



HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

Course Name: B. Sc. Chemistry Semester: V

PROGRAM CODE: SCIUG102
COURSE CODE: SC23MJDSCCHE501

Type of course: Major Discipline Specific course

Name of course: Fundamentals of Chemistry III (Major-1)

Total Marks: 100

Effective from June 2025 Under NEP 2020

Total Credits: 04	Teaching Hours per Week: 04	Theory	External 50 Marks
	Teaching Hours per Semester: 60		Internal 50 Marks

Course Objectives:

1. To understand the core concepts of electro motive force.
2. To understand physical chemistry concepts of Nucleophilic Substitution Reaction
3. To know about the Volumetric titrations and calculations for Acid Base Titration.
4. To study about the Symmetry group elements & symmetry operations.

Course Outcome:

1. Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in, physical and analytical chemistry.
2. Students will appreciate the central role of chemistry in our society and use this as a basis for ethical behaviors in issues facing chemists including an understanding of safe handling of chemicals, environmental issues and key issues facing our society in energy, health and medicine.
3. Students will be able to design and carry out scientific experiments as well as accurately record and analyse the results of such experiments.
4. Students will be skilled in problem solving approach, creative thinking and analytical reasoning as applied to scientific problems.
5. To know about the Volumetric titrations and calculations for estimation.

Unit	Topic	Credit	Hours
1	Electro Motive Force Introduction of Terms - Oxidation, Reduction, Redox, Anode, Cathode - Electrode, Half cell - Oxidation & Reduction Potential - Electro Chemical Series - Nernst Equation Without Transference with Transference Verification of Concentration cell and it's EMF equation. Electrolyte concentration cell Concentration cell without transference, Concentration cell with	1	15

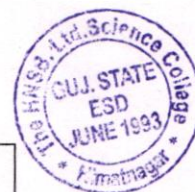
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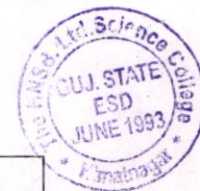
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	transference Electrode concentration cell Liquid -Liquid junction potential Application of EMF measurements Determination of -Solubility product of sparingly soluble salt -Stability constant of complex -Equilibrium constant -pH -Ionic constant of water -Dissociation constant of weak acid, Numerical			
2	Nucleophilic Substitution Reaction The reaction mechanism Mechanism of SN^1 and SN^2 reactions Stereochemistry of reaction SN^1 and SN^2 reactions Relative reactivity in substitution Solvent effect variation at carbon site Relative leaving group activity Neighbouring group participation Competitive reactions. Elimination E^1, E^2 and E^1cb mechanisms	1	15	APK
3	Acid Base Titration Construction of titration curves (Neutralization of weak acid by strong base and weak base by strong acid only) Neutralization of polyprotic acid (Dibasic and tribasic acid only) by strong base Analysis of Soda Ash Indicators, Mechanism of Indicators Gran's plot Buffer Solution, buffer level, types of buffers, buffer range & buffer capacity Numerical	1	15	ZMV
4	Symmetry Symmetry elements & symmetry operations Multiplications of symmetry operations Multiplication table for C_{2v}, C_{3v}, C_{2h} point groups only Classification of schoenflies point groups Determination of schoenflie point groups notations Symmetry & optical activity Symmetry property of orbital's for C_{2v}, C_{3v}, C_{2h} point groups	1	15	HKP



Suggested books:

1. Chemical application of group theory by F.A. Cotton
2. Chemical bonding and introduction by K.C. Patel, R.D. Patel and Raval
3. Application of group theory to chemistry by Bhattacharya
4. Symmetry in chemistry by Jafle and Orchin 9 4-2013
5. Advance inorganic chemistry by cotton & Wilkinson
6. Basic principles of spectroscopy by R. Chand
7. Organic chemistry Vol. 1 by S.M. Mukherji, S.P. Shingh, Kapoor
8. Spectroscopy organic compounds VIth edition by P.S. kalsi
9. Organic chemistry by Morrison and Boyd
10. Spectrometric identification of organic compounds IVth edition by Silverstain, Basslerand Morrill.
11. Application of absorption spectroscopy of organic compounds by John R. Dyer
12. Spectroscopic method in organic chemistry Vth edition by Dudley H. Williams & Ian Fleming
13. Physical methods for chemist Ruwssell S. Drago
14. Organic spectroscopy by Williams & Kemp
15. Organic spectroscopy by V.R. Dani
16. Qualitative Analysis R.A. Day & A.L. Underwood
17. Analytical Chemistry G.D. Christain
18. Fundamentals of Analytical Chem istry D.A. Skoog, D.M. West &F.J. Holler
19. Principals of Analytical Chemistry J.H. Kennedy
20. Analytical Chemistry – Principals & Techniques L.G. Hargis


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Course Name: B.Sc. Chemistry Semester: -V

PROGRAM CODE: SCIUG102
COURSECODE:SC23MJDSCCHE501

Type of course: Major Discipline Specific IKS course
Name of course: Ancient Indian Chemistry (Major-2)
Total Marks:100

Effective from June 2025 Under NEP2020

TotalCredits: 04	Teaching Hours per Week:04	Theory	External50 Marks
	Teaching Hours per Semester:60		Internal50Marks

Course Objectives:

1. To understand and appreciate Indian contribution to chemical sciences. .
2. To understand ancient Indian metallurgy and compare with present system.
3. To appreciate the contribution of Indian chemist sir P. C. in chemicals sciences and industrial chemistry.
4. To acknowledge the contribution of Raman effect ny indian lobel laurette Dr. C. V. Raman.
5. To know about extraction of various fragrances in ancient India.

