

**GOVERNMENT COLLEGE FOR WOMEN,  
PARADE GROUND, JAMMU  
(An Autonomous College)**



**CHEMISTRY SYLLABUS  
SEMESTER I-II  
OF  
FOUR YEAR UNDER GRADUATE PROGRAMME (FYUGP)  
UNDER NEP - 2020**



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**GOVERNMENT COLLEGE FOR WOMEN, PARADE GROUND, JAMMU**  
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**Syllabi and Courses of Study in Chemistry for Semesters I & II of Four Year Undergraduate Programme (FYUGP) Under NEP-2020**

Semester	Course Type	Course Code	Course Title	Credits
I	Major	UCHMJT 101	Foundation Course Chemistry - I	4
	Major	UCHMJP 101	Major Practical Course – I	2
	Minor	UCHMNT 101	Foundation Course Chemistry – I	4
	Minor	UCHMNP 101	Minor Practical Course – I	2
	Multidisciplinary	UCHMDT 101	Basic Concepts in Chemistry	3
II	Major	UCHMJT 201	Foundation Course Chemistry - II	4
	Major	UCHMJP 201	Major Practical Course – II	2
	Minor	UCHMNT 201	Foundation Course Chemistry – II	4
	Minor	UCHMNP 201	Minor Practical Course -II	2
	Multidisciplinary	UCHMDT 201	Basic Concepts in Chemistry	3



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**Syllabi and Courses of Study in Chemistry for Semester I of Four Year Undergraduate Programme (FYUGP) Under NEP-2020 for the Examinations to be held in Dec. 2022, 2023 & 2024**

**Programme :- Undergraduate Programme in Chemistry (FYUGP Under NEP-2020)**

**Semester: Ist**

**Course Type: Major Theory Course**

**Course Title: Foundation Course Chemistry - I**

**Course Code: UCHMJT 101**

**Credits: 04**

**Maximum Marks: 100**

**Total Teaching Hours: 60 Hours**

**External Examination: 80 marks**

**Duration of Examination: 03 Hours**

**Internal Assessment: 20 marks**

**Course Objectives:**

The course reviews the structure of the atom, which is a necessary pre-requisite in understanding the nature of chemical bonding in compounds. The course provides basic information about organic chemistry and reaction mechanism. The course also gives knowledge of gaseous state of matter.

**Learning Outcomes:**

After the completion of course, students will be able to:

- Understand the applications of quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of orbitals.
- Understand the periodic table and classification of elements.
- Understand the applications of general concepts of organic chemistry.
- Understand reaction intermediates and their reactivity.
- Acquire knowledge of behaviour of gases.
- Understand the kinetic theory of gases and explain why real gases deviate from ideal behaviour.
- Understand the different types of molecular speeds and their temperature dependence.
- Understand collision number, collision frequency, collision diameter and mean free path of molecules.
- Understand liquefaction of gases.

**Unit I Atomic Structure**

**(12 Hours)**

Introduction to Quantum mechanics, Time independent Schrodinger wave equation and meaning of various terms. Significance of  $\psi$  and  $\psi^2$ , application of Schrödinger wave equation

(For examinations to be held in Dec. 2022, 2023 & 2024)

to hydrogen atom (in terms of spherical polar co-ordinates), radial and angular parts of the hydrogenic wave functions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (only graphical representation). Radial and angular nodes and their significance. Probability distribution curves and radial probability distribution curves. Quantum numbers and their significance. Shapes of s, p and d atomic orbitals.

**Rules for filling electrons in atomic orbitals:** Aufbau principle, Pauli's Exclusion principle and Hund's rule of maximum multiplicity. Stability of fully filled and half filled orbitals (concept of exchange energy).

## **Unit II Classification of Elements, Periodic Properties and Study of s-block elements** (12 Hours)

**Classification:** Periodic laws (Mendeleev and Mosley), classification of elements into s, p, d and f blocks, Nuclear charge, Effective nuclear charge, Slater's rule.

**Periodic Properties:** Atomic/ionic radii, ionization energy, oxidation state, electron affinity and electronegativity.

**s-Block Elements:** Physical and chemical properties of alkali and alkaline earth metals. Compounds of alkali and alkaline earth metals with special reference to oxides and hydroxides. Classification and general properties of hydrides.

## **Unit III Fundamentals of Organic Chemistry** (12 Hours)

$sp^3$ ,  $sp^2$  and  $sp$  hybridization of carbon compounds; Bond length, bond angle and bond energy; Localized and delocalized chemical bond, polar and non-polar organic molecules, dipole moment and hydrogen bonding.

Electron displacements in organic molecules: Inductive Effect, Electromeric Effect, Resonance /Mesomeric Effect and Hyperconjugation.

Aromaticity and aromatic compounds: Huckel rule

## **Unit IV Mechanism of Organic Reactions** (12 Hours)

**Reactive Intermediates:** Generation, structure and stability of carbocations, carbanions and free radicals. Elementary idea of carbenes, nitrenes and arynes.

Arrow notations in organic reactions. Homolytic and heterolytic bond cleavage.

**Types of reagents:** Nucleophiles and electrophiles.

**Types of organic reactions:** Substitution, addition and elimination reactions (with examples).

Mechanism of Nucleophilic substitution reactions ( $S_N^1$  and  $S_N^2$ ) with energy profile diagram.

Mechanism of  $\beta$ -elimination reactions (E1 and E2).

## **Unit V States of Matter – I** (12 Hours)

Postulates of kinetic theory of gases, ideal and non-ideal gases, ideal gas equation, deviation from ideal behaviour, compressibility factor, causes of deviation and Van der Waal's equation, explanation of behaviour of real gases on the basis of Van der Waal's equation.

(For examinations to be held in Dec. 2022, 2023 & 2024)

**Molecular velocities:** Root mean square, average and most probable velocities, collision theory, collision number, mean free path and collision diameter.

**Liquefaction of gases:** Critical phenomenon, critical constants and their calculation from Van der Waal's equation, Linde's method and Claude's method for liquefaction of gases

**Books recommended:**

1. Concise Inorganic Chemistry, J.D. Lee; ELBS, 1991.
2. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson, & P. L. Gaus; 3<sup>rd</sup> ed., Wiley.
3. Concepts and Models in Inorganic Chemistry, B.E. Douglas, D.H. McDaniel & J.J. Alexander; John Wiley & Sons.
4. Inorganic Chemistry: Principles of Structure and Reactivity, J.E. Huheey, E.A. Keiter, R.L. Keiter & O.K. Medhi; Pearson Education India, 2006.
5. Principles of Inorganic Chemistry; B.R. Puri, L.R. Sharma and K.C. Kalia; 33<sup>rd</sup> Edition, Vishal Publishers & Co. 2017.
6. Periodic Table and Periodic Properties; V.B. Patania; Campus Books International, 2007.
7. Organic Chemistry; T.W. Graham Solomon, C.B. Fryhle & S.A. Snyder; John Wiley & Sons, 2014.
8. Fundamentals of Organic Chemistry, 7<sup>th</sup> Ed. J.E. McMurry; Cengage Learning India Edition, 2013.
9. A Guidebook to Mechanism in Organic Chemistry; P. Sykes; Orient Longman, New Delhi, 1988.
10. Organic Chemistry (Vol. I & II); I.L. Finar; E.L.B.S.
11. Organic Chemistry; R.T. Morrison & R.N. Boyd; Pearson, 2010.
12. Advanced Organic Chemistry; A. Bahl & B.S. Bahl; S. Chand, 2010.
13. Physical Chemistry; G.M. Barrow; Tata McGraw-Hill, 2007.
14. Physical Chemistry 4th Ed.; G.W. Castellan; Narosa, 2004.
15. Principles of Physical Chemistry; B.R. Puri, L.R. Sharma and L.S. Pathania; 47<sup>th</sup> Edition, Vishal Publishers & Co. 2017.

(For examinations to be held in Dec. 2022, 2023 & 2024)

### **NOTE FOR PAPER SETTERS**

#### **Internal Assessment Test Paper (Total Marks: 20; Time Duration: 1 hour)**

The internal assessment test shall be of 15 marks and will be held on completion of about 40% of the prescribed syllabus.

