

**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     | Theory | External 50 Marks |
|                    | Teaching Hours per Semester: 60 |        | 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 basic 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.

  
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| Unit | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Credit | Hr |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----|
| 1    | <b>CFT of Coordination compounds</b> HKP<br>CFT theory, splitting of d-orbitals Oh and Td complex. Factor influencing the magnitude of $\Delta$ (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    | <b>Carbohydrates.</b> SPV<br>Introduction, Classification and nomenclature of Mono Saccharides.<br>Reactions of Glucose and Fructose. (Methylation, Acetylation, Oxidation with Br <sub>2</sub> water and Conc. HNO <sub>3</sub> , Reaction with HCN, NH <sub>2</sub> OH, C <sub>6</sub> H <sub>5</sub> NHNH <sub>2</sub> , 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    | <b>Ultra violet Spectroscopy</b> MAP<br>Introduction, Type of electronic transitions.<br>Origin of UV Spectra, Effect of conjugation, Concept of Chromophores and Auxochromes.<br>Bathochromic, Hypsochromic, Hyper chromic, and Hypochromic shifts.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1      | 15 |





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|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----|
|    | Woodward – Fisher rules.<br>Problems of conjugated enes, enones and aromatic ketones,<br>aldehydes, acids and esters using empirical rules.<br>(Data table has to be provided to students)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |   |    |
| 4. | <b>Thermodynamics</b> <span style="color: blue;">MRC</span><br>Clapeyron equation and its Applications for various phase equilibrium, Integrated form of Clapeyron - Clausius 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 |

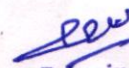
**Books Recommended:**

➤ **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, Hendrickson, 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.

  
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**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., Oxford, 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.**

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MJ-2-301-A Theory

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

Course Name : B. Sc. Chemistry

Semester : III

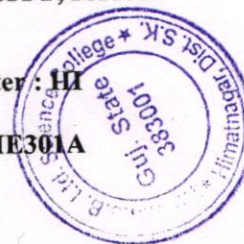
PROGRAM CODE : SCIUG102

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     | Theory | External 50 Marks |
|                    | Teaching Hours per Semester: 60 |        | Internal 50 Marks |

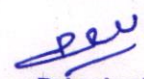
**Course Objectives:**

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

**Course Outcome:**

1. Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories based 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 |
|------|-------|--------|----|
|------|-------|--------|----|

  
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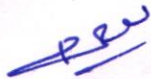


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|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----|
| 1  | <b>Magnetic Properties of Co-ordination compounds.</b> HKP<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  | <b>Wave Mechanics</b> NIP<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  | <b>Electrophilic Aromatic substitution</b> MAP<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. | <b>Physical properties of Liquid.</b> KPD<br>Vapour pressure, Surface tension, Application of surface tension and Measurement using Stalagmometer Perachore 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 |





