# PROGRAM CODE : SCIUG102
# Syllabus and Scheme of Examination
**for**

# Sem. III and Sem. IV of B.Sc. Honors Chemistry

Four-year Graduate Honors Program in Chemistry
Under NEP 2020

Submitted

to

*Hemchandracharya North Gujarat University, Patan*

Under

**Choice Based Credit System**

**Implemented w.e. f June, 2024**

Submitted on March, 2024

| Semester | Type Of Course Opted | Course Name | Course Code | Credits | Examination | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | | | | Internal | External | Examination Hours | |
| III | Major Discipline Specific course MJDSC-I | Basic of Chemistry- I | SC23MJDSCCHE301 | 4 | 50 | 50 | 2.30 | 100 |
| | Major Discipline Specific course MJDSC-II | Basic chemistry -1I | SC23MIDSCCHE301A | 4 | 50 | 50 | 2.30 | 100 |
| | Major Discipline Specific course MJDSC-III Practicals | PMJDC Practical -I & II Lab Group A & Group B | SC23PMJDSCCHE301 | 4 | 50 | 50 | 2.30 | 100 |
| | Multi/Inter disciplinary Course MDC/IDC | Simplified chemistry-I | SC23MDCCHE303 | 2 | 25 | 25 | 2.00 | 50 |
| | Multi/Inter disciplinary Course MDC/IDC Practicals | PMDC/PIDC Practical- Lab | SC23PMDCCHE303 | 2 | 25 | 25 | 2.00 | 50 |
| | Ability Enhancement Courses AEC | To be Selected ( From languages) | SC23AECCHE304 | 2 | 25 | 25 | 2.00 | 50 |
| | Indian Knowledge System IKS | To be Selected (Basic concept of IKS) | SC23IKSCHE305 | 2 | 25 | 25 | 2.00 | 50 |
| | Skill Enhancement Course SEC | To be selected SEC-I Environmental Pollution or SEC-2 Chemical Metallurgy | SC23SECCHE306/ SC23SECCHE306A | 2 | 25 | 25 | 2.00 | 50 |
| | Total Credits of Semester - III | | | 22 | 275 | 275 | | 550 |

**HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN**

**Course Name : B. Sc. Chemistry Semester : III**
**PROGRAM CODE : SCIUG102**
**COURSE CODE : SC23MJDSCCHE301**

**Type of course : Major Discipline Specific course**
**Name of course : Basic chemistry I**
**Total Marks : 100**

**Effective from June 2023 Under NEP 2020**

| | | | |
|---|---|---|---|
| Total Credits : 04 | Teaching Hours per Week: 04<br>Teaching Hours per Semester: 60 | Theory | External 50 Marks<br>Internal 50 Marks |

**Course Objectives**:

1. To understand the core concepts of coordination compounds using CFT.
2. To understand carbohydrates and their chemistry.
3. To study and understand electronic spectroscopy.
4. To know basicc principals of thermodynamics and relevant numericals.

**Course Outcome:**

1.Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in coordination compounds, carbohydrates and thermodynamics.

2. Students will appreciate the central role of chemistry in our society and use this as a basis for ethical behavior 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 analyze the results of such experiments.

4. Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.

| Unit | Topic | Credit | Hr |
|---|---|---|---|
| 1 | **CFT of Coordination compounds**<br>CFT theory, splinting of d-orbitals Oh and Td complex. Factor influencing the magnitude of Δ ( Crystal field splitting energies).<br>Calculation of Crystal field stabilization energies for Oh and Td complexes.<br>Applications of CFT: For determination of color of complexes. Use of CFSE Value to determine the stability of Complex, Low spin and high spin complexes.<br>Limitation of CFT | 1 | 15 |
| 2 | **Carbohydrates.**<br>Introduction, Classification and nomenclature of Mono Saccharides.<br>Reactions of Glucose and Fructose. (Methylation, Acetylation, Oxidation with $Br_2$ water and Conc. $HNO_3$, Reaction with HCN, $NH_2OH$, $C_6H_5NHNH_2$, Osazone formation and Epimerization.)<br>Lengthening of carbon chain of aldoses, Shortening of carbon chain of aldoses.<br>Configuration of Aldo Hexoses [D (+) Glucose], Hemi acetal and acetal forms, Cyclic structure of D (+) glucose, Mechanism of mutarotation, cyclic structure of D (-) fructose (only introduction about structure), Determination of ring size of Aldo hexose.<br>Inter conversions of Glucose from Fructose, Fructose from Glucose, Glucose from Manose, Manose from Glucose, Glucose from Arabinose, Arabinose from Glucose | 1 | 15 |
| 3 | **Ultra violet Spectroscopy**<br>Introduction, Type of electronic transitions.<br>Origin of UV Spectra, Effect of conjugation, Concept of Chrmophores and Auxochromes.<br>Bathochromic, Hypsochromic, Hyper chromic, and Hypochromic shifts. | 1 | 15 |