The question paper will have three sections.

**Section A** will consist of three short answer type questions of two marks each, covering the syllabus prescribed for the test. The candidate shall have to attempt any two questions with explanation upto 30 words. **(Total: 04 marks)**

**Section B** will consist of three medium answer type questions of three marks each, covering the syllabus prescribed for the test. The candidate shall have to attempt any two questions with explanation upto 50 words **(Total: 06 marks)**

**Section C** will consist of two long answer type questions of five marks each, covering the syllabus prescribed for the test. The candidate shall have to attempt any one question with explanation upto 100 words **(Total marks: 05)**

Weightage for attendance – 05 marks

#### **External End Semester Examination (Total Marks: 80; Time Duration: 3 hours)**

The question paper will have three sections.

**Section A** will consist of five short answer type questions of three marks each (one question from each unit). The candidate shall have to attempt all the questions with explanation upto 70 to 80 words. **(Total: 15 marks)**

**Section B** will consist of five medium answer type questions of seven marks each, (one question from each unit). The candidate shall have to attempt all the questions upto having 250 to 300 words. **(Total: 35 marks)**

**Section C** will consist of five long answer type questions (one question from each unit) of fifteen marks each. The candidate shall have to attempt any two questions upto having 500 to 600 words. **(Total: 30 marks)**

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## **SEMESTER-I**

(For examinations to be held in Dec. 2022, 2023 & 2024)

**Course Title: - Major Practical Course - I**

**Course Code: UCHMJP 101**

**Credits: 02**

**Time: 4 Hours**

**Maximum Marks: 50**

**External Examination: 25 marks**

**Internal Examination: 25 marks**

**Learning Outcomes:** The students will be trained in preparation and standardization of solutions of different concentrations, volumetric analysis and detection of elements. The students will be trained in purification of organic compounds by crystallization and sublimation.

1. Preparation of solutions of different concentrations - 0.1 M to 0.001 M and 0.1 N to 0.001 N (NaOH, oxalic acid,  $\text{KMnO}_4$ ,  $\text{K}_2\text{Cr}_2\text{O}_7$ )
2. Standardization of solutions.
3. Estimation of oxalic acid by titrating it with  $\text{KMnO}_4$ .
4. Estimation of water of crystallization in Mohr's salt by titrating it with  $\text{KMnO}_4$ .
5. Estimation of Fe(II) ions by titrating it with  $\text{K}_2\text{Cr}_2\text{O}_7$  using internal indicator.
6. Estimation of Fe(II) ions by titrating it with  $\text{K}_2\text{Cr}_2\text{O}_7$  using external indicator.
7. Estimation of Cu(II) ions iodometrically using sodium thiosulphate.
8. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
9. Purification of organic compounds by crystallization (from water and alcohol) and sublimation (benzoic acid, camphor and naphthalene).
10. Criteria of Purity: Determination of melting and boiling points.
11. Detection of extra elements (N, S, Cl, Br, I) in organic compounds.
12. Determination of mass of gas.
13. Determination of numerical value of gas constant.

### **Books recommended:**

1. Vogel's Qualitative Inorganic Analysis; G. Svehla; Pearson Education, 2012.
2. Vogel's Quantitative Chemical Analysis; J. Mendham; Pearson, 2009.
3. Textbook of Practical Organic Chemistry; A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford and P.W.G. Smith; Prentice-Hall, 5<sup>th</sup> edition, 1996.

(For examinations to be held in Dec. 2022, 2023 & 2024)

4. Practical Organic Chemistry Orient-Longman; F.G. Mann & B.C. Saunders; 1960.
5. Advanced Practical Organic Chemistry; N.K. Vishnoi; Second edition.
6. Advanced Practical Physical Chemistry; J.B. Yadav; Third edition.
7. Experiments in Chemistry; D.V. Jahagirdhar; Himalaya Publishing House, 2015.
8. A Textbook of Chemistry Practicals; S.S. Sawhney, M.S. Jassal & S.P. Mittal; APH Publishing Corporation, 1996.
9. An Introduction to Practical Chemistry; K.K. Sharma & D.S. Sharma; Vikas Publishing House Pvt. Ltd., 1996.

### **DISTRIBUTION OF MARKS**

A.	Internal Assessment (Daily evaluation of practical records/viva-voce/attendance, etc.)	Attendance: 05 marks
		Day to day performance: 06 marks
		Minor Project: 06 marks
		Practical Test: 08 marks
B.	External Examination (100% syllabus)	Examination: 20 marks (Two practicals of 10 marks each)
		Viva-voce: 05 marks

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**Syllabi and Courses of Study in Chemistry for Semester I of Four Year Undergraduate Programme (FYUGP) Under NEP-2020 for the Examinations to be held in Dec. 2022, 2023 & 2024**

**Programme: - Undergraduate Programme in Chemistry (FYUGP Under NEP-2020)**

**Semester: Ist**

**Course Type: Minor Theory Course**

**Course Title: Foundation Course Chemistry - I**

**Course Code: UCHMNT 101**

**Credits: 04**

**Maximum Marks: 100**

**Total Teaching Hours: 60 Hours**

**External Examination: 80 marks**

**Duration of Examination: 03 Hours**

**Internal Assessment: 20 marks**

**Course Objectives:**

The course reviews the structure of the atom, which is a necessary pre-requisite in understanding the nature of chemical bonding in compounds. The course provides basic information about organic chemistry and reaction mechanism. The course also gives knowledge of gaseous state of matter.

**Learning Outcomes:**

After the completion of course, students will be able to:

- Understand the applications of quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of orbitals
- Understand the periodic table and its classification
- Understand the applications of general concepts of organic chemistry
- Understand reaction intermediates and their reactivity.
- Acquire knowledge of behaviour of gases.
- Understand the kinetic theory of gases and explain why real gases deviate from ideal behaviour.
- Understand the different types of molecular speeds and their temperature dependence.
- Understand collision number, collision frequency, collision diameter and mean free path of molecules

**Unit I Atomic Structure**

**(12 Hours)**

Introduction to Quantum mechanics, Time independent Schrodinger wave equation and meaning of various terms. Significance of  $\psi$  and  $\psi^2$ , application of Schrödinger wave equation

(For examinations to be held in Dec. 2022, 2023 & 2024)

to hydrogen atom (in terms of spherical polar co-ordinates), radial and angular parts of the hydrogenic wave functions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (only graphical representation). Radial and angular nodes and their significance. Probability distribution curves and radial probability distribution curves. Quantum numbers and their significance. Shapes of s, p and d atomic orbitals.

**Rules for filling electrons in atomic orbitals:** Aufbau principle, Pauli's Exclusion principle and Hund's rule of maximum multiplicity. Stability of fully filled and half filled orbitals (concept of exchange energy).

## **Unit II Classification of Elements, Periodic Properties and Study of s-block elements** (12 Hours)

**Classification:** Periodic laws (Mendeleev and Mosley), classification of elements into s, p, d and f blocks, Nuclear charge, Effective nuclear charge, Slater's rule.

**Periodic Properties:** Atomic/ionic radii, ionization energy, oxidation state, electron affinity and electronegativity.

**s-Block Elements:** Physical and chemical properties of alkali and alkaline earth metals. Compounds of alkali and alkaline earth metals with special reference to oxides and hydroxides. Classification and general properties of hydrides.

## **Unit III Fundamentals of Organic Chemistry** (12 Hours)

$sp^3$ ,  $sp^2$  and  $sp$  hybridization of carbon compounds; Bond length, bond angle and bond energy; Localized and delocalized chemical bond, polar and non-polar organic molecules, dipole moment and hydrogen bonding.

Electron displacements in organic molecules: Inductive Effect, Electromeric Effect, Resonance /Mesomeric Effect and Hyperconjugation.

Aromaticity and aromatic compounds: Huckel rule

## **Unit IV Mechanism of Organic Reactions** (12 Hours)

**Reactive Intermediates:** Generation, structure and stability of carbocations, carbanions and free radicals. Elementary idea of carbenes, nitrenes and arynes.