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| <p><b>Books Recommended:</b></p> <p>➤ <b>Inorganic Chemistry</b></p> <p>1 Quantum Chemistry by R.K.Prasad, Revised IIIrd Edition, Page- 3,5,7,34-37,41,65-68.</p> <p>2. Concise Inorganic Chemistry J.D.Lee, 4th edition, ELBS publication.</p> <p>3. Magnetochemistry by Shymal and Dutta, Revised IIIrd Edition, New age publications.</p> <p>➤ <b>Organic Chemistry</b></p> <p>1. Organic Chemistry by Morrison and Boyd. 4th ed. Pearson Education- 2003</p> <p>2. Organic Chemistry by pine, Hendrickson, Cram and Hammond 4th ed. By P.S.Kalsi.</p> <p>3. Advance Organic Chemistry by Jerry March.</p> <p>4. Advance Organic Chemistry by ArunBahal and B.S.Bahal.</p> <p>5. Organic Chemistry Vol. I &amp; II by S.M.Mukherji, S.P.Sing, R.P.Kapoor.</p> <p>6. Reaction mechanism and Reagents in Organic Chemistry by GurdeepR.Chatwal 4th ed. Himalaya public House.</p> <p>7. Text book of Organic Chemistry by ArunBahal, B.S.Bhal, S.Chand.</p> <p>8. Organic Spectroscopy by P.S.Kalsi.</p> <p>9. Organic Chemistry by I.R.Finar.</p> <p>➤ <b>Physical Chemistry</b></p> <p>1. Advance Physical Chemistry by Gurdeep Raj</p> <p>2. Physical Chemistry (Question and Answers) by R.N.Madan, G.D.Tully, S.Chand.</p> <p>3. Principal of Physical Chemistry by Puri, Sharma, Pathania.</p> <p>4. Chemical Thermodynamics by R.P.Rastogy and R.R.Misra.</p> <p>5. Essentials of Physical Chemistry by B.S.Bahal, ArunBahal,G.D.Tully.</p> <p>6. Physical Chemistry by P.W.Atkins, 5th ed., Oxferd, 1994, 7th ed.,2002</p> <p>7. Physical Chemistry by R.A.Alberty and R.J.Silbey, John Wiley, 1995.</p> <p>8. Physical Chemistry by G.H.Barrow, 5th ed., Mac Graw Hill, 1998, 6th ed.</p> <p>9. Physical Chemistry by W.J.Moore, 4th ed., Orient Longmans, 1969.</p> <p><b>Further Reading:</b></p> |                                                                                                                                                             |  |  |

  
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Practical - PMJDSC-CHE-301

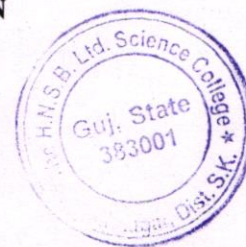
**HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN**

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        | Practicals | External 25 Marks |
|                                               | Lab Teaching Hours per semester:60 |            | Internal 25 Marks |
| Minimum Number Practicals to be Performed: 12 |                                    |            |                   |

**GROUP B**

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

**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 |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----|
| <b>GROUP A</b> | Inorganic Chemistry<br>1. Inorganic Qualitative analysis. (any 8 Mixtures)<br>Mixture containing four radicals. Anion should be ( $\text{CO}_3^{2-}$ , $\text{NO}_2^-$ , $\text{SO}_3^{2-}$ , $\text{S}^{2-}$ , $\text{Br}^-$ , $\text{Cl}^-$ , $\text{I}^-$ , $\text{NO}_3^-$ , $\text{SO}_4^{2-}$ , $\text{CrO}_4^{2-}$ , $\text{Cr}_2\text{O}_7^{2-}$ ) (except $\text{PO}_4^{3-}$ , $\text{Bo}_3^{3-}$ , $\text{ASO}_3^{3-}$ , $\text{ASO}_4^{3-}$ , $\text{O}^{2-}$ ) | 2      | 60 |

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|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----|
|                | 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |    |
| <b>GROUP B</b> | Physical Chemistry (Do any 10)<br>✓ 1. Conductometric titration of HCl/CH <sub>3</sub> COOH Vs NaOH<br>✓ 2. Conductometric titration of HCl Vs NH <sub>4</sub> OH<br>✓ 3. pH-metric titration of HCl Vs NaOH after Calibration of pH meter.<br>✓ 4. Determine the Dissociation constant of the acid using mixtures of CH <sub>3</sub> COONa and CH <sub>3</sub> COOH 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 <sub>3</sub> COOC <sub>2</sub> H <sub>5</sub> , CH <sub>3</sub> COOCH <sub>3</sub> and CH <sub>3</sub> COOCH <sub>2</sub> , and show the constancy of reaction equivalent of -CH <sub>2</sub> - 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 <sub>2</sub> O <sub>2</sub> 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.

  
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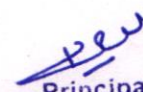
Chand's, Paperback – 1 January 2012

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) publisher 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.

  
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