| | | | |
|---|---|---|---|
| | Woodward – Fisher rules.<br>Problems of conjugated enes, enones and aromatic ketones, aldehydes, acids and esters using empirical rules.<br>(Data table has to be provided to students) | | |
| 4. | **Thermodynamics**<br>Clapeyron equation and its Applications for various phase equilibrium ,Integrated form of Clapeyron - Clauses equation, and its Applications for various phase equilibrium.<br>Traouton's Law, Craft equation.<br>Elevation of Boiling point, Depression in Freezing point<br>Partial molar Properties, Gibbs Duhem equation of Free energy, Entropy, Enthalpy, Concept of chemical potential, Duhem Margules equation.<br>Variation of chemical potential with temperature and pressure.<br>Roult's law of ideal solution, Vapour pressure of Ideal solutions & Thermodynamics of Ideal solutions.<br>Numericals | 1 | 15 |

**Books Recommended:**

➢ **Inorganic Chemistry**


**1. Inorganic chemistry, Catherine E. house croft, 5 th edition, Pearson , 2018.**

**2. Concise Inorganic Chemistry J.D.Lee, 4th edition, ELBS publication.**


➢ **Organic Chemistry**


**1. Organic Chemistry by Morrison and Boyd. 4th ed. Pearson Education- 2003**

**2. Organic Chemistry by pine, Hendriction, Cram and Hammond 4th ed. By P.S.Kalsi.**

**3. Advance Organic Chemistry by Jerry March.**

**4. Advance Organic Chemistry by ArunBahal and B.S.Bahal.**

**5. Organic Chemistry Vol. I & II by S.M.Mukherji, S.P.Sing, R.P.Kapoor.**

**6. Reaction mechanism and Reagents in Organic Chemistry by GurdeepR.Chatwal 4th ed. Himalaya public House.**

**7. Text book of Organic Chemistry by ArunBahal, B.S.Bhal, S.Chand.**

**8. Organic Spectroscopy by P.S.Kalsi.**

**9. Organic Chemistry by I.R.Finar.**

➢ **Physical Chemistry**

**1. Advance Physical Chemistry by Gurdeep Raj**

**2. Physical Chemistry (Question and Answers) by R.N.Madan, G.D.Tully, S.Chand.**

**3. Principal of Physical Chemistry by Puri, Sharma, Pathania.**

**4. Chemical Thermodynamics by R.P.Rastogy and R.R.Misra.**

**5. Essentials of Physical Chemistry by B.S.Bahal, ArunBahal, G.D.Tully.**

**6. Physical Chemistry by P.W.Atkins, 5th ed., Oxferd, 1994, 7th ed.,2002**

**7. Physical Chemistry by R.A.Alberty and R.J.Silbey, John Wiley, 1995.**

**8. Physical Chemistry by G.H.Barrow, 5th ed., Mac Graw Hill, 1998, 6th ed.**

**9. Physical Chemistry by W.J.Moore, 4th ed., Orient Longmans, 1969.**

**HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN**

**Course Name : B. Sc. Chemistry Semester : III**
**PROGRAM CODE : SCIUG102**
**COURSE CODE : SC23MJDSCCHE301A**
**Type of course : Major Discipline Specific course**
**Name of course : Basic chemistry II**
**Total Marks : 100**

**Effective from June 2023 Under NEP 2020**

| | | | |
|---|---|---|---|
| Total Credits : 04 | Teaching Hours per Week: 04<br>Teaching Hours per Semester: 60 | Theory | External 50 Marks<br>Internal 50 Marks |

**Course Objectives**:

1. To understand the core concepts of Magnetochemistry.
2. To understand basic quantum chemistry i.e. paricle and wave natureof particle, Dual nature of particle.
3. Understanting concept of aromatic substitution reactions
4. To study about the nature and physical properties of liquid.