Arrow notations in organic reactions. Homolytic and heterolytic bond cleavage.

**Types of reagents:** Nucleophiles and electrophiles.

**Types of organic reactions:** Substitution, addition and elimination reactions (with examples).

Mechanism of Nucleophilic substitution reactions ( $S_N^1$  and  $S_N^2$ ) with energy profile diagram.

Mechanism of  $\beta$ -elimination reactions (E1 and E2).

## **Unit V States of Matter – I** (12 Hours)

Postulates of kinetic theory of gases, ideal and non-ideal gases, ideal gas equation, deviation from ideal behaviour, compressibility factor, causes of deviation and Van der Waal's equation, explanation of behaviour of real gases on the basis of Van der Waal's equation.

(For examinations to be held in Dec. 2022, 2023 & 2024)

**Molecular velocities:** Root mean square, average and most probable velocities, collision theory, collision number, mean free path and collision diameter.

**Liquefaction of gases:** Critical phenomenon, critical constants and their calculation from Van der Waal's equation, Linde's method and Claude's method for liquefaction of gases

**Books recommended:**

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2. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson, & P. L. Gaus; 3<sup>rd</sup> ed., Wiley.
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(For examinations to be held in Dec. 2022, 2023 & 2024)

### **NOTE FOR PAPER SETTERS**

#### **Internal Assessment Test Paper (Total Marks: 20; Time Duration: 1 hour)**

The internal assessment test shall be of 15 marks and will be held on completion of about 40% of the prescribed syllabus.

The question paper will have three sections.

**Section A** will consist of three short answer type questions of two marks each, covering the syllabus prescribed for the test. The candidate shall have to attempt any two questions with explanation upto 30 words. **(Total: 04 marks)**

**Section B** will consist of three medium answer type questions of three marks each, covering the syllabus prescribed for the test. The candidate shall have to attempt any two questions with explanation upto 50 words **(Total: 06 marks)**

**Section C** will consist of two long answer type questions of five marks each, covering the syllabus prescribed for the test. The candidate shall have to attempt any one question with explanation upto 100 words **(Total marks: 05)**

Weightage for attendance – 05 marks

#### **External End Semester Examination (Total Marks: 80; Time Duration: 3 hours)**

The question paper will have three sections.

**Section A** will consist of five short answer type questions of three marks each (one question from each unit). The candidate shall have to attempt all the questions with explanation upto 70 to 80 words. **(Total: 15 marks)**

**Section B** will consist of five medium answer type questions of seven marks each, (one question from each unit). The candidate shall have to attempt all the questions upto having 250 to 300 words. **(Total: 35 marks)**

**Section C** will consist of five long answer type questions (one question from each unit) of fifteen marks each. The candidate shall have to attempt any two questions upto having 500 to 600 words. **(Total: 30 marks)**

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## **SEMESTER-I**

(For examinations to be held in Dec. 2022, 2023 & 2024)

**Course Title: - Minor Practical Course - I**

**Course Code: UCHMNP 101**

**Credits: 02**

**Time: 4 Hrs**

**Maximum Marks: 50**

**External Examination: 25 marks**

**Internal Examination: 25 marks**

**Learning Outcomes:** The students will be trained in preparation and standardization of solutions of different concentrations, volumetric analysis and detection of elements. The students will be trained in purification of organic compounds by crystallization and sublimation.

1. Preparation of solutions of different concentrations - 0.1 M to 0.001 M and 0.1 N to 0.001 N (NaOH, oxalic acid,  $\text{KMnO}_4$ ,  $\text{K}_2\text{Cr}_2\text{O}_7$ )
2. Standardization of solutions.
3. Estimation of oxalic acid by titrating it with  $\text{KMnO}_4$ .
4. Estimation of water of crystallization in Mohr's salt by titrating it with  $\text{KMnO}_4$ .
5. Estimation of Fe(II) ions by titrating it with  $\text{K}_2\text{Cr}_2\text{O}_7$  using internal indicator.
6. Estimation of Fe(II) ions by titrating it with  $\text{K}_2\text{Cr}_2\text{O}_7$  using external indicator.
7. Estimation of Cu(II) ions iodometrically using sodium thiosulphate.
8. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
9. Purification of organic compounds by crystallization (from water and alcohol) and sublimation (benzoic acid, camphor and naphthalene).
10. Criteria of Purity: Determination of melting and boiling points.
11. Detection of extra elements (N, S, Cl, Br, I) in organic compounds.
12. Determination of mass of gas.
13. Determination of numerical value of gas constant.

### **Books recommended:**

1. Vogel's Qualitative Inorganic Analysis; G. Svehla; Pearson Education, 2012.
2. Vogel's Quantitative Chemical Analysis; J. Mendham; Pearson, 2009.
3. Textbook of Practical Organic Chemistry; A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford and P.W.G. Smith; Prentice-Hall, 5<sup>th</sup> edition, 1996.

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5. Advanced Practical Organic Chemistry; N.K. Vishnoi; Second edition.
6. Advanced Practical Physical Chemistry; J.B. Yadav; Third edition.
7. Experiments in Chemistry; D.V. Jahagirdhar; Himalaya Publishing House, 2015.
8. A Textbook of Chemistry Practicals; S.S. Sawhney, M.S. Jassal & S.P. Mittal; APH Publishing Corporation, 1996.
9. An Introduction to Practical Chemistry; K.K. Sharma & D.S. Sharma; Vikas Publishing House Pvt. Ltd., 1996.

### **DISTRIBUTION OF MARKS**

A	Internal assessment (Daily evaluation of practical records/viva-voce/attendance, etc.)	Attendance: 05 marks
		Day to day performance: 12 marks
		Practical Test: 08 marks
B	External Examination (100% syllabus)	Examination: 20 marks (Two practicals of 10 marks each)
		Viva-voce: 05 marks

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**Syllabi and Courses of Study in Chemistry for Semester I of Four Year Undergraduate Programme (FYUGP) Under NEP-2020 for the Examinations to be held in Dec. 2022, 2023 & 2024**

**Programme :- Undergraduate Programme in Chemistry (FYUGP Under NEP-2020)**

**Semester: Ist**

**Course Type: Multidisciplinary Course**

**Course Title: Basic Concepts in Chemistry**

**Course Code: UCHMDT 101**

**Credits: 03**

**Maximum Marks: 75**

**Total Teaching Hours: 45 Hours**

**External Examination: 60 marks**

**Duration of Examination: 2.5 Hours**

**Internal Assessment: 15 marks**

**Course Objectives:**

The course reviews the structure of the atom, which is a necessary pre-requisite in understanding the nature of chemical bonding in compounds. The course gives knowledge of states of matter and provides basic knowledge about carbon and its compounds. The course also discusses how chemistry is involved in everyday life.

**Learning Outcomes:**

After the completion of course, students will be able to:

- Understand different models of atoms.
- Understand the concept of shells, subshells and orbitals and their filling.
- Understand nature of different bonds.
- Acquire knowledge of different states of matter.
- Understand the hybridization and homologues series in alkanes, alkenes and alkynes.
- Understand concept of functional groups.
- Understand chemistry in everyday life.

**Unit I Structure of Atom and Chemical Bonding (12 Hours)**

Concept of elements, atoms and molecules; Atomic and molecular mass, Mole concept and molar mass; Discovery of electron, proton and neutron; Atomic number, isotopes and isobars. Rutherford's model of atom and its limitations, Bohr's model of atom and its limitations. Concept of shells, subshells and orbitals; Rules for filling electrons in orbitals – Aufbau principle, Pauli's exclusion principle and Hund's rule of maximum multiplicity; Electronic configuration of elements (first twenty elements).

(For examinations to be held in Dec. 2022, 2023 & 2024)

Types of chemical bond: Ionic and covalent bonds, characteristics of ionic and covalent compounds.

**Unit II States of Matter (11 Hours)**

Characteristics of solids, liquids and gases, intermolecular interactions.

**Gases** - Boyle's law, Charles's law, Gay-Lussac's law & Avogadro's law. Ideal gas equation, deviation from ideal behaviour. Concept of real gases.

