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

CHEMISTRY SYLLABUS

SEMESTER I-IV

OF

FOUR YEAR UNDER GRADUATE PROGRAMME (FYUGP)

UNDER NEP - 2020

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

Syllabi and Courses of Study in Chemistry for Semesters I, II, III & IV 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
III	Major	UCHMJT 301	Foundation Course Chemistry - III	4
	Major	UCHMJT 302	Foundation Course Chemistry - IV	4
	Major	UCHMJP 301	Major Practical Course – III	2
	Minor	UCHMNT 301	Foundation Course Chemistry – III	4
	Multidisciplinary	UCHMDT 301	Basic Concepts in Chemistry	3
IV	Major	UCHMJT 401	Inorganic Chemistry - I	4
	Major	UCHMJT 402	Physical Chemistry - I	4
	Major	UCHMJT 403	Organic Chemistry - I	4
	Major	UCHMJP 401	Major Practical Course – IV	2
	Major	UCHMJP 402	Major Practical Course – V	2
	Vocational	UCHVOC 401	Industrial Chemistry - I	4

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

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 ψ and ψ^2, application of Schrödinger wave equation

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 orbitials (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_N1 and S_N2) with energy profile diagram.

Mechanism of β-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; 3rd 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; 33rd 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. Dnyder; John Wiley & Sons, 2014.
8. Fundamentals of Organic Chemistry, 7th 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; 47th 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)**

SEMESTER-I

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

Course Title: - Major Practical Course - I

Course Code: UCHMJP 101 **Maximum Marks: 50**

Credits: 02 **External Examination: 25 marks**

Time: 4 Hours **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, $KMnO_4$, $K_2Cr_2O_7$)
2. Standardization of solutions.
3. Estimation of oxalic acid by titrating it with $KMnO_4$.
4. Estimation of water of crystallization in Mohr's salt by titrating it with $KMnO_4$.
5. Estimation of Fe(II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator.
6. Estimation of Fe(II) ions by titrating it with $K_2Cr_2O_7$ 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, 5th 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

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

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 ψ and ψ^2, application of Schrödinger wave equation

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 orbitials (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_N1 and S_N2) with energy profile diagram.

Mechanism of β-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; 3rd 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; 33rd 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. Dnyder; John Wiley & Sons, 2014.
8. Fundamentals of Organic Chemistry, 7th 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; 47th 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)**

SEMESTER-I

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

Course Title: - Minor Practical Course - I

Course Code: UCHMNP 101 **Maximum Marks: 50**

Credits: 02 **External Examination: 25 marks**

Time: 4 Hrs **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, $KMnO_4$, $K_2Cr_2O_7$)
2. Standardization of solutions.
3. Estimation of oxalic acid by titrating it with $KMnO_4$.
4. Estimation of water of crystallization in Mohr's salt by titrating it with $KMnO_4$.
5. Estimation of Fe(II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator.
6. Estimation of Fe(II) ions by titrating it with $K_2Cr_2O_7$ 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, 5th 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.
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

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

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).

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 sweetners 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; 33rd Edition, Vishal Publishers & Co. 2017.
4. Principles of Physical Chemistry; B. R. Puri, L. R. Sharma and L. S. Pathania; 47th 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 8th Ed.; Dr Jagdamba Singh; Pragati Prakashan, 2015.

9. A Textbook of Physical Chemistry; A.S. Negi and S.C. Anand; New Age International Publishes, 2005.
10. Advanced Inorganic Chemistry, 36th 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, 6th Ed.; J.H. Weil; New Age International Limited Publishers.
14. Medicinal Chemistry, 2nd 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)**

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

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 ΔU, ΔH, ΔS and ΔG 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 (BeF_2, $ZnCl_2$), trigonal planar (BF_3, CO_3^{2-}, NO_3^-, $SnCl_2$), tetrahedral (CH_4, ClO_4^-, SO_4^{2-}, NH_3, H_2O), trigonal bipyramidal (PF_5, SF_4, ClF_3, XeF_2) and octahedral (SF_6, BrF_5, 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, NO^+ and 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 co-efficient 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.