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**Course Outcome:**

1.Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories bsed on wave mechanics, magnetic properties, Organic aromatic reactions and liquid behaviour.

2. Students will appreciate the central role of chemistry in our society and use this as a basis for ethical behavior 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 analyze the results of such experiments.

4. Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.

5. To know about the physical characteristics of liquids for various estimations.

| Unit | Topic | Credit | Hr |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | **Magnetic Properties of Co-ordination compounds.**<br>Elementary theory of Magneto chemistry, Guoy's method for determination of Magnetic susceptibility, Calculation of Magnetic Moments, Magnetic properties of Free ions,<br>Application of Magneto chemistry in structure determination, Determination of the oxidation state of transition metal centre, Determination of the stereochemistry of various transition metal | 1 | 15 |
| 2 | **Wave Mechanics**<br>Black Body Radiation & Quantum Theory, Photo electric effect, Wave particle duality of radiation, Compton Effect.<br>Basic postulates of quantum Mechanics,<br>Operator: Definition, Algebra of operators, Addition, Multiplication, Commutative properties, Linear operator, Commutative operators, Laplacian operator, Hamiltonian<br>Operators for atoms, Molecules and Molecule ions.<br>Free particle System, Particle in one-dimension box. | 1 | 15 |
| 3 | **Electrophilic Aromatic substitution**<br>Introduction, Effect of substituent groups, Determination of orientation.<br>Classification of substituent groups, Orientation in disubstituted benzenes.<br>Use of Orientation in synthesis, Mechanism of Nitration, Sulphonation, Friedel – crafts alkylation and Halogenation.<br>Electrophilic aromatic substitution (Two steps).<br>Theory of Reactivity & Orientation, Electron release via resonance. | 1 | 15 |
| 4. | **Physical properties of Liquid.**<br>Vapour pressure, Surface tension, Application of surface tension and Measurement using StalagmometerPerachore and its applications.<br>Defination of Viscosity, Application of viscosity and Measurement by Ostwald viscometer<br>Refractive index, Specific refraction,Molar refraction Application of Refractive index and Measurement using abbe's Refractometer. | 1 | 15 |

| | | | |
|---|---|---|---|
| | Optical activity, Applications of optical activity and Measurement using Polari meter.<br>Dipole moment and its applications and measurement.<br>Numerical. | | |