**Liquid** - Surface tension and viscosity; Effect of temperature on surface tension and viscosity of liquids.

**Solids** - Crystalline and amorphous solids; Types of crystalline solids (ionic, covalent, molecular & metallic solids).

**Unit-III Carbon and its Compounds (11 Hours)**

Covalent bonding in carbon compounds, hybridization, concept of sigma and pi-bonds, versatile nature of carbon, allotropic forms of carbon (diamond, graphite and fullerenes), saturated and unsaturated hydrocarbons.

Alkanes, Alkenes and Alkynes; Homologous series; Concept of functional groups (alkylhalides, alcohols, aldehydes, ketones and carboxylic acids).

**Unit-IV Chemistry in Everyday Life (11 Hours)**

Elementary idea of analgesics, antiseptics, anti-inflammatory, antibiotics, antacids, antipyretics, antimicrobials, antiallergic, antidepressants, tranquilizers (examples without structures).

Food preservatives, artificial sweeteners and flavouring agents (definition with examples).

Soaps & detergents and their cleansing action.

Preparation and uses of baking soda, washing soda, bleaching powder.

Vitamins, proteins and carbohydrates (Sources & deficiency diseases).

**Books recommended:**

1. The Language of Chemistry; G. D. Tuli and P. L. Soni; S. Chand Publishers.
2. General Chemistry 5th Ed.; R.H. Petrucci; Macmillan Publishing Co.: New York (1985).
3. Principles of Inorganic Chemistry; B. R. Puri, L. R. Sharma and K. C. Kalia; 33<sup>rd</sup> Edition, Vishal Publishers & Co. 2017.
4. Principles of Physical Chemistry; B. R. Puri, L. R. Sharma and L. S. Pathania; 47<sup>th</sup> Edition, Vishal Publishers & Co. 2017.
5. General Chemistry Cengage Learning India Pvt. Ltd.; J.C. Kotz, P.M. Treichel & J.R. Townsend; New Delhi, 2009.
6. University Chemistry; B.H. Mahan; 3rd Ed. Narosa, 1998.
7. General Chemistry 5th Ed.; R.H. Petrucci; Macmillan Publishing Co.: New York, 1985.
8. Organic Chemistry Concepts and Applications 8<sup>th</sup> Ed.; Dr Jagdamba Singh; Pragati Prakashan, 2015.



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9. A Textbook of Physical Chemistry; A.S. Negi and S.C. Anand; New Age International Publishes, 2005.
10. Advanced Inorganic Chemistry, 36<sup>th</sup> Ed.; Gurdeep Raj; Krishna's Educational Publishers, 2016.
11. Organic Chemistry; P.N. Mukherjee; Wisdom Press, 2019.
12. Bioinorganic Chemistry; K.H. reddy; NewAge International Publishers, 2007.
13. General Biochemistry, 6<sup>th</sup> Ed.; J.H. Weil; New Age International Limited Publishers.
14. Medicinal Chemistry, 2<sup>nd</sup> Ed.; A.L. Gupta; A Pragati Publications, 2008.
15. A-Z Chemistry; N. Purohit; Centrum Press, 2009.

### **NOTE FOR PAPER SETTERS**

#### **Internal Assessment Test Paper (Total Marks: 15; Time Duration: 45 minutes)**

The internal assessment test shall be of 10 marks and will be held on completion of about 40% of the prescribed syllabus.

The question paper will have three sections.

**Section A** will consist of three short answer type questions of one mark each, covering the syllabus prescribed for the test. The candidate shall have to attempt any two questions with explanation up to 20 words **(Total: 02 marks)**

**Section B** will consist of three medium answer type questions of two marks each, covering the syllabus prescribed for the test. The candidate shall have to attempt any two questions with explanation up to 30 words **(Total: 04 marks)**

**Section C** will consist of two long answer type questions of four marks each, covering the syllabus prescribed for the test. The candidate shall have to attempt any one question with explanation up to 50 words **(Total marks: 04)**

Weightage for attendance – 05 marks

#### **External End Semester Examination (Total Marks: 60; Time Duration: 2.5 hours)**

The question paper will have three sections.

**Section A** will consist of four short answer type questions of three marks each (one question from each unit). The candidate shall have to attempt all the questions with explanation upto 70 to 80 words. **(Total: 12 marks)**

**Section B** will consist of four medium answer type questions of six marks each, (one question from each unit). The candidate shall have to attempt all the questions with explanation upto 250 to 300 words. **(Total: 24 marks)**

**Section C** will consist of four long answer type questions (one question from each unit) of twelve marks each. The candidate shall have to attempt any two questions with explanation upto 500 to 600 words. **(Total: 24 marks)**



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**GOVERNMENT COLLEGE FOR WOMEN, PARADE GROUND, JAMMU**  
**(An Autonomous College)**

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**Syllabi and Courses of Study in Chemistry for Semester II of Four Year Undergraduate Programme (FYUGP) Under NEP-2020 for the Examinations to be held in May 2023, 2024 & 2025**

**Programme :- Undergraduate Programme in Chemistry (FYUGP Under NEP-2020)**

**Semester: 2nd**

**Course Type: Major Theory Course**

**Course Title: Foundation Course Chemistry - II**

**Course Code: UCHMJT 201**

**Credits: 04**

**Maximum Marks: 100**

**Total Teaching Hours: 60 Hours**

**External Examination: 80 marks**

**Duration of Examination: 03 Hours**

**Internal Assessment: 20 marks**

**Course Objectives:**

The course reviews the nature of chemical bonding in compounds. The aim of this course is to make students understand thermodynamic concepts, properties of thermodynamic systems, laws of thermodynamics and their correlation with other branches of physical chemistry and make students able to apply thermodynamic concepts to the system of variable compositions and equilibrium. The course also provides basic knowledge about stereochemistry and hydrocarbons.

**Learning Outcomes:**

After the completion of course, students will be able to:

- Draw the plausible structures and geometries of molecules using VSEPR theory and MO diagrams (homo- & hetero-nuclear diatomic molecules)
- Understand the importance and applications of chemical bonds
- Understand the properties of liquids and liquid crystals.
- Understand surface tension and viscosity of liquids.
- Understand various symmetry elements and crystal structure of NaCl, KCl and CsCl.
- Understand the importance of  $\Delta U$ ,  $\Delta H$ ,  $\Delta S$  and  $\Delta G$  for a chemical change
- Understand the three laws of thermodynamics
- Understand the applications of general concepts of organic chemistry
- Understand stereo-chemical aspects of organic molecules.
- Acquire knowledge of synthesis and reactions of aliphatic and aromatic hydrocarbons.

(For examinations to be held in May 2023, 2024 & 2025)

### **Unit I Chemical Bonding and Molecular Structure (12 Hours)**

**Ionic Bonding:** General characteristics of ionic bond. Energy considerations in ionic bond, lattice energy, solvation energy and their importance in the context of stability and solubility of ionic compounds. Born-Haber cycle and its applications, polarizing power and polarizability. Fajans' rules, percentage ionic character in covalent bond.

**Covalent bonding:** VB Approach, Shapes of some inorganic molecules and ions on the basis of VSEPR theory and hybridization with suitable examples of linear ( $\text{BeF}_2$ ,  $\text{ZnCl}_2$ ), trigonal planar ( $\text{BF}_3$ ,  $\text{CO}_3^{2-}$ ,  $\text{NO}_3^-$ ,  $\text{SnCl}_2$ ), tetrahedral ( $\text{CH}_4$ ,  $\text{ClO}_4^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ), trigonal bipyramidal ( $\text{PF}_5$ ,  $\text{SF}_4$ ,  $\text{ClF}_3$ ,  $\text{XeF}_2$ ) and octahedral ( $\text{SF}_6$ ,  $\text{BrF}_5$ ,  $\text{XeF}_4$ ) arrangements.

**MO Approach:** Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, non-bonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO,  $\text{NO}^+$  and  $\text{NO}^-$ . Comparison of VB and MO approaches.