Course Outcome:

1. Students will have firm faith in our knowledge systems.
2. Students will appreciate the central role of chemistry in uplifting our society for centuries.
3. Students will be able to understand and earlier methods of design/ synthesis/extraction of new components and compare these with present systems.
4. Students will be more motivated and believe in our indegenious sytems and get skilled in problem solving approach, critical thinking and analytical reasoning to have answers to social problems.
5. Students will know about Tradtional frangrances and their cultural, spiritual, and medicinal role.

Unit	Topic	Credit	Hours
1	Indian traditional metallurgy • Overview of Indian metallurgical tradition • Vedic Metallurgy of Copper, Iron, Zinc, Gold and Silver • Chemistry of Modern Alloy (mild Steel and Stainless steel, and German silver) and Ores (Gold, Silver, Iron, Aluminum) • Chemistry of Ashok Stambh • Techniques of Manufacturing Coins in Ancient India and in present times, Types of Historical Coins • Matels used in Ayurveda, Material and process, Rasayan and Bhasam	1	15

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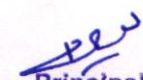


2	P. C. Ray's philosophy of chemical sciences - Ray's Synthesis of sulphur compounds including long chain species, and comparison with modern methods, - Ray's Synthesis of condensed heptacyclic c - Ray's Synthesis Thioketones and applications of thioketones. Discovery of Mercurous Nitrite ($\text{Hg}_2(\text{NO}_2)_2$): Experimental methods used and Significance and applications. Comparison of mercurous nitrite with mercuric nitrate. - Organic and inorganic nitrites - Philosophy for nationalism and education, Influence on future generations of chemists in India, Creation of a research culture in Indian universities - Relevance of Ray's methods in modern inorganic and industrial chemistry - Study of Nitrites and Hyponitrites of Alkali and Alkaline Earth Metals Development of stable chemical compounds and their crystal structures	1	15	KVU
3	Raman Spectroscopy - History and discovery, Contribution of Dr. C.V. Raman and his team in the Raman Effect - Basic principles: Raman effect, elastic and inelastic scattering of light. - Molecular vibrations and energy levels - Selection rules in Raman spectroscopy - Stokes and Anti-Stokes lines - Polarizability and Raman activity - Examples of 03 compounds which are Raman active - Role in promoting ancient science in India - Raman's philosophy and views on science and society - Influence on future generations of scientists	1	15	NIP
4	Chemical Background of Fragrance in India - Importance of fragrance in Indian culture: Ayurveda, rituals, and cosmetics - Ancient texts on perfumery (e.g., <i>Charaka Samhita</i>, <i>Brihat Samhita</i>) - Role of perfumers in Mughal and post-Mughal India - Use of natural ingredients: sandalwood, rose, jasmine, vetiver, kewda - Traditional methods of extraction: Hydro distillation (Deg Bhapka system) and Steam distillation in Kannauj (Attar capital of India) - Modern Distillation Methods in Fragrance: Extraction Supercritical Fluid Extraction (SFE), Molecular Distillation (Short-Path Distillation) and Microwave-Assisted Extraction (MAE) - Development of attars and natural perfumes	1	15	



Books Suggested:

1. Vedic Metallurgy: Unveiling The Ancient Technology Kindle Edition
By Ashutosh Dandekar , Akhilesh Joshi , Indraja Dandekar
2. Ancient India Metallurgy (Theory and Practice), By Ashoka K. Mishra
3. Life And Experiences Of A Bengali Chemist (2 Volumes) , By Prafulla Chandra Ray
4. The Fragrance Of India, By By Doris Potter
5. Perfumery And Kindred Arts by R. S. Cristiani
6. "Practical Raman Spectroscopy: An Introduction" by Peter Vandenabeele,
7. "Introductory Raman Spectroscopy" by John R. Ferraro, Kazuo Nakamoto, and Chris W. Brown,
8. "Modern Raman Spectroscopy: A Practical Approach" by Ewen Smith and Geoff Dent.