**Books Recommended:**

**➢ Inorganic Chemistry**

**1Quantum Chemistry by R.K.Prasad, Revised IIIrd Edition, Page- 3,5,7,34-37,41,65-68.**

**2. Concise Inorganic Chemistry J.D.Lee, 4th edition, ELBS publication.**

**3. Magnetochemistry by Shymal and Dutta, Revised IIIrd Edition, New age publications.**

**➢ Organic Chemistry**

**1. Organic Chemistry by Morrison and Boyd. 4th ed. Pearson Education- 2003**

**2. Organic Chemistry by pine, Hendriction, Cram and Hammond 4th ed. By P.S.Kalsi.**

**3. Advance Organic Chemistry by Jerry March.**

**4. Advance Organic Chemistry by ArunBahal and B.S.Bahal.**

**5. Organic Chemistry Vol. I & II by S.M.Mukherji, S.P.Sing, R.P.Kapoor.**

**6. Reaction mechanism and Reagents in Organic Chemistry by GurdeepR.Chatwal 4th ed. Himalaya public House.**

**7. Text book of Organic Chemistry by ArunBahal, B.S.Bhal, S.Chand.**

**8. Organic Spectroscopy by P.S.Kalsi.**

**9. Organic Chemistry by I.R.Finar.**

**➢ Physical Chemistry**

**1. Advance Physical Chemistry by Gurdeep Raj**

**2. Physical Chemistry (Question and Answers) by R.N.Madan, G.D.Tully, S.Chand.**

**3. Principal of Physical Chemistry by Puri, Sharma, Pathania.**

**4. Chemical Thermodynamics by R.P.Rastogy and R.R.Misra.**

**5. Essentials of Physical Chemistry by B.S.Bahal, ArunBahal,G.D.Tully.**

**6. Physical Chemistry by P.W.Atkins, 5th ed., Oxferd, 1994, 7th ed.,2002**

**7. Physical Chemistry by R.A.Alberty and R.J.Silbey, John Wiley, 1995.**

**8. Physical Chemistry by G.H.Barrow, 5th ed., Mac Graw Hill, 1998, 6th ed.**

**9. Physical Chemistry by W.J.Moore, 4th ed., Orient Longmans, 1969.Further Reading**:

**HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN**

Program Name **: B. Sc. ChemPMJDSCistry** **Semester : III**
**PROGRAM CODE : SCIUG102**
**COURSE CODE : SC23PMJDSCCHE301**

**Type of Course : Practicals Major Discipline Specific Course PMJDSC**
**Name of Course : Practical's for Basic chemistry I**
**Total Marks : 100**

**Effective from June 2023 Under NEP 2020**

**GROUP A**

| | | |
|---|---|---|
| Total Credits : 02 Teaching Hours per Week: 04<br>Lab Teaching Hours per semester:60<br>Minimum Number Practicals to be Performed: 12 | Practicals | External 25 Marks<br>Internal 25 Marks |

**GROUP B**

| | | |
|---|---|---|
| Total Credits : 02 Teaching Hours per Week: 04<br>Lab Teaching Hours per semester:60<br>Minimum Number Practicals to be Performed: 08 | Practicals | External 25 Marks<br>Internal 25 Marks |

**Course Objectives**:

1. To identify the In organic components in mixtures
2. To find out of normmality of components in mixture using instruments like conductometers.

**Course Outcomes:**

1. Students will gain a comprehensive knowledge and skills in operations of instruments needed in industry.
2. To find of the concentrationof acids in binary mixtures.
2. To understand basic methods to identify the cations and anions in the prepared samples.

| Sr.No. | List of Practicals | Credit | Hr |
|---|---|---|---|
| **GROUP A** | Inorganic Chemistry<br>1. Inorganic Qualitative analysis. (any 8 Mixtures)<br>Mixture containing four radicals. Anion should be ($CO_3^{-2}$,$NO_2^-$ ;$SO_3^{-2}$;$S^{-2}$;$Br^-$;$Cl^-$;$I^-$;$NO_3^-$;$SO_4^{-2}$;$CrO_4^{-2}$; $Cr_2O_7^{-2}$) (except $PO_4^{-3}$, $Bo_3^{-3}$,$ASO_3^{-3}$,$ASO_4^{-3}$,$O^{-2}$) | 2 | 60 |

| | | | |
|---|---|---|---|
| | 2. To separate Pb, Ag, and Hg ions present in a mixture by paper chromatography.<br>3. To separate Zn,Co, Ni ions by paper chromatography. | | |
| **GROUP B** | Physical Chemistry (Do any 10)<br>1. Conductrometric titration of $HCl/CH_3COOH$ Vs $NaOH$<br>2. Conductrometric titration of HCI Vs $NH_4OH$<br>3. pH-metric titration of HCI Vs NaOH after Calibration of pH meter.<br>4. Determine the Dissociation constant of the acid using mixtures of CH3COONa and CH3COOH using pH meter.<br>5. Determine the specific refraction and molar refraction of the given liquid A, B and mixture C (A+B) and calculate the percentage composition of A and B in the given mixture C using Abbe's Refractometer.<br>6. Determine the molar refraction $CH_3COOC_2H_5$, $CH_3COOCH_5$ and $CH_3COOCH_7$, and show the constancy of reaction equivalent of -$CH_2$ - Group using Abbe's Refractometer.<br>7. To determine the viscosity of a different mixture of liquid A and B and determine the percentage composition of unknown mixture by graphical method.<br>8. To determine the surface tension and compare cleaning-efficiency of two samples of a detergent or soap with stalagmometer.<br>9. To study kinetic reaction of decomposition of $H_2O2$ catalysis by iodine ion (Clock reaction)<br>10. Find the solubility and heat of solution of the given organic acid at two different temperatures<br>11. To separate Cu, Pb, Cd ions by paper chromatography | 2 | 60 |

**Books Recommended:**

1. Practical Chemistry : For B.Sc. I, II And III Year Students of All India Universities By Pandey O.P. & et Al. publisher S. Chand's, Paper back December 2010.