### **Unit II States of Matter—II (12 Hours)**

**Liquid state:** Intermolecular forces, vapour pressure, boiling points of liquids, surface tension and its determination using Stalagmometer and factors affecting surface tension.

Viscosity and its determination using Ostwald's viscometer, effect of temperature on coefficient of viscosity of liquids (quantitative treatment only).

**Liquid crystals:** Introduction and types (nematic, smectic & cholesteric) with examples.

**Solid state:** Characteristics of solids, types of solids, space lattice, unit cell and its types, elements of symmetry, crystal systems, Bravais lattice types. Laws of Crystallography-Law of Constancy of Interfacial Angles, Law of Rational Indices, Miller Indices. X-ray diffraction, Bragg's equation and its derivation. Interplanar distance in terms of Miller Indices. Defects in crystals. Structure of NaCl, KCl and CsCl.

### **Unit III Thermodynamics – I (12 Hours)**

System and surroundings, types of system, intensive and extensive properties, State and path functions and their differentials. Thermodynamic processes, concept of heat, work and internal energy. First Law of Thermodynamics. Concept of enthalpy, heat capacities at constant volume and constant pressure and their relationship. Joule's law, Joule-Thomson coefficient and inversion temperature.

Standard state, standard enthalpy of formation, Hess's law of heat summation and its application, heat of reaction at constant pressure and constant volume, enthalpy of neutralization, bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy; Kirchoff's equation.

### **Unit IV Isomerism (12 Hours)**

Isomerism, structural isomerism and its types (brief idea).

Stereoisomerism and its types.

(For examinations to be held in May 2023, 2024 & 2025)

**Conformational isomerism:** Projection formulas: Flying wedge, Newman, Sawhorse and Fisher projection formulae and their interconversions. Conformational analysis of ethane, butane and cyclohexane.

**Optical isomerism:** Concept of chirality, achirality, elements of symmetry (plane of symmetry, centre of symmetry, alternating axis of symmetry). Enantiomerism, diastereoisomerism, meso compounds. Threo and Erythro nomenclature.

**Configurations:** Absolute and relative configuration, CIP rules up to 2 chiral carbons, D/L and R/S configuration

**Geometrical isomerism:** Cis-trans and E-Z Nomenclature (up to two C=C systems).

## **Unit V Aliphatic and Aromatic Hydrocarbons (12 Hours)**

**Aliphatic hydrocarbons:** IUPAC system of naming alkanes, alkenes and alkynes.

**Alkanes:** Methods of preparation with special reference to Wurtz's reaction, Kolbe's reaction and decarboxylation along with mechanism. Physical and chemical properties of alkanes with special reference to free radical halogenation.

**Alkenes:** Methods of preparation with special reference to dehydration of alcohols, dehydrohalogenation of alkyl halides (Saytzeff's rule) and partial hydrogenation of alkynes. Physical properties and chemical reactions with special reference to addition of hydrogen halides (Markownikov's rule and anti-Markownikov's addition), halogenation, hydroboration-oxidation, oxymercuration-demercuration and hydration.

**Alkynes:** Preparation of acetylene from calcium carbide and its conversion into higher alkynes. Physical properties and chemical reactions with special reference to bromination, oxymercuration-demercuration and addition of alkaline  $\text{KMnO}_4$ . Acidic nature of terminal alkynes.

**Aromatic hydrocarbons:** Nomenclature, methods of preparation of benzene from phenol, acetylene and benzoic acid.

Electrophilic substitution reactions of benzene: Nitration, halogenation, sulphonation and Friedel-Crafts reaction (with mechanism).

### **Books recommended:**

1. Concise Inorganic Chemistry, J .D. Lee; ELBS, 1991.
2. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson, & P. L. Gaus; 3<sup>rd</sup> ed., Wiley.
3. Concepts and Models in Inorganic Chemistry, B.E. Douglas, D.H. McDaniel & J.J. Alexander; John Wiley & Sons.
4. Inorganic Chemistry: Principles of Structure and Reactivity, J.E. Huheey, E.A. Keiter, R.L. Keiter & O.K. Medhi; Pearson Education India, 2006.

(For examinations to be held in May 2023, 2024 & 2025)

- Principles of Inorganic Chemistry; B.R. Puri, L.R. Sharma and K.C. Kalia; 33<sup>rd</sup> Edition, Vishal Publishers & Co. 2017.
- March's Advanced Organic Chemistry, Mechanism and Structure, T.W. Graham Solomon, C.B. Fryhle & S.A. Snyder; 7<sup>th</sup> Ed by Michael B. Smith.
- Organic Chemistry, John Wiley & Sons; 2014.
- Fundamentals of Organic Chemistry, 7<sup>th</sup> Ed.; J.E. McMurry; Cengage Learning India Edition, 2013.
- Stereochemistry Conformation and Mechanism 7<sup>th</sup> Ed.; P.S. Kalsi; New Age International Limited Publishers, 2009.
- Stereochemistry of Carbon Compounds; E.L. Eliel; Tata McGraw Hill education, 2000.
- Organic Chemistry (Vol. I & II); I.L. Finar; E.L.B.S.
- Organic Chemistry; R.T. Morrison & R.N. Boyd; Pearson, 2010.
- Advanced Organic Chemistry; A. Bahl & B.S. Bahl; S. Chand, 2010.
- Organic Chemistry A Brief Course, 2<sup>nd</sup> Ed.; W.W. Linstromberg; Heath International Student Edition.
- Physical Chemistry; G.M. Barrow; Tata McGraw-Hill (2007).
- Physical Chemistry 4<sup>th</sup> Ed.; G.W. Castellan; Narosa (2004).
- A Textbook of Physical Chemistry, Volume 1 to 4; K.L. Kapoor; MacMillan India Limited, 1984.
- Principles of Physical Chemistry; B.R. Puri, L.R. Sharma and L.S. Pathania; 47<sup>th</sup> Edition, Vishal Publishers & Co. 2017.
- Physical Chemistry, 3<sup>rd</sup> Ed.; P.W. Atkins; Oxford University Press, 1989.
- Thermodynamics for Chemists; S. Glasstone; East-West Press Limited, 2005.

### **NOTE FOR PAPER SETTERS**

#### **Internal Assessment Test Paper (Total Marks: 20; Time Duration: 1 hour)**

The internal assessment test shall be of 15 marks and will be held on completion of about 40% of the prescribed syllabus.

The question paper will have three sections.

**Section A** will consist of three short answer type questions of two marks each, covering the syllabus prescribed for the test. The candidate shall have to attempt any two questions with explanation up to 30 words **(Total: 04 marks)**

**Section B** will consist of three medium answer type questions of three marks each, covering the syllabus prescribed for the test. The candidate shall have to attempt any two questions with explanation up to 50 words **(Total: 06 marks)**

**Section C** will consist of two long answer type questions of five marks each, covering the syllabus prescribed for the test. The candidate shall have to attempt any one question with explanation up to 100 words **(Total marks: 05)**

Weightage for attendance – 5 marks

(For examinations to be held in May 2023, 2024 & 2025)

**External End Semester Examination (Total Marks: 80; Time Duration: 3 hours)**

The question paper will have three sections.

**Section A** will consist of five short answer type questions of three marks each (one question from each unit). The candidate shall have to attempt all the questions with explanation upto 70 to 80 words. **(Total: 15 marks)**

**Section B** will consist of five medium answer type questions of seven marks each, (one question from each unit). The candidate shall have to attempt all the questions with explanation upto 250 to 300 words. **(Total: 35 marks)**

**Section C** will consist of five long answer type questions (one question from each unit) of fifteen marks each. The candidate shall have to attempt any two questions with explanation upto 500 to 600 words. **(Total: 30 marks)**

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## **SEMESTER-II**

(For examinations to be held in May 2023, 2024 & 2025)

**Course Title:- Major Practical Course - II**

**Course Code: UCHMJP 201**

**Credits: 02**

**Time: 4 Hours**

**Maximum Marks: 50**

**External Examination: 25 marks**

**Internal Examination: 25 marks**

**Learning Outcomes:** The students will be trained in qualitative salt analysis and quantitative estimation of some metal ions in a given solution, in determining the surface tension and viscosity of liquids. In addition, the students will be able to synthesize and purify organic compounds.

