine Synthesis)

Reducing Reagents - Only Formula & 02 Applications

- $LiAlH_4$, $NaBH_4$
- Diisobutylaluminiumhydride – DiBAL- H
- BH_3
- Na or Li – NH_3

UNIT-5: Study of Physical Properties

[9-hours]

Introduction, Types of Physical Properties: Additive and Constitutive Properties

Molar Volume: Kopp's Law, Atomic Volume

Surface Tension: Explanation of Surface Tension, Name of Methods to Determine Surface Tension, The Drop Weight Method

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

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.

Refractive Index and Refractivity: Introduction, Specific and Molecular Refractivity, Abbe Refractometer, Molecular Refractivity and Chemical Constitution.

Optical Activity: Polarization of Light, Optical Activity, Factors Affecting Angle of Rotation, Specific Rotation, Polari meter

Dipole Moment: Polar and Non-polar molecule, Electric Polarization (Polarizability of Molecules), The Mosotti Clausious Equation, Kinds of Molar Polarization [Electron & Nuclear Polarization, Orientation Polarization (Permanent Dipole Moment)];

Application of Dipole Moment: Identification of Polar and Non- polar molecules,

Molecular Structure :(i) Mono-atomic molecules, (ii) Diatomic molecules (iii) Triatomic molecules (CO₂, H₂O, SO₂) (iv) Tetratomic molecules (NH₃, BCl₃) (v) Aromatic Compounds (Benzene) (vi) Resonance Structure (N₂O) (vii) Cis-Trans Isomer (viii) Orientations in Organic Molecules (o, m and p substitution)

Numerical

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

SEMESTER-II
CHEMISTRY PRACTICAL COURSE [DSC-CHP-202]

01-Credit: 50Marks

Program/Class: Major (Core)	Year: First	Semester: Second
Paper-4 : DSC-CHP-202	Theory Subject: Chemistry Practical-IV	
Course Code: DSC-CHP-202	Course Title: Chemistry Practical -IV	

1	Course Outcomes દરેક વિષયની શરૂઆતમાં દર્શાવેલ છે?: હા
2	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?:હા
3	Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
4	Major: હા Minor: ના, Skill Enhancement Courses: હા, Ability Enhancement Courses: હા Value Added Courses: ના, Exit/Vocational Courses: હા
5	Holistic Education: હા, Multidisciplinary: ના, Interdisciplinary: હા
6	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસંગિક જોગવાઈ કરાયેલ છે? : હા
7	New India Literacy Programme (NILP) મુજબનો વિષય છે?: ના
8	Swayamપ્લેટફોર્મ પરના MOOCવિષય પર આધારિત આ વિષય છે?: હા
9	ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે?: હા

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

Practical Examination:

- Total Marks : 50 Marks {35 Marks Semester End & 15 Marks Internal}
- Duration : 03 hrs.
- Two exercises to be performed each carrying 15 marks and 5 marks for Vivavoce / MCQ :

Exercise:- Qualitative Analysis of Inorganic Salts:

[30 Marks]

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

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

Semester End Examination:

Theory Question Paper Pattern

70 Marks for Semester End Examination (External) & 30 marks for Internal Examinations

Instructions:

- All Units/ Module carry equal weightage of 14 Marks each
- There must be One Question from each Unit/ Module
- Each Subtopic/ Chapter must be given due weightage in the Question paper
- TimeDuration:2½Hours**

The Theory Question Paper Skeleton is as follows:

Question 1 (Unit/Module 1)		Marks
A	Answer Any Two out of Four	04
B	Answer Any One out of Two	04
C	Answer Any One out of Two	06
Total Marks Question 1		14
Question 2 (Unit/Module 2)		Marks
A	Answer Any Two out of Four	04
B	Answer Any One out of Two	04
C	Answer Any One out of Two	06
Total Marks Question 2		14
Question 3 (Unit/Module 3)		Marks
A	Answer Any Two out of Four	04
B	Answer Any One out of Two	04
C	Answer Any One out of Two	06
Total Marks Question 3		14
Question 4 (Unit/Module 4)		Marks
A	Answer Any Two out of Four	04
B	Answer Any One out of Two	04
C	Answer Any One out of Two	06
Total Marks Question 4		14
Question 5 (Unit/Module 5)		Marks
A	Answer Any Two out of Four	04
B	Answer Any One out of Two	04
C	Answer Any One out of Two	06
Total Marks Question 5		14

Total Unit/Module	Total Questions	Marks per Question	Total Marks
5	5	14	14 X 5 = 70

SEMESTER – II

SKILL ENHANCEMENT COURSE SEC-CH-201 Analysis of Oils and Fats

2-Credits: 50 Marks

Program/Class: SEC	Year: First	Semester: First
Paper: SEC-CH-201 Practical Subject: Chemistry		
Course Code: SEC-CH-201	Course Title: Analysis of Oils and Fats	

1.	Course Outcomes દરેક વિષયની શરૂઆતમાં દર્શાવેલ છે?: હા
2.	Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ?:હા
3.	Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે?: હા
4.	Major: ના, Minor: ના, Skill Enhancement Courses: હા, Ability Enhancement Courses:હા, Value Added Courses: હા, Exit/Vocational Courses: હા
5.	Holistic Education: ના, Multidisciplinary: હા, Interdisciplinary: હા
6.	દિવ્યાંગ માટે વિષય અંતર્ગત આનુસંગિક જોગવાઈ કરાયેલ છે? : હા
7.	New India Literacy Programme (NILP) મુજબનો વિષય છે?: હા
8.	Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે?: હા
9.	ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે?: હા

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
-

Theory & Analysis of Oils and Fats

1. Determination of Specific Gravity
2. Determination of Refractive Index
3. Determination of Saponification Value
4. Determination of Unsaponifiable Matter
5. Determination of Acid Value
6. Determination of Iodine Value
7. Determination of Reichert Meissl and Polenske Value
8. Test for Sesame Oil (Baudouins Test)
9. Test for Cottonseed Oil (Halphens Test)
10. Test for presence of Rice Bran Oil

11. Test for presence of Linseed oil (Hexabromide Test)
12. Polybromide test for Mustard Oil
13. Detection of Rancidity
14. Detection of Argemone oil
15. Detection of Cottonseed oil
16. Detection of Karanjia Oil
17. Detection of Mineral Oil
18. Detection of Castor oil
19. Detection of mobile oil (Lube) in edible Oil
20. Detection of Adulteration in coconut oil
21. Detection of Vanaspati/Hydrogenated Edible Fat In Ghee

Reference Book/ Manual:

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