2 .Basic Principles of Practical Chemistry by V. Venkateswaran (Author) publisher S.

Chand's, Paperback – 1 January 2012

3. Chemistry In Laboratory-B.Sc.-Sem-I-Vi-Hons.
By Dr.Subhojit Ghosh (Author), Dr.Madhushree Das Sharma (Author), publisher CBCS, Paperback – 1 January 2019.

**Further Reading**:

1. Practical Chemistry, By Sonia Ratnani (Author), Swati Agrawal (Author), Sujeet Kumar Mishra (Author) publisger Mc Graw Hill, 1st Edition Paperback – 16 September 2020.

2. B.Sc. Practical Chemistry First Year By Paperback, Dr. M.M.N. Tandon, Publisher: Shiva Lal Agarwal & Company, 2020.

**HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN**

Course Name **: B. Sc. Chemistry** **Semester : III**
**PROGRAM CODE : SCIUG102**
**COURSE CODE : SC23MDCCHE303**

**Type of course : Multi disciplinary course MDSC**
**Name of course : Simplified chemistry I** **Total Mark : 50**

**Effective from June 2023 Under NEP 2020**

| | | | |
|---|---|---|---|
| Total Credits : 02 | Teaching Hours per Week: 02<br>Teaching Hours per Semester: 30 | Theory | External 25 Marks<br>Internal 25 Marks |

**Course Objectives**:

1. To understand the core concepts of Boron compounds.
2. To understand Heterocyclic chemistry and their application.

**Course Outcome:**

1.Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those of boron compounds and hetrocyclic Chemistries.

2.Students will be able to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.

3. Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.

| Unit | Topic | Credit | Hr |
|---|---|---|---|
| 1 | Boron Hydride<br>Introduction for Metal Hydride<br>Classification of hydrides.<br>Preparation, properties structure and use of Diborone.<br>Bridge bonding in $B_2H_6$ (M.O. and sp3 approach).<br>Structure of higher Borones: $B_4H_{10}$, $B_5H_9$, $B_5H_{11}$, $B_6H_{10}$, $B_{10}H_{14}$. | 1 | 15 |

| | | | |
|---|---|---|---|
| 2 | Heterocyclic Compounds.<br>Introduction, Nomenclature, Structure and aromatic characteristic of Pyrrole, Furan and Thiophene and Pyridine<br>Reactivity and orientation of electrophilic substitution reactions (ESR) in five membered heterocycles (Pyrrole, Furan and Thiophene) and six membered heterocycles (Pyridine).<br>Synthesis and electrophilic substitution of Pyrrole, Furan and Thiophene<br>Structure of Pyridine, Electrophilic and Nucleophilic substitution reactions of pyridine.<br>Basicity of pyridine, piperidine and pyrrole | 1 | 15 |

**Books Recommended:**

**Inorganic Chemistry**


1. Modern Inorganic Chemistry' by G.F.Liporni, ELBS, 4th edn. Coilin Educational. 1983.
2. Inorganic Chemistry' D.F.Shriver. P.W.Atkinss and C.H.Longford, 3rd edn, ELPS Oxford University Press, 1999..
3. 'Concise Inorganic Chemistry' J.D.Lee. 5th edn. Oxford University Press.
4. Inorganic Chemistry', D.F.Slirjver, P.W.Atkinss, 3rdedn, Oxferd. 1999.
5. 'Concise Inorganic Chemistry' J.D.Lee, 4thedn, Champman and hall ELBS,1991.
6. 'Inorganic Chemistry' by A.G.Sharp, 3rdedn, ELBS, Longman, 1990.