1. Qualitative analysis of inorganic salt (one anion and one cation) out of the following:  
Cations:  $\text{NH}_4^+$ ,  $\text{Pb}^{2+}$ ,  $\text{Ag}^+$ ,  $\text{Bi}^{3+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Sn}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Al}^{3+}$ ,  $\text{Cr}^{3+}$ ,  $\text{Co}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Na}^+$ ,  $\text{K}^+$   
Anions:  $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$ ,  $\text{S}^{2-}$ ,  $\text{SO}_3^{2-}$ ,  $\text{S}_2\text{O}_3^{2-}$ ,  $\text{NO}_2^-$ ,  $\text{CH}_3\text{COO}^-$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{C}_2\text{O}_4^{2-}$
2. Determination of the surface tension of a liquid or a dilute solution using a Stalagmometer.
3. Study of the variation of surface tension of a detergent solution with concentration.
4. Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.
5. Study of the variation of viscosity of an aqueous solution with concentration of solute.
6. Preparations:
  - (a) Bromination of Phenol/Aniline
  - (b) Benzoylation of amines/phenols
  - (c) Oxime and 2,4-dinitrophenylhydrazone of aldehydes and ketones  
(Recrystallisation, determination of melting point and calculation of quantitative yields to be done)

### **Books recommended:**

1. Vogel's Qualitative Inorganic Analysis; G. Svehla; Pearson Education, 2012.
2. Vogel's Quantitative Chemical Analysis; J. Mendham; Pearson, 2009.
3. Textbook of Practical Organic Chemistry; A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford and P.W.G. Smith; Prentice-Hall, 5<sup>th</sup> edition, 1996.
4. Practical Organic Chemistry Orient-Longman; F.G. Mann & B.C. Saunders; 1960.
5. Advanced Practical Organic Chemistry; N.K. Vishnoi; Second edition.
6. Advanced Practical Physical Chemistry; J.B. Yadav; Third edition.
7. Experiments in Chemistry; D.V. Jahagirdhar; Himalaya Publishing House, 2015.

(For examinations to be held in May 2023, 2024 & 2025)

8. A Textbook of Chemistry Practicals; S.S. Sawhney, M.S. Jassal & S.P. Mittal; APH Publishing Corporation, 1996.
9. An Introduction to Practical Chemistry; K.K. Sharma & D.S. Sharma; Vikas Publishing House Pvt. Ltd., 1996.

### DISTRIBUTION OF MARKS

A.	Internal Assessment (Daily evaluation of practical records/viva-voce/attendance, etc.)	Attendance: 05 marks
		Day to day performance: 06 marks
		Minor Project: 06 marks
		Practical Test: 08 marks
B.	External Examination (100% syllabus)	Examination: 20 marks (Two practicals of 10 marks each)
		Viva-voce: 05 marks

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**Syllabi and courses of Study in Chemistry for Semester II of Four Year Undergraduate Programme (FYUGP) Under NEP-2020 for the Examinations to be held in May 2023, 2024 & 2025**

**Programme :- Undergraduate Programme in Chemistry (FYUGP Under NEP-2020)**

**Semester: 2nd**

**Course Type: Minor Theory Course**

**Course Title: Foundation Course Chemistry - II**

**Course Code: UCHMNT 201**

**Credits: 04**

**Maximum Marks: 100**

**Total Teaching Hours: 60 Hours**

**External Examination: 80 marks**

**Duration of Examination: 03 Hours**

**Internal Assessment: 20 marks**

**Course Objectives:**

The course reviews the nature of chemical bonding in compounds. The aim of this course is to make students understand thermodynamic concepts, properties of thermodynamic systems, laws of thermodynamics and their correlation with other branches of physical chemistry and make students able to apply thermodynamic concepts to the system of variable compositions and equilibrium. The course also provides basic knowledge about stereochemistry and hydrocarbons.

**Learning Outcomes:**

After the completion of course, students will be able to:

- Draw the plausible structures and geometries of molecules using VSEPR theory and MO diagrams (homo- & hetero-nuclear diatomic molecules)
- Understand the importance and applications of chemical bonds
- Understand the properties of liquids and liquid crystals.
- Understand surface tension and viscosity of liquids.
- Understand various symmetry elements and crystal structure of NaCl, KCl and CsCl.
- Understand the importance of  $\Delta U$ ,  $\Delta H$ ,  $\Delta S$  and  $\Delta G$  for a chemical change
- Understand the three laws of thermodynamics
- Understand the applications of general concepts of organic chemistry
- Understand stereo-chemical aspects of organic molecules.
- Acquire knowledge of synthesis and reactions of aliphatic and aromatic hydrocarbons.

(For examinations to be held in May 2023, 2024 & 2025)

### **Unit I Chemical Bonding and Molecular Structure (12 Hours)**

**Ionic Bonding:** General characteristics of ionic bond. Energy considerations in ionic bond, lattice energy, solvation energy and their importance in the context of stability and solubility of ionic compounds. Born-Haber cycle and its applications, polarizing power and polarizability. Fajans' rules, percentage ionic character in covalent bond.

**Covalent bonding:** VB Approach, Shapes of some inorganic molecules and ions on the basis of VSEPR theory and hybridization with suitable examples of linear ( $\text{BeF}_2$ ,  $\text{ZnCl}_2$ ), trigonal planar ( $\text{BF}_3$ ,  $\text{CO}_3^{2-}$ ,  $\text{NO}_3^-$ ,  $\text{SnCl}_2$ ), tetrahedral ( $\text{CH}_4$ ,  $\text{ClO}_4^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ), trigonal bipyramidal ( $\text{PF}_5$ ,  $\text{SF}_4$ ,  $\text{ClF}_3$ ,  $\text{XeF}_2$ ) and octahedral ( $\text{SF}_6$ ,  $\text{BrF}_5$ ,  $\text{XeF}_4$ ) arrangements.

**MO Approach:** Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, non-bonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO,  $\text{NO}^+$  and  $\text{NO}^-$ . Comparison of VB and MO approaches.

### **Unit II States of Matter—II (12 Hours)**

**Liquid state:** Intermolecular forces, vapour pressure, boiling points of liquids, surface tension and its determination using Stalagmometer and factors affecting surface tension.

Viscosity and its determination using Ostwald's viscometer, effect of temperature on coefficient of viscosity of liquids (quantitative treatment only).

**Liquid crystals:** Introduction and types (nematic, smectic & cholesteric) with examples.

**Solid state:** Characteristics of solids, types of solids, space lattice, unit cell and its types, elements of symmetry, crystal systems, Bravais lattice types. Laws of Crystallography-Law of Constancy of Interfacial Angles, Law of Rational Indices, Miller Indices. X-ray diffraction, Bragg's equation and its derivation. Interplanar distance in terms of Miller Indices. Defects in crystals. Structure of NaCl, KCl and CsCl.

### **Unit III Thermodynamics – I (12 Hours)**

System and surroundings, types of system, intensive and extensive properties, State and path functions and their differentials. Thermodynamic processes, concept of heat, work and internal energy. First Law of Thermodynamics. Concept of enthalpy, heat capacities at constant volume and constant pressure and their relationship. Joule's law, Joule-Thomson coefficient and inversion temperature.

Standard state, standard enthalpy of formation, Hess's law of heat summation and its application, heat of reaction at constant pressure and constant volume, enthalpy of neutralization, bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy; Kirchoff's equation.

### **Unit IV Isomerism (12 Hours)**

Isomerism, structural isomerism and its types (brief idea).

Stereoisomerism and its types.

(For examinations to be held in May 2023, 2024 & 2025)

**Conformational isomerism:** Projection formulas: Flying wedge, Newman, Sawhorse and Fisher projection formulae and their interconversions. Conformational analysis of ethane, butane and cyclohexane.

**Optical isomerism:** Concept of chirality, achirality, elements of symmetry (plane of symmetry, centre of symmetry, alternating axis of symmetry). Enantiomerism, diastereoisomerism, meso compounds. Threo and Erythro nomenclature.