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Course Name: B. Sc. Chemistry Semester: V

PROGRAM CODE: SCIUG102

COURSE CODE: SC23PMJDSCCHE501B

Type of course: Practical Major Discipline Specific Course

Name of course: Practical's for Fundamentals of Chemistry III (Major-3)

Total Marks: 100

Effective from June 2025 Under NEP 2020

Group-A

Total Credits: 02	Teaching Hours per Week: 04	Practical	External 25 Marks
	Teaching Hours per Semester: 60		Internal 25 Marks
	Minimum No. of. Practical to be Performed:12(Twelve)		

Group-B

Total Credits: 02	Teaching Hours per Week: 04	Practical	External 25 Marks
	Teaching Hours per Semester: 60		Internal 25 Marks
	Minimum No. of. Practical to be Performed:12(Twelve)		

Course Objectives:

1. To Identify the organic components.
2. Preparation of solutions and their standardization.

Course Outcome:

1. Students will gain a comprehensive knowledge and skills in standardizations, hands on instruments, Separation techniques and Preparation of solutions for carrying out reactions.

Type	Topic
1	Organic Practical (Any 08 Binary Mixtures)
2	Inorganic Practical (Any 4 Alloy & Any 4 Preparation)
3	Physical Practical (Any 08)

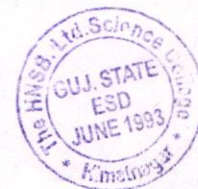
Group	Practicals	Practicals	Marks
A	Organic -08	Inorganic-04(Alloy)	25
B	Physical-08	Inorganic-04(Preparation)	25

Note: Certified Practical Journal is Compulsory for Practical Examination

This syllabus is to be completed by assigning four laboratory session per week, each of three periods. The number of students in the laboratory batch should not exceed ten(10) the medium of instruction will be English in laboratory course.

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Mayor- Bachel. Bsc V



Batch distribution (for maximum 30 students and 3 Examiners)
[Maximum 10 students per each Examiner]

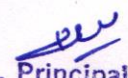
Sr. No	Topic	Credit	Hours
Group-A	Organic Qualitative Analysis: (i) Qualitative Analysis (Minimum 08) Analysis of an organic mixture containing two components using water, NaHCO_3 , NaOH , HCl as a solvent for Separation /or using distillation process for separation and identification with the suitable chemical tests and preparation of suitable derivatives. Soluble Components:- Oxalic Acid, Succinic Acid, Resorcinol, Urea, Thiourea (Give water soluble compounds only in solid + solid mixture and water soluble components should not give with same natured compound's mixture) Separation of two components from Mixture Such as.... Solid-Solid -----Mixture (Both are Water insoluble Or One is water soluble) Solid- Liquid ----- Mixture (Solid is water insoluble) Liquid-Liquid -----Mixture [Liquid component must be neutral in nature]	1	30
	(ii) Gravimetric Estimation for Single Constituents. (Any 4 (Four)) 1) Gravimetric Estimation of Ni as $\text{Ni}(\text{DMG})_2$ 2) Gravimetric Estimation of Zn as Zinc Ammonium Phosphate 3) Gravimetric Estimation of Al as Al_2O_3 4) Gravimetric Estimation of Fe as Fe_2O_3 5) Gravimetric Estimation of Ba as BaSO_4 6) Gravimetric Estimation of SO_4 as BaSO_4	1	30
Group-B	(i) Inorganic Preparation. (Any 4 (Four)) 1) Preparation of Hexathiourea cuprous Nitrate 2) Preparation of Tetraamine cupric Sulphate 3) Preparation of CuCl 4) Preparation of Potassium Tri-Oxalato Chromate 5) Preparation of Mohr's salt $[\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}]$ 6) Preparation of Potash Alum. $[\text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}]$	1	30
	(ii) Physical Chemistry practical (Any Eight (08)) [A] Instruments: 1. To Determine the Normality and Amount of each acid in given mixture of XN ($\text{HCl} + \text{CH}_3\text{COOH}$) by PH metric titration using 0.09 N to 0.12 N NaOH . 2. To Determine the Normality and Amount of each acid in given mixture of XN ($\text{HCl} + \text{CH}_3\text{COOH}$) by Potentiometry titration using 0.09 N to 0.12 N NaOH .	1	30

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3. To Determine the Normality and Amount of each acid in given mixture of XN ($\text{HCl} + \text{CH}_3\text{COOH}$) by Conductometry titration using 0.09 N to 0.12 N NaOH. 4. To Determine the Solubility & Solubility product of Sparingly Soluble salt PbSO_4 by Conductometric. 5. Determine the Concentration of Mn^{+2} ions and Cr^{+3} ions in in a given mixture of ($\text{K}_2\text{Cr}_2\text{O}_7 + \text{KMnO}_4$). 6. To Determine the Amount of Nickel in the given unknown solution by Colorimetric method. [B] Chemical Kinetics & viscosity: 7. To determine the order of reaction between $\text{K}_2\text{S}_2\text{O}_8$ and KI. 8. To determine the order of reaction between H_2O_2 and HI. 9. To determine the molecular weight of high polymer by viscosity method.		
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Reference Books:

- 1) Advanced Practical Physical Chemistry, PB : J B Yadav
- 2) Organic practical mann & saunders
- 3) Vogel's Textbook of Quantitative Chemical Analysis
- 4) Elementary practical organic chemistry Arthur I Vogel
- 5) Practical organic chemistry pragati prakhan
- 6) A Textbook of Qualitative Chemical Analysis (Arthur I Vogel)


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