**Organic Chemistry**


1. 'Organic reaction and mechanism, P.S.Kalsi, New Age internationalPublishers.
2. Text book of organic Chemistry. P.S.Kalsi, New Age international Publishers.
3. Organic Chemistry Vol. I&II.S.M.Muklierji, S.P.Singh.R.P.Kapoor.
4. Reaction mechanism in Organic Chemistry, S.M.Mukhergi. S.P.Singh. 3rdedn. Macmillan.


**Further Reading**:


1. Reaction Mechanism and Reagents in Organic Chemistry, GurdeepR.Chatwal 4thedn, Himalaya Publication House.
2. Text book of Organic Chemistry, ArunBahal, S.Chand.
3. Organic Chemistry, R.Morrison and R.Boyd, 6thedn, Pearson Education 2003.

4. Organic Chemistry. T.W.GrahamSolomons, 4thedn. John Wilay. 1998.
5. Nuclear Chemistry by C.V.Shekhar, Dominent-Publisher. New Delhi.
6. Essentials of physical Chemistr by B.S.Bahal, ArunBahal. G. D.Tuli.
7. Physical Chemistry by P.W.Atkins. 5th edn.Oxferd 1994 7thedn-2002.

**HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN**

Program Name **: B. Sc. Chemistry** **Semester : III**
**PROGRAM CODE : SCIUG102**
**COURSE CODE : SC23PMDCCHE303**

**Type of Course : Practicals Multidisciplinary (Elective) Course PMDSC**
**Name of Course : Practical's for Simplified chemistry I**

**Total Marks : 50**

**Effective from June 2023 Under NEP 2020**

| | | |
|---|---|---|
| Total Credits : 02 Teaching Hours per Week: 04<br>Lab Teaching Hours per semester:60<br>Minimum Number Practicals to be Performed: 10 | Practicals | External 25 Marks<br>Internal 25 Marks |

**Course Objectives**:

1. To identify the components in Inorganic mixtures.
2. Preparation of different solutions and samples.

**Course Outcomes:**

1. Students will gain a comprehensive knowledge and skills in preparation of solutions for carrying out reactions in inorganic samples.
2. To understand basic methods to identify the compnents in mixtures.

| Sr.No. | List of Practicals | Credit | Hr |
|---|---|---|---|
| 1 | **Inorganic Chemistry**<br>**1. Inorganic Qualitative analysis. (any 8 Mixture)**<br>Mixture containing four radicals.Anion should be be ($CO_3^{-2}$,$NO_2^-$ ;$SO_3^{-2}$;$S^{-2}$;$Br^-$;$Cl^-$;$I^-$;$NO_3^-$;$SO_4^{-2}$;$CrO_4^{-2}$; $Cr_2O_7^{-2}$) (except $PO_4^{-3}$ , $Bo_3^{-3}$,$ASO_3^{-3}$,$ASO_4^{-3}$,$O^{-2}$<br>**2.** To separate Pb, Ag, and Hg ions present in a mixture by paper chromatography.<br>**3.** To separate Zn,Co, Ni ions by paper chromatography. | 1 | 30 |

**Books Recommended:**

1.Practical Chemistry : For B.Sc. I, II And III Year Students of All India Universities By Pandey O.P. & et Al. publisher S. Chand's, Paperback December 2010.

2. Basic Principles of Practical Chemistry,
by V. Venkateswaran (Author) publisher S. Chand's, Paperback – 1 January 2012
3. Chemistry In Laboratory-B.Sc.-Sem-I-Vi-Hons.
By Dr.Subhojit Ghosh (Author), Dr.Madhushree Das Sharma (Author), publisher CBCS, Paperback – 1 January 2019.

**Further Reading**:

1. Practical Chemistry, By Sonia Ratnani (Author), Swati Agrawal (Author), Sujeet Kumar Mishra (Author) publisger Mc Graw Hill, 1st Edition Paperback – 16 September 2020.
2. B.Sc. Practical Chemistry First Year By Paperback, Dr. M.M.N. Tandon, Publisher: Shiva Lal Agarwal & Company, 2020.

**HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN**

Program Name **: B. Sc. Chemistry** **Semester : III**

**PROGRAM CODE : SCIUG102**
**COURSE CODE : SC23IKSCHE305**

**Type of course : Indian Knowledge System course IKS**
**Name of course : Basic concept of IKS** **Total Mark : 50**

**Effective from June 2023 Under NEP 2020**

| | | |
|---|---|---|
| Total Credits : 02 Teaching Hours per Week: 02<br>Teaching hours per semester: 30 | Theory | External 25 Marks<br>Internal 25 Marks |

**Course Objectives**:

1. To understand importance IKS
2. To have knowledge of IKS.
3. To know about principle and appication of IKS.

**Course Outcome:**

1. Students will gain a comprehensive knowledge of IKS.
2. To raise awareness among students about Indian culture .
3. Students will learn how to control and prevent pollution.

| Unit | Topic | Credit | Hr |
|---|---|---|---|
| 1 | **Indian Knowledge System**<br>Introduction to IKS, Importance of IKS,<br>What is Santa Dhrma and its core literature source, Vedas and Vedagas, Purans and its Itihas, classification of Santan dharma literature,Fourteen major divisions, Dharma Shastras and Smritis, oral and writte scripts of IKS. | 1 | 15 |
| 2 | **Religion and Dharma**<br>Distinction of religion and Dharma, spirutial and materialistic dimensions, Presentation of IKS in form of sutras,concept of yagna, | 1 | 15 |

| | | | |
|---|---|---|---|
| | Indian philosphical system – Upnishdas, IKS and modern science, Apllications of IKS of humanity. | | |

**Books Recommended:**

1. Mahadavan, Bhatt, Nagendra Pavana, Indian knowledge system : concepts and applications, (PHI Learning privatelimited, New Delhi, 2022.

2. Bhag Chand Chuhan, Indian knowledge system, Garuda Prakashan ltd, 2023..

3. Vasant Shinde, Bhartiya Knowledge systems, ; Bhishma Prakashan, 2022.

4. Virander kumar Singh, Pranchin Bhartiya, Akshayavata Prakashan, 2016.

**Further Reading**:

**Suggestive Digital Platforms Web Links:**

1. http://www.phindia.com
2. https://www.garudabooks.com
3. https://www.exotiindiaart.com/
4. https://www.anaadi.org

**3HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN**

Program Name **: B. Sc. Chemistry** **Semester : III**

**PROGRAM CODE : SCIUG102**
**COURSE CODE : SC23SECCHE306**

**Type of course : Skill Enhancement course SEC**
**Name of course : Environmental Pollution** **Total Mark : 50**

**Effective from June 2023 Under NEP 2020**

| | | |
|---|---|---|
| Total Credits : 02 Teaching Hours per Week: 02<br>Teaching hours per semester: 30 | Theory | External 25 Marks<br>Internal 25 Marks |

**Course Objectives**:

1. To understand importance environment and its protection
2. To have knowledge of principles of environment protection.
3. To know about types of pollutants.

**Course Outcome:**

1. Students will gain a comprehensive knowledge about natural and artificil pollutants.
2. To understand the importance of environment forour survival.
3. Students will learn how to reduce and stop environment pollution with helpof various agencies.

| Unit | Topic | Credit | Hr |
|---|---|---|---|
| 1 | **Air Pollution And Water Pollution**<br>Introduction & Classification of pollutant<br>What is air pollution and Types of pollution<br>Source of air pollution and action to reduce air pollution<br>Acid Rain, Green house effect, Emissions of major industrial air pollutant and air quality index<br>Water pollution; Source of Water Pollution Sewage and Wastewater, Agricultural, How to prevent pollutions of Indian rivers, lakes and seas. | 1 | 15 |

| | | | |
|---|---|---|---|
| | Types of water pollution- Physical &Chemicals, Biological and Physiological<br>What is Climate Change - Impacts of global warming | | |
| 2 | **Soil, Noise, Thermal And Radio Pollution**<br>Introduction of soil pollution<br>Sources of soil pollution and action to reduce soil pollution.,<br>Effect of Modern Agro-Technology on Soil and Benefit of organic farming.<br>What is Noise Pollution and action to reduce Noise pollution.What is Thermal PollutionWhat is Radio Active Pollution and How to prevent Radio Active PollutionPrevention and control of Pollution | 1 | 15 |

**Books Recommended:**

1. Environmental chemistry by Shankar IAS Academy, 10 edition, vikas book house, Pune
2. Environment Issues In India, Mahesh Rangarajan, By Pearson Education India 2006.
3. Environmental Science 8 Th Edition By Botkin And Keller, Wiley, 2012 House,2008.
4. Perspective in enviromental studies, Anubhav Kaushik, CP kaushik, 7th edition, New age International pvt ltd. 2021.