**Configurations:** Absolute and relative configuration, CIP rules up to 2 chiral carbons, D/L and R/S configuration

**Geometrical isomerism:** Cis-trans and E-Z Nomenclature (up to two C=C systems).

## Unit V Aliphatic and Aromatic Hydrocarbons (12 Hours)

**Aliphatic hydrocarbons:** IUPAC system of naming alkanes, alkenes and alkynes.

**Alkanes:** Methods of preparation with special reference to Wurtz's reaction, Kolbe's reaction and decarboxylation along with mechanism. Physical and chemical properties of alkanes with special reference to free radical halogenation.

**Alkenes:** Methods of preparation with special reference to dehydration of alcohols, dehydrohalogenation of alkyl halides (Saytzeff's rule) and partial hydrogenation of alkynes. Physical properties and chemical reactions with special reference to addition of hydrogen halides (Markownikov's rule and anti-Markownikov's addition), halogenation, hydroboration-oxidation, oxymercuration-demercuration and hydration.

**Alkynes:** Preparation of acetylene from calcium carbide and its conversion into higher alkynes. Physical properties and chemical reactions with special reference to bromination, oxymercuration-demercuration and addition of alkaline  $\text{KMnO}_4$ . Acidic nature of terminal alkynes.

**Aromatic hydrocarbons:** Nomenclature, methods of preparation of benzene from phenol, acetylene and benzoic acid.

Electrophilic substitution reactions of benzene: Nitration, halogenation, sulphonation and Friedel-Crafts reaction (with mechanism).

### Books recommended:

1. Concise Inorganic Chemistry, J .D. Lee; ELBS, 1991.
2. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson, & P. L. Gaus; 3<sup>rd</sup> ed., Wiley.
3. Concepts and Models in Inorganic Chemistry, B.E. Douglas, D.H. McDaniel & J.J. Alexander; John Wiley & Sons.
4. Inorganic Chemistry: Principles of Structure and Reactivity, J.E. Huheey, E.A. Keiter, R.L. Keiter & O.K. Medhi; Pearson Education India, 2006.
5. Principles of Inorganic Chemistry; B.R. Puri, L.R. Sharma and K.C. Kalia; 33<sup>rd</sup> Edition, Vishal Publishers & Co. 2017.

(For examinations to be held in May 2023, 2024 & 2025)

6. March's Advanced Organic Chemistry, Mechanism and Structure, T.W. Graham Solomon, C.B. Fryhle & S.A. Dnyder; 7<sup>th</sup> Ed by Michael B. Smith.
7. Organic Chemistry, John Wiley & Sons; 2014.
8. Fundamentals of Organic Chemistry, 7<sup>th</sup> Ed.; J.E. McMurry; Cengage Learning India Edition, 2013.
9. Stereochemistry Conformation and Mechanism 7<sup>th</sup> Ed.; P.S. Kalsi; New Age International Limited Publishers, 2009.
10. Stereochemistry of Carbon Compounds; E.L. Eliel; Tata McGraw Hill education, 2000.
11. Organic Chemistry (Vol. I & II); I.L. Finar; E.L.B.S.
12. Organic Chemistry; R.T. Morrison & R.N. Boyd; Pearson, 2010.
13. Advanced Organic Chemistry; A. Bahl & B.S. Bahl; S. Chand, 2010.
14. Organic Chemistry A Brief Course, 2<sup>nd</sup> Ed.; W.W. Linstromberg; Heath International Student Edition.
15. Physical Chemistry; G.M. Barrow; Tata McGraw-Hill (2007).
16. Physical Chemistry 4<sup>th</sup> Ed.; G.W. Castellan; Narosa (2004).
17. A Textbook of Physical Chemistry, Volume 1 to 4; K.L. Kapoor; MacMillan India Limited, 1984.
18. Principles of Physical Chemistry; B.R. Puri, L.R. Sharma and L.S. Pathania; 47<sup>th</sup> Edition, Vishal Publishers & Co. 2017.
19. Physical Chemistry, 3<sup>rd</sup> Ed.; P.W. Atkins; Oxford University Press, 1989.
20. Thermodynamics for Chemists; S. Glasstone; East-West Press Limited, 2005.

### **NOTE FOR PAPER SETTERS**

#### **Internal Assessment Test Paper (Total Marks: 20; Time Duration: 1 hour)**

The internal assessment test shall be of 15 marks and will be held on completion of about 40% of the prescribed syllabus.

The question paper will have three sections.

**Section A** will consist of three short answer type questions of two marks each, covering the syllabus prescribed for the test. The candidate shall have to attempt any two questions with explanation up to 30 words **(Total: 04 marks)**

**Section B** will consist of three medium answer type questions of three marks each, covering the syllabus prescribed for the test. The candidate shall have to attempt any two questions with explanation up to 50 words **(Total: 06 marks)**

**Section C** will consist of two long answer type questions of five marks each, covering the syllabus prescribed for the test. The candidate shall have to attempt any one question with explanation up to 100 words **(Total marks: 05)**

Weightage for attendance – 5 marks

(For examinations to be held in May 2023, 2024 & 2025)

**External End Semester Examination (Total Marks: 80; Time Duration: 3 hours)**

The question paper will have three sections.

**Section A** will consist of five short answer type questions of three marks each (one question from each unit). The candidate shall have to attempt all the questions with explanation upto 70 to 80 words. **(Total: 15 marks)**

**Section B** will consist of five medium answer type questions of seven marks each, (one question from each unit). The candidate shall have to attempt all the questions with explanation upto 250 to 300 words. **(Total: 35 marks)**

**Section C** will consist of five long answer type questions (one question from each unit) of fifteen marks each. The candidate shall have to attempt any two questions with explanation upto 500 to 600 words. **(Total: 30 marks)**

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## SEMESTER-II

(For examinations to be held in May 2023, 2024 & 2025)

**Course Title: - Minor Practical Course - II**

**Course Code: UCHMNP 201**

**Credits: 02**

**Time: 4 Hrs**

**Maximum Marks: 50**

**External Examination: 25 marks**

**Internal Examination: 25 marks**

**Learning Outcomes:** The students will be trained in qualitative salt analysis and quantitative estimation of some metal ions in a given solution, in determining the surface tension and viscosity of liquids. In addition, the students will be able to synthesize and purify organic compounds.

1. Qualitative analysis of inorganic salt (one anion and one cation) out of the following:  
Cations:  $\text{NH}_4^+$ ,  $\text{Pb}^{2+}$ ,  $\text{Ag}^+$ ,  $\text{Bi}^{3+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Sn}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Al}^{3+}$ ,  $\text{Cr}^{3+}$ ,  $\text{Co}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Na}^+$ ,  $\text{K}^+$   
Anions:  $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$ ,  $\text{S}^{2-}$ ,  $\text{SO}_3^{2-}$ ,  $\text{S}_2\text{O}_3^{2-}$ ,  $\text{NO}_2^-$ ,  $\text{CH}_3\text{COO}^-$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{C}_2\text{O}_4^{2-}$
2. Determination of the surface tension of a liquid or a dilute solution using a Stalagmometer.
3. Study of the variation of surface tension of a detergent solution with concentration.
4. Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.
5. Study of the variation of viscosity of an aqueous solution with concentration of solute.
6. Preparations:
  - (a) Bromination of Phenol/Aniline
  - (b) Benzoylation of amines/phenols
  - (c) Oxime and 2,4-dinitrophenylhydrazone of aldehydes and ketones  
(Recrystallisation, determination of melting point and calculation of quantitative yields to be done)

### **Books recommended:**

1. Vogel's Qualitative Inorganic Analysis; G. Svehla; Pearson Education, 2012.
2. Vogel's Quantitative Chemical Analysis; J. Mendham; Pearson, 2009.
3. Textbook of Practical Organic Chemistry; A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford and P.W.G. Smith; Prentice-Hall, 5<sup>th</sup> edition, 1996.
4. Practical Organic Chemistry Orient-Longman; F.G. Mann & B.C. Saunders; 1960.
5. Advanced Practical Organic Chemistry; N.K. Vishnoi; Second edition.
6. Advanced Practical Physical Chemistry; J.B. Yadav; Third edition.
7. Experiments in Chemistry; D.V. Jahagirdhar; Himalaya Publishing House, 2015.