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, acharlity, elements of symmetry (plane of symmetry, centre of symmetry, alternating axis of symmetry). Enantiomerism, diastereoisomerism, meso compounds. Threo and Erytho 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, dehdyrohalogenation 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 $KMnO_4$. 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 Fridel-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; 3rd 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; 33rd Edition, Vishal Publishers & Co. 2017.
6. March's Advanced Organic Chemistry, Mechanism and Structure, T.W. Graham Solomon, C.B. Fryhle & S.A. Dnyder; 7th Ed by Michael B. Smith.
7. Organic Chemistry, John Wiley & Sons; 2014.
8. Fundamentals of Organic Chemistry, 7th Ed.; J.E. McMurry; Cengage Learning India Edition, 2013.
9. Stereochemistry Conformation and Mechanism 7th 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, 2nd Ed.; W.W. Linstromberg; Heath International Student Edition.
15. Physical Chemistry; G.M. Barrow; Tata McGraw-Hill (2007).
16. Physical Chemistry 4th 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; 47th Edition, Vishal Publishers & Co. 2017.
19. Physical Chemistry, 3rd 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)**

SEMESTER-II

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

Course Title:- Major Practical Course - II

Course Code: UCHMJP 201 **Maximum Marks: 50**

Credits: 02 **External Examination: 25 marks**

Time: 4 Hours **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: NH_4^+, Pb^{2+}, Ag^+, Bi^{3+}, Cu^{2+}, Cd^{2+}, Sn^{2+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Na^+, K^+

   Anions: CO_3^{2-}, HCO_3^- S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, NO_2^-, CH_3COO^-, Cl^-, Br^-, I^-, NO_3^-,SO_4^{2-}, PO_4^{3-}, $C_2O_4^{2-}$
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, 5th 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.

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

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

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 ΔU, ΔH, ΔS and ΔG 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 (BeF_2, $ZnCl_2$), trigonal planar (BF_3, CO_3^{2-}, NO_3^-, $SnCl_2$), tetrahedral (CH_4, ClO_4^-, SO_4^{2-}, NH_3, H_2O), trigonal bipyramidal (PF_5, SF_4, ClF_3, XeF_2) and octahedral (SF_6, BrF_5, 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, NO^+ and 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 co-efficient 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.

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, acharlity, elements of symmetry (plane of symmetry, centre of symmetry, alternating axis of symmetry). Enantiomerism, diastereoisomerism, meso compounds. Threo and Erytho 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, dehdyrohalogenation 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 $KMnO_4$. 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 Fridel-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; 3rd 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; 33rd Edition, Vishal Publishers & Co. 2017.

6. March's Advanced Organic Chemistry, Mechanism and Structure, T.W. Graham Solomon, C.B. Fryhle & S.A. Dnyder; 7th Ed by Michael B. Smith.
7. Organic Chemistry, John Wiley & Sons; 2014.
8. Fundamentals of Organic Chemistry, 7th Ed.; J.E. McMurry; Cengage Learning India Edition, 2013.
9. Stereochemistry Conformation and Mechanism 7th 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, 2nd Ed.; W.W. Linstromberg; Heath International Student Edition.
15. Physical Chemistry; G.M. Barrow; Tata McGraw-Hill (2007).
16. Physical Chemistry 4th 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; 47th Edition, Vishal Publishers & Co. 2017.
19. Physical Chemistry, 3rd 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)**

SEMESTER-II

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

Course Title: - Minor Practical Course - II

Course Code: UCHMNP 201 **Maximum Marks: 50**

Credits: 02 **External Examination: 25 marks**

Time: 4 Hrs **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: NH_4^+, Pb^{2+}, Ag^+, Bi^{3+}, Cu^{2+}, Cd^{2+}, Sn^{2+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Na^+, K^+

Anions: CO_3^{2-}, HCO_3^- S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, NO_2^-, CH_3COO^-, Cl^-, Br^-, I^-, NO_3^-,SO_4^{2-}, PO_4^{3-}, $C_2O_4^{2-}$

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, 5th 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.

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

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

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).

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 sweetners 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; 33rd Edition, Vishal Publishers & Co. 2017.
4. Principles of Physical Chemistry; B. R. Puri, L. R. Sharma and L. S. Pathania; 47th 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 8th Ed.; Dr Jagdamba Singh; Pragati Prakashan, 2015.

9. A Textbook of Physical Chemistry; A.S. Negi and S.C. Anand; New Age International Publishes, 2005.
10. Advanced Inorganic Chemistry, 36th 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, 6th Ed.; J.H. Weil; New Age International Limited Publishers.
14. Medicinal Chemistry, 2nd 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)**

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

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

Programme :- Undergraduate Programme in Chemistry (FYUGP under NEP-2020)
Semester: 3rd
Course Type: Major Theory Course
Course Title: Foundation Course Chemistry - III
Course Code: UCHMJT 301

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 aim of this course is to make students understand basic chemistry of p-block elements and their important compounds, Chemical thermodynamics and make them able to apply thermodynamic concepts to the system of variable compositions and equilibrium. Further the course gives better understanding of organic compounds containing cyclic rings and halogens.

Learning Outcomes:

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

- *Understand basic concepts like back bonding, diagonal relationship, allotropy, catenation and anomalous behaviour of period second elements.*
- *Understand the basic chemistry of some important compounds like interhalogens, carbides, silicones, silicates, hydrides, borazine and phosphazenes.*
- *Understand the basic chemistry of noble gases and their compounds.*
- *Understand basic concept of thermodynamics and its application to various systems.*
- *Understand the importance of ΔU, ΔH, ΔS, ΔG and ΔA for a chemical change.*
- *Acquire knowledge about the criteria for the spontaneity of a reaction.*
- *Understand the concept of equilibrium state.*
- *Understand preparation, properties and reactions of cycloalkanes, haloalkanes and haloarenes.*
- *Understand the basic mechanism of nucleophilic substitution reactions like SN^1, SN^2 and SN^i, addition-elimination and elimination –addition mechanism.*

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

Unit I: p-Block Elements-I (12 Hours)

General study of groups 13-17 elements. Compounds with special refrence to oxides (nitrogen, phosphorus, sulphur), oxoacids (nitrogen, phosphorus, sulphur, chlorine) and halides of groups 13-16. Interhalogens, polyhalide ions and pseudohalogens.

Inert pair effect, back bonding, relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy (Carbon, Phosphorous, Sulphur), catenation. Hydrides and their classification: ionic, covalent and interstitial.

Unit II: p-Block Elements-II (12 Hours)

Structure, bonding, preparation, properties and applications: Diborane, boric acid, borazine, phosphazenes. carboranes, carbides, silicones, silicates, polymeric sulphur nitride.

Noble gases: Occurrence and uses. Preparation and properties of XeF_2, XeF_4 and XeF_6. Nature of bonding in noble gas compounds (Valence bond treatment). MO treatment for XeF_2.

Unit III: Thermodynamics –II (12 Hours)

Recapitulation of First Law of Thermodynamics, Calculation of w, q, dU and dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Application to cyclic process, Carnot cycle and its efficiency (The Carnot Theorem).

Second law of thermodynamics, Need for the law, Different statements of the law, concept of entropy, mathematical treatment of entropy concept, entropy change in reversible and irreversible processes, Clausius inequality, combined form of the first and second laws of thermodynamics, entropy as a state function, entropy as function of V and T, entropy as function of P and T, entropy change in mixing of ideal gases, Calculation of entropy changes of physical processes (Phase changes, Reversible isothermal expansion of ideal gas, Heating or cooling of substance, Reversible adiabatic change), Numericals.

Unit IV Thermodynamics –III (12 Hours)

Third law of thermodynamics-Nernst heat theorem, Definition of third law, Evaluation of absolute entropy of solids, liquids and gases from heat capacity data, Residual entropy.

Free energy functions: Purpose of new functions, Helmholtz (A) and Gibbs (G) free energy function, Significance of A and G, Variation of A and G with P, V and T; A and G as criteria for thermodynamic equilibrium and spontaneity.

Relation between A and G, Gibbs – Helmholtz equation and its application, Maxwell relations. Clausius-Clapeyron equation and its integrated form, Numericals.

Unit V Cycloalkanes, Alkyl halides and Aryl halides (12 Hours)

Cycloalkanes: Definition, nomenclature, methods of preparation (2+2 cycloaddition reaction, Simon-Smith reaction), Chemical reactions, Baeyer strain theory and its limitations, theory of strainless rings, banana bond.

Alkyl Halides: Nomenclature and classification, preparation from alkenes and alcohols. Mechanism of nucleophilic substitution reactions (SN^1, SN^2 and SN^i) with energy profile diagrams. Reactions: Hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Elimination vs substitution. Wurtz reaction, Finkelstein reaction, Wurtz-Fittig reaction, Corey-House reaction.

Aryl Halides: Nomenclature, methods of preparation from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution, (Addition-elimination and elimination-addition mechanism). Ullmann reaction, Fittig reaction, reactivity and relative strength of Carbon-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

Books recommended:

1. Concise Inorganic Chemistry, J.D. Lee; ELBS, 1991.
2. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson, & P. L. Gaus; 3rd 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. Shriver and Atkins Inorganic Chemistry, P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller, F. A. Armstrong: 5th Edition (2010), Oxford University Press.
6. Inorganic Chemistry, G.L. Miessler, P.J. Fischer, D. A. Tarr, 5th Edition (2014), Pearson.
7. Principles of Inorganic Chemistry; B.R. Puri, L.R. Sharma and K.C. Kalia; 33rd Edition, Vishal Publishers & Co. 2017.
8. Physical Chemistry, P.W. Atkins, Oxford University Press.
9. Physical Chemistry; G.M. Barrow; Tata McGraw-Hill, 2007.
10. Physical Chemistry 4th Ed.; G.W. Castellan; Narosa, 2004.
11. Principles of Physical Chemistry; B.R. Puri, L.R. Sharma and L.S. Pathania; 47th Edition, Vishal Publishers & Co. 2017.
12. Organic Chemistry; T.W. Graham Solomon, C.B. Fryhle & S.A. Dnyder; John Wiley & Sons, 2014.

13. Fundamentals of Organic Chemistry, 7th Ed. J.E. McMurry; Cengage Learning India Edition, 2013.
14. A Guidebook to Mechanism in Organic Chemistry; P. Sykes; Orient Longman, New Delhi, 1988.
15. Organic Chemistry (Vol. I & II); I.L. Finar; E.L.B.S.
16. Organic Chemistry; R.T. Morrison & R.N. Boyd; Pearson, 2010.
17. Advanced Organic Chemistry; A. Bahl & B.S. Bahl; S. Chand, 2010.
18. Organic Chemistry (2013), J. Clayden, N. Greeves, S. Warren, P. Wothers, Oxford University Press.

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)**

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

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

Programme :- Undergraduate Programme in Chemistry (FYUGP under NEP-2020)
Semester: 3rd
Course Type: Major Theory Course
Course Title: Foundation Course Chemistry - IV
Course Code: UCHMJT 302

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 aim of this course is to make students understand general chemistry of transition elements and inner transition elements. In addition the course helps the students to learn colligative properties of dilute solutions and chemistry of oxygen containing organic compounds and their reactivity pattern.

Learning Outcomes:

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

- *Understand the characteristic properties of d-block elements, including the geometry of their complexes.*
- *Understand the general characteristics of second and third transition metal series including their magnetic properties and stereochemistry.*
- *Understand the structure, bonding and isomerism in various types of complexes.*
- *Understand the important properties of f-block elements and their isolation and applications including the comparison between lanthanoids and actinoids.*
- *Understand the thermodynamics of ideal and non-ideal solutions.*
- *Understand the colligative properties and their importance.*
- *Understand preparation and properties of oxygen containing functional groups.*

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

Unit I: Chemistry of Transition Elements (12 Hours)

General characteristic properties of d-block elements. Properties of the elements of the first transition series, relative stability of their oxidation states with reference to their binary compounds (oxides, halides and sulphides). Coordination number and geometry of complexes of 3d transition elements. Latimer diagrams of Cu, Mn and Fe.

Chemistry of Elements of Second and Third Transition Series - General characteristics, comparative treatment with their 3d- analogues in respect of ionic radii, oxidation states, magnetic behaviour and spectral properties.

A study of the following compounds (including preparation and important properties);

Peroxo compounds of Cr, $K_2Cr_2O_7$, $KMnO_4$, $K_4[Fe(CN)_6]$, $Na_2[Fe(CN)_5NO]$, $[Co(NH_3)_6]Cl_3$, $Na_3[Co(NO_2)_6]$.

Unit II: Chemistry of Lanthanoids and Actinoids (12 Hours)

Lanthanoids: Position of lanthanoids in the periodic table, electronic configuration, oxidation states, ionic radii and lanthanoid contraction, magnetic and spectral properties, complex formation, chemical reactivity, occurrence and isolation, applications of lanthanoids.

Actinoids: Position of actinoids in the periodic table, electronic configuration, oxidation states, ionic radii and actinoid contraction, magnetic and spectral properties, complex formation. Chemistry of separation of Np, Pu and Am from U, applications of actinoides. Comparison between lanthanoids and actinoids.

UNIT-III: Solutions and Colligative Properties (12 Hours)

Methods of expressing of concentration of solutions, activity and activity coefficient, Raoult's law, ideal and non-ideal solutions, Henry's law. Thermodynamic treatment using chemical potential to derive relations between colligative properties (relative lowering of vapour pressure, elevation of boiling point, depression in freezing point, osmotic pressure) and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution. Numericals.

Unit-IV: Alcohols and Phenols (12 Hours)

Alcohols: nomenclature and Classification, preparation of alcohols using Grignard reagent, reduction of aldehydes, ketones, carboxylic acids and esters.

Reactions: with sodium, HX (Lucas test), esterification, oxidation (with PCC, alkaline $KMnO_4$, acidic $K_2Cr_2O_7$, conc. HNO_3). Oppeneauer oxidation.

Alkoxide ions as nuceophillic and non-nucleophillic bases.

Synthesis of 1,2-diols (using OsO_4, Alkaline $KMnO_4$), Pinacol and pinacolone rearrangement in vicinal diols.

Phenols: Preparation: From Cumene hydroperoxide, diazonium salts, aryl halides and Grignard reagent.

Reactions: Electrophilic substitution reactions viz; nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann synthesis, Houben–Hoesch condensation, Schotten–Baumann Reaction.

Unit-V: Ethers and Epoxides (12 Hours)

Ethers (aliphatic and aromatic): Nomenclature and classification. Methods of preparation: Williamson's ether synthesis, from alkenes, alkyl halides, diazomethane and primary alcohols. Physical properties of ethers. Chemical reactions: Cleavage of ethers with HI and Ziesels formation. Claisen rearrangement, oxidation, Wittig rearrangement and electrophillic substitution reactions in aromatic ethers.

Epoxides: Nomenclature, Synthesis of epoxides from alkenes and halohydrins, Ring opening of epoxide under acidic and basic conditions. Orientation of ring opening. Reactions of epoxides with orgalolithium and Grignard reagent.

Books recommended:

1. Concise Inorganic Chemistry, J.D. Lee; ELBS, 1991.
2. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson, & P. L. Gaus; 3rd 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. Shriver and Atkins Inorganic Chemistry, P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller, F. A. Armstrong: 5th Edition (2010), Oxford University Press.
6. Inorganic Chemistry, G.L. Miessler, P.J. Fischer, D. A. Tarr, 5th Edition (2014), Pearson.
7. Principles of Inorganic Chemistry; B.R. Puri, L.R. Sharma and K.C. Kalia; 33rd Edition, Vishal Publishers & Co. 2017.
8. Physical Chemistry, P.W. Atkins, Oxford University Press.
9. Physical Chemistry; G.M. Barrow; Tata McGraw-Hill, 2007.
10. Physical Chemistry 4th Ed.; G.W. Castellan; Narosa, 2004.
11. Principles of Physical Chemistry; B.R. Puri, L.R. Sharma and L.S. Pathania; 47th Edition, Vishal Publishers & Co. 2017.
12. Organic Chemistry; T.W. Graham Solomon, C.B. Fryhle & S.A. Dnyder; John Wiley & Sons, 2014.

13. Fundamentals of Organic Chemistry, 7th Ed. J.E. McMurry; Cengage Learning India Edition, 2013.
14. A Guidebook to Mechanism in Organic Chemistry; P. Sykes; Orient Longman, New Delhi, 1988.
15. Organic Chemistry (Vol. I & II); I.L. Finar; E.L.B.S.
16. Organic Chemistry; R.T. Morrison & R.N. Boyd; Pearson, 2010.
17. Advanced Organic Chemistry; A. Bahl & B.S. Bahl; S. Chand, 2010.
18. Organic Chemistry (2013), J. Clayden, N. Greeves, S. Warren, P. Wothers, Oxford University Press.

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)**

SEMESTER-III

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

Course Title:- Major Practical Course - III

Course Code: UCHMJP 301 | **Maximum Marks: 50**

Credits: 02 | **External Examination: 25 marks**

Time: 4 Hours | **Internal Examination: 25 marks**

Learning Outcomes: The students will be trained in qualitative analysis of organic compounds and quantitative estimation of some metal ions in a given solution. In addition, the students will be able to estimate hardness of water.

1. Systematic qualitative analysis of organic compounds with the following functional groups (-COOH, phenolic, aldehydic, ketonic, carbohydrates, amide, nitro, amines) and preparation of derivatives.
2. Determination of molecular weight of a non-volatile solute by Rast method/Beckmann's point method.
3. Determination of the apparent degree of dissociation of an electrolyte (e.g NaCl) in aqueous solution at different concentrations by ebullioscopy
4. Gravimetric estimation of nickel present in a given solution as bis(dimethylglyoximato) nickel(II) and aluminium as oxinate in a given solution.
5. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
6. Estimation of total hardness of a given sample of water by complexometric titration.
7. Determination of concentration of Na^{+} and K^{+} using Flame Photometry.

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, 5th 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.
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.

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

DISTRIBUTION OF MARKS

C.	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
D.	External Examination (100% syllabus)	Examination: 20 marks Two practicals of 10 mark each. (However exercise number 1 is compulsory).
		Viva-voce: 05 marks

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

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

Programme: - Undergraduate Programme in Chemistry (FYUGP under NEP-2020)
Semester: 3rd
Course Type: Minor Theory Course
Course Title: Foundation Course Chemistry - III
Course Code: UCHMNT 301

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 aim of this course is to make students understand basic chemistry of p-block elements and their important compounds, Chemical thermodynamics and make them able to apply thermodynamic concepts to the system of variable compositions and equilibrium. Further the course gives better understanding of organic compounds containing cyclic rings and halogens.

Learning Outcomes:

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

- *Understand basic concepts like back bonding, diagonal relationship, allotropy, catenation and anomalous behaviour of period second elements.*
- *Understand the basic chemistry of some important compounds like interhalogens, carbides, silicones, silicates, hydrides, borazine and phosphazenes.*
- *Understand the basic chemistry of noble gases and their compounds.*
- *Understand basic concept of thermodynamics and its application to various systems.*
- *Understand the importance of ΔU, ΔH, ΔS, ΔG and ΔA for a chemical change.*
- *Acquire knowledge about the criteria for the spontaneity of a reaction.*
- *Understand the concept of equilibrium state.*
- *Understand preparation, properties and reactions of cycloalkanes, haloalkanes and haloarenes.*
- *Understand the basic mechanism of nucleophilic substitution reactions like SN^1, SN^2 and SN^i, addition-elimination and elimination –addition mechanism.*

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

Unit I: p-Block Elements-I (12 Hours)

General study of groups 13-17 elements. Compounds with special refrence to oxides (nitrogen, phosphorus, sulphur), oxoacids (nitrogen, phosphorus, sulphur, chlorine) and halides of groups 13-16. Interhalogens, polyhalide ions and pseudohalogens.

Inert pair effect, back bonding, relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy (Carbon, Phosphorous, Sulphur), Catenation. Hydrides and their classification: ionic, covalent and interstitial.

Unit II: p-Block Elements-II (12 Hours)

Structure, bonding, preparation, properties and applications: Diborane, boric acid, borazine, phosphazenes. carboranes, carbides, silicones, silicates, polymeric sulphur nitride.

Noble gases: Occurrence and uses. Preparation and properties of XeF_2, XeF_4 and XeF_6. Nature of bonding in noble gas compounds (Valence bond treatment). MO treatment for XeF_2.

Unit III: Thermodynamics –II (12 Hours)

Recapitulation of First Law of Thermodynamics, Calculation of w, q, dU and dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Application to cyclic process, Carnot cycle and its efficiency (The Carnot Theorem).

Second law of thermodynamics, Need for the law, Different statements of the law, Concept of entropy, Mathematical treatment of entropy concept, Combined form of the first and second laws of thermodynamics, Entropy as a state function, Entropy as function of V and T, Entropy as function of P and T, Entropy change in mixing of ideal gases, Calculation of entropy changes of physical processes (Phase changes, Reversible isothermal expansion of ideal gas, Heating or cooling of substance, Reversible adiabatic change), Numericals.

Unit IV Thermodynamics –III (12 Hours)

Third law of thermodynamics-Nernst heat theorem, Definition of third law, Evaluation of absolute entropy of solids, liquids and gases from heat capacity data, Residual entropy.

Free energy functions: Purpose of new functions, Helmholtz (A) and Gibbs (G) free energy function, Significance of A and G, Variation of A and G with P, V and T; A and G as criteria for thermodynamic equilibrium and spontaneity.

Relation between A and G, Gibbs – Helmholtz equation and its application, Maxwell relations. Clausius-Clapeyron equation and its integrated form, Numericals.

Unit V Cycloalkanes, Alkyl halides and Aryl halides (12 Hours)

Cycloalkanes: Definition, nomenclature, methods of preparation (2+2 cycloaddition reaction, Simon-Smith reaction), Chemical reactions, Baeyer strain theory and its limitations, theory of strainless rings, banana bond.

Alkyl Halides: Nomenclature and classification, preparation from alkenes and alcohols. Mechanism of nucleophilic substitution reactions (SN^1, SN^2 and SN^i) with energy profile diagrams. Reactions: Hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Elimination vs substitution. Wurtz reaction, Finkelstein reaction, Wurtz-Fittig reaction, Corey-House reaction.

Aryl Halides: Nomenclature, methods of preparation from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution, (Addition-elimination and elimination-addition mechanism). Ullmann reaction, Fittig reaction, reactivity and relative strength of Carbon-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

Books recommended:

1. Concise Inorganic Chemistry, J.D. Lee; ELBS, 1991.
2. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson, & P. L. Gaus; 3rd 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. Shriver and Atkins Inorganic Chemistry, P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller, F. A. Armstrong: 5th Edition (2010), Oxford University Press.
6. Inorganic Chemistry, G.L. Miessler, P.J. Fischer, D. A. Tarr, 5th Edition (2014), Pearson.
7. Principles of Inorganic Chemistry; B.R. Puri, L.R. Sharma and K.C. Kalia; 33rd Edition, Vishal Publishers & Co. 2017.
8. Physical Chemistry, P.W. Atkins, Oxford University Press.
9. Physical Chemistry; G.M. Barrow; Tata McGraw-Hill, 2007.
10. Physical Chemistry 4th Ed.; G.W. Castellan; Narosa, 2004.
11. Principles of Physical Chemistry; B.R. Puri, L.R. Sharma and L.S. Pathania; 47th Edition, Vishal Publishers & Co. 2017.
12. Organic Chemistry; T.W. Graham Solomon, C.B. Fryhle & S.A. Dnyder; John Wiley & Sons, 2014.

13. Fundamentals of Organic Chemistry, 7th Ed. J.E. McMurry; Cengage Learning India Edition, 2013.
14. A Guidebook to Mechanism in Organic Chemistry; P. Sykes; Orient Longman, New Delhi, 1988.
15. Organic Chemistry (Vol. I & II); I.L. Finar; E.L.B.S.
16. Organic Chemistry; R.T. Morrison & R.N. Boyd; Pearson, 2010.
17. Advanced Organic Chemistry; A. Bahl & B.S. Bahl; S. Chand, 2010.
18. Organic Chemistry (2013), J. Clayden, N. Greeves, S. Warren, P. Wothers, Oxford University Press.

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)**

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

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

Programme :- Undergraduate Programme in Chemistry (FYUGP under NEP-2020)
Semester: 3rd
Course Type: Multidisciplinary Course
Course Title: Basic Concepts in Chemistry
Course Code: UCHMDT 301

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.*

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

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).

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 sweetners 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).

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

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; 33rd Edition, Vishal Publishers & Co. 2017.
4. Principles of Physical Chemistry; B. R. Puri, L. R. Sharma and L. S. Pathania; 47th 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 8th Ed.; Dr Jagdamba Singh; Pragati Prakashan, 2015.
9. A Textbook of Physical Chemistry; A.S. Negi and S.C. Anand; New Age International Publishes, 2005.
10. Advanced Inorganic Chemistry, 36th 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, 6th Ed.; J.H. Weil; New Age International Limited Publishers.
14. Medicinal Chemistry, 2nd 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

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

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)**

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

Syllabi and Courses of Study in Chemistry for Semester IV of Four Year Undergraduate Programme (FYUGP) Under NEP-2020 for the Examinations to be held in May 2024, 2025 & 2026

Programme :- Undergraduate Programme in Chemistry (FYUGP under NEP-2020)
Semester: 4th
Course Type: Major Theory Course
Course Title: Inorganic Chemistry - I
Course Code: UCHMJT 401

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 general introduction to the bonding in coordination complexe and theories of coordination compounds. The aim of this course is to make students understand various theories including Werner,s Coordination theory, Crystal Field Theory and to make students able to apply these theories to elucidate the bonding in coordination compounds. The course also aims at giving students a deep insight into Organometallic Chemistry and Bio Inorganic Chemistry.

Learning Outcomes:

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

- *Understand the various bonding theories of metal-ligand bonding in transition metal complexes.*
- *Acquire knowledge about various aspects of magnetic properties of metal complexes*
- *Understand the electronic spectra of transition metal complexes Understand the significance of selection rules for d-d transitions and spectroscopic ground states*
- *Understand the synthesis, bonding and application of organometallic compounds*
- *Understand the chemistry and importance of metal ions and their complexes in the biological systems.*

(For examinations to be held in May 2024, 2025 & 2026)

Unit –I: Coordination Chemistry-I (12 Hours)

Coordination Compounds:

Definition and terminology, Werner's coordination theory and its experimental verification, EAN rule, IUPAC nomenclature of coordination compounds, isomerism in coordination compounds (structural and stereoisomerism in coordination complexes with coordination number 4 and 6).

Thermodynamic and kinetic aspects of metal complexes

A brief outline of thermodynamic and kinetic stability of metal complexes, stepwise and overall stability constants, factors affecting the stability of complexes, chelate effect, macrocyclic effect.

Unit-II: Coordination Chemistry-II (12 Hours)

Bonding in Coordination Compounds

Metal-ligand bonding in transition metal complexes-Valence bond theory and its applications to transition metal complexes. Inner orbital and outer orbital complexes, limitations of valence bond theory. Crystal field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, crystal field stabilization energy (CFSE), spectrochemical series, Effects of CFSE on hydration energy, factors affecting the crystal stabilization energy. John-Teller distortion.

Unit-III: Coordination Chemistry-III (12 Hours)

Magnetic properties of transition Metal Complexes

Types of Magnetic behaviour, methods of determining magnetic susceptibility (Guoy's and Faraday's methods) spin only formula, L-S coupling and correlation of values, orbital contribution to magnetic moments, application of magnetic moment data for structure analysis of 3d-metal complexes.

Electronic Spectra of Transition Metal Complexes

Ground state term symbols, Types of electronic transition, selection rules for d- d transitions, spectroscopic ground states, spectro-chemical series, Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion. Charge transfer spectra.

Unit-IV: Organometallic Chemistry (12 Hours)

Definition, nomenclature and classification with appropriate examples based on nature of metal-carbon bond (ionic, σ, π, and multicentre bonds). Structure and bonding in methyl lithium, Zeise`s salt and Ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding (synergistic effect) and properties of carbonyls of 3d metals. π-acceptor behaviour of CO (MO diagram of CO to be discussed).

Unit-V: Bio-inorganic Chemistry (12 Hours)

A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to Na^+, K^+ and Mg^{2+} ions: Na/K pump; Role of Mg^{2+} ions in energy production and structure of chlorophyll. Role of Ca^{2+} in blood clotting, stabilization of protein structures and structural role in bones. Metalloporphyrins with special reference to haemoglobin and myoglobin. Chemical and biological nitrogen fixation.

Books recommended:

1. Concise Inorganic Chemistry, J .D. Lee; ELBS, 1991.
2. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson, & P. L. Gaus; 3rd 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; 33rd Edition, Vishal Publishers & Co. 2017.
6. Shriver and Atkins Inorganic Chemistry, P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller, F. A. Armstrong: 5th Edition (2010), Oxford University Press.
7. Inorganic Chemistry, G.L. Miessler, P.J. Fischer, D. A. Tarr, 5th Edition (2014), Pearson.

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 2024, 2025 & 2026)

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)**

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

Syllabi and Courses of Study in Chemistry for Semester IV of Four Year Undergraduate Programme (FYUGP) Under NEP-2020 for the Examinations to be held in May 2024, 2025 & 2026

Programme :- Undergraduate Programme in Chemistry (FYUGP under NEP-2020)
Semester: 4th
Course Type: Major Theory Course
Course Title: Physical Chemistry - I
Course Code: UCHMJT 402

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 aim of this course is to make students understand thermodynamics of open systems, chemical, ionic and phase equilibria.

Learning Outcomes:

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

- *Understand partial molar properties of open systems*
- *Understand chemical equilibria and the factors affecting it.*
- *Understand the ionization of electrolytes, acids, bases and salt hydrolysis.*
- *Understand the buffer solutions, solubility and solubility product of sparingly soluble salts.*
- *Explain the thermodynamic aspects of equilibria between phases*
- *Demostrate the phase diagrams of simple one, two and three component systems.*

UNIT-I: Systems of variable compositions and Chemical Equilibrium (12 Hours)

Partial molar quantities, determination of partial molar quatities, dependence of thermodynamic parameters on composition; Gibbs Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.

Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration (Le Chatelier Principle, Quantitatively).

UNIT-II: Ionic Equilibria-I (12 Hours)

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono and diprotic acids. Salt hydrolysis: Calculation of hydrolysis constant, degree of hydrolysis and pH for different salts.

UNIT-III: Ionic Equilibria-II (12 Hours)

Buffer solutions; derivation of Henderson equation and its applications. Solubility and solubility product of sparingly soluble salts, applications of solubility product principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of acid–base indicators; selection of indicators and their limitations.

UNIT-IV: Phase Equilibria-I (12 Hours)

Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its applications to solid-liquid, liquid-vapour and solid-vapour equilibria, phase diagram for one component systems (H_2O and S). Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points.

UNIT-V: Phase Equilibria-II (12 Hours)

Three component systems: triangular plots, water-chloroform-acetic acid system. Binary solutions: Gibbs-Duhem-Margules equation, its derivation and applications to fractional distillation of binary miscible liquids (ideal and non ideal),
Azeotropes, lever rule, partial miscibility of liquids, CST, miscible pairs, steam distillation. Nernst distribution law: its derivation and applications.

Books recommended:

1. Physical Chemistry; G.M. Barrow; Tata McGraw-Hill, 2007.
2. Physical Chemistry 4th Ed.; G.W. Castellan; Narosa, 2004.
3. Physical Chemistry, P.W. Atkins, Oxford University Press.
4. Principles of Physical Chemistry; B.R. Puri, L.R. Sharma and L.S. Pathania; 47th Edition, Vishal Publishers & Co. 2017.
5. A Textbook of Physical Chemistry, Volume 1 