**Further Reading**:

1. Green chemistry: theory and Practice, Paul t. Anatas, John charles Warner, Oxford university Press,1998.
2. A text book ofgreenchemistry, sankar p dey and Nayin sepoy, Tech word, 2012.

**Suggestive Digital Platforms Web Links:**

1. http://earthwatch.org/vlabs
2. https://www.treehugger.com.
3. https://www.earthday.org.
4. https://www.fivebooks.com

**3HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN**

Program Name **: B. Sc. Chemistry** **Semester : III**
**PROGRAM CODE : SCIUG102**
**COURSE CODE : SC23SECCHE306A**

**Type of course : Skill Enhancement course SEC**
**Name of course : Chemical Metallurgy** **Total Mark : 50**

**Effective from June 2023 Under NEP 2020**

| | | |
|---|---|---|
| Total Credits : 02 Teaching Hours per Week: 02<br>Teaching hours per semester: 30 | Theory | External 25 Marks<br>Internal 25 Marks |

**Course Objectives**:

1. To understand importance metals and their utility
2. To have knowledge of extraction of metals.
3. To know about types of electro metallurgical processes.

**Course Outcome:**

1. Students will gain a comprehensive knowledge about metullargical methods.
2. To understand the importance of earth as source of metals.
3. Students will learn how to extract metals from natural resources and electrometallurgical tools..

| Unit | Topic | Credit | Hr |
|---|---|---|---|
| 1 | **General principles of Extraction of Metals**<br>Parts of Earth, composition of lithosphere, different layers of earth, production of elements in sea water, metals, non-metals and metalloids, occurrence of elements in nature, minerals and ores, types of ores,<br>Different steps of Metallurgy,Crushing and grinding of the ore(pulverisation of the ore),<br>Removal of impurities from the ore, Electromagnec separation Method, Hydraulic washing method, leaching process, Hand picking method, Froth flotation process, Calcination, Roasting,<br>Pyrometallurgical process, Gold schmidts',Alamino thermic | 1 | 15 |

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|---|---|---|---|
| | process, Thermite welding process, Carbon reduction process, Reduction of metallic sulphides, Reduction of Metallic slphates, Reduction of metallic halides, Smelting, flux, slag, Electrolytic reduction, | | |
| 2 | **Electro metallurgy and Furnaces**<br>Electro metallurgy, refining of impure metals, Liquation process, Fractional distillation process, Zone refining process, Oxidative process, Cupellation process, Bessemer's process, puddling process, softening process, Parke's process, Bett's electrolytic process, Poling process, Mond's process, Van-Arkelde Boer's process, Amalgamation process, Electrolytic process, Hydrometallurgical process,<br>Types of furnaces, Reverberatory furnace, Blast furnace, Pudding furnace, Bessemer's converter, Open-hearth furnace, Siemen's Martins furnace, Electric furnace. | 1 | 15 |

**Books Recommended:**


1. Industrial Chemistry vol 1 & 2by B. K. Sharma, Krishna prakashan, 2022.
2. Comphrensive industrial chemistry by Prakshan more,Pragati prakshan, 2022.
3. Industrial chemistry by B K sharma, Goel publication house,2008.


**Further Reading**:


1. Extractive metullargy, Avinash b. lele, Yakshil B. Choksi, second edition, International Press 2022.
2. Refractory metals extractive metallurgy, Roger Rumby, Wiley press, 1998.


**Suggestive Digital Platforms Web Links:**

1. http://chemcollective.org/vlabs
2. https://www.krishna.com.
3. https://wp.labster.com/chemistry-virtual-labs/
4. https://www.youtube.com/watch?v=O_nyEj_hZzg