(For examinations to be held in May 2023, 2024 & 2025)

8. A Textbook of Chemistry Practicals; S.S. Sawhney, M.S. Jassal & S.P. Mittal; APH Publishing Corporation, 1996.
9. An Introduction to Practical Chemistry; K.K. Sharma & D.S. Sharma; Vikas Publishing House Pvt. Ltd., 1996.

### DISTRIBUTION OF MARKS

A	Internal assessment (Daily evaluation of practical records/viva-voce/attendance, etc.)	Attendance: 05 marks
		Day to day performance: 12 marks
		Practical Test: 08 marks
B	External Examination (100% syllabus)	Examination: 20 marks (Two practicals of 10 marks each)
		Viva-voce: 05 marks

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**GOVERNMENT COLLEGE FOR WOMEN, PARADE GROUND, JAMMU**  
**(An Autonomous College)**

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**Syllabi and Courses of Study in Chemistry for Semester II of Four Year Undergraduate Programme (FYUGP) Under NEP-2020 for the Examinations to be held in May 2023, 2024 & 2025**

**Programme :- Undergraduate Programme in Chemistry (FYUGP Under NEP-2020)**

**Semester: 2nd**

**Course Type: Multidisciplinary Course**

**Course Title: Basic Concepts in Chemistry**

**Course Code: UCHMDT 201**

**Credits: 03**

**Maximum Marks: 75**

**Total Teaching Hours: 45 Hours**

**External Examination: 60 marks**

**Duration of Examination: 2.5 Hours**

**Internal Assessment: 15 marks**

**Course Objectives:**

The course reviews the structure of the atom, which is a necessary pre-requisite in understanding the nature of chemical bonding in compounds. The course gives knowledge of states of matter and provides basic knowledge about carbon and its compounds. The course also discusses how chemistry is involved in everyday life.

**Learning Outcomes:**

After the completion of course, students will be able to:

- Understand different models of atoms.
- Understand the concept of shells, subshells and orbitals and their filling.
- Understand nature of different bonds.
- Acquire knowledge of different states of matter.
- Understand the hybridization and homologues series in alkanes, alkenes and alkynes.
- Understand concept of functional groups.
- Understand chemistry in everyday life.

**Unit I Structure of Atom and Chemical Bonding (12 Hours)**

Concept of elements, atoms and molecules; Atomic and molecular mass, Mole concept and molar mass; Discovery of electron, proton and neutron; Atomic number, isotopes and isobars. Rutherford's model of atom and its limitations, Bohr's model of atom and its limitations. Concept of shells, subshells and orbitals; Rules for filling electrons in orbitals – Aufbau principle, Pauli's exclusion principle and Hund's rule of maximum multiplicity; Electronic configuration of elements (first twenty elements).



(For examinations to be held in May 2023, 2024 & 2025)

Types of chemical bond: Ionic and covalent bonds, characteristics of ionic and covalent compounds.

**Unit II States of Matter (11 Hours)**

Characteristics of solids, liquids and gases, intermolecular interactions.

**Gases** - Boyle's law, Charles's law, Gay-Lussac's law & Avogadro's law. Ideal gas equation, deviation from ideal behaviour. Concept of real gases.

**Liquid** - Surface tension and viscosity; Effect of temperature on surface tension and viscosity of liquids.

**Solids** - Crystalline and amorphous solids; Types of crystalline solids (ionic, covalent, molecular & metallic solids).

**Unit-III Carbon and its Compounds (11 Hours)**

Covalent bonding in carbon compounds, hybridization, concept of sigma and pi-bonds, versatile nature of carbon, allotropic forms of carbon (diamond, graphite and fullerenes), saturated and unsaturated hydrocarbons.

Alkanes, Alkenes and Alkynes; Homologous series; Concept of functional groups (alkylhalides, alcohols, aldehydes, ketones and carboxylic acids).

**Unit-IV Chemistry in Everyday Life (11 Hours)**

Elementary idea of analgesics, antiseptics, anti-inflammatory, antibiotics, antacids, antipyretics, antimicrobials, antiallergic, antidepressants, tranquilizers (examples without structures).

Food preservatives, artificial sweeteners and flavouring agents (definition with examples).

Soaps & detergents and their cleansing action.

Preparation and uses of baking soda, washing soda, bleaching powder.

Vitamins, proteins and carbohydrates (Sources & deficiency diseases).

**Books recommended:**

1. The Language of Chemistry; G. D. Tuli and P. L. Soni; S. Chand Publishers.
2. General Chemistry 5th Ed.; R.H. Petrucci; Macmillan Publishing Co.: New York (1985).
3. Principles of Inorganic Chemistry; B. R. Puri, L. R. Sharma and K. C. Kalia; 33<sup>rd</sup> Edition, Vishal Publishers & Co. 2017.
4. Principles of Physical Chemistry; B. R. Puri, L. R. Sharma and L. S. Pathania; 47<sup>th</sup> Edition, Vishal Publishers & Co. 2017.
5. General Chemistry Cengage Learning India Pvt. Ltd.; J.C. Kotz, P.M. Treichel & J.R. Townsend; New Delhi, 2009.
6. University Chemistry; B.H. Mahan; 3rd Ed. Narosa, 1998.
7. General Chemistry 5th Ed.; R.H. Petrucci; Macmillan Publishing Co.: New York, 1985.
8. Organic Chemistry Concepts and Applications 8<sup>th</sup> Ed.; Dr Jagdamba Singh; Pragati Prakashan, 2015.

(For examinations to be held in May 2023, 2024 & 2025)

9. A Textbook of Physical Chemistry; A.S. Negi and S.C. Anand; New Age International Publishes, 2005.
10. Advanced Inorganic Chemistry, 36<sup>th</sup> Ed.; Gurdeep Raj; Krishna's Educational Publishers, 2016.
11. Organic Chemistry; P.N. Mukherjee; Wisdom Press, 2019.
12. Bioinorganic Chemistry; K.H. reddy; NewAge International Publishers, 2007.
13. General Biochemistry, 6<sup>th</sup> Ed.; J.H. Weil; New Age International Limited Publishers.
14. Medicinal Chemistry, 2<sup>nd</sup> Ed.; A.L. Gupta; A Pragati Publications, 2008.
15. A-Z Chemistry; N. Purohit; Centrum Press, 2009.

### **NOTE FOR PAPER SETTERS**

#### **Internal Assessment Test Paper (Total Marks: 15; Time Duration: 45 minutes)**

The internal assessment test shall be of 10 marks and will be held on completion of about 40% of the prescribed syllabus.

The question paper will have three sections.

**Section A** will consist of three short answer type questions of one mark each, covering the syllabus prescribed for the test. The candidate shall have to attempt any two questions with explanation up to 20 words **(Total: 02 marks)**

**Section B** will consist of three medium answer type questions of two marks each, covering the syllabus prescribed for the test. The candidate shall have to attempt any two questions with explanation up to 30 words **(Total: 04 marks)**

**Section C** will consist of two long answer type questions of four marks each, covering the syllabus prescribed for the test. The candidate shall have to attempt any one question with explanation up to 50 words **(Total marks: 04)**

Weightage for attendance – 05 marks

#### **External End Semester Examination (Total Marks: 60; Time Duration: 2.5 hours)**

The question paper will have three sections.

**Section A** will consist of four short answer type questions of three marks each (one question from each unit). The candidate shall have to attempt all the questions with explanation upto 70 to 80 words. **(Total: 12 marks)**

**Section B** will consist of four medium answer type questions of six marks each, (one question from each unit). The candidate shall have to attempt all the questions with explanation upto 250 to 300 words. **(Total: 24 marks)**

**Section C** will consist of four long answer type questions (one question from each unit) of twelve marks each. The candidate shall have to attempt any two questions with explanation upto 500 to 600 words. **(Total: 24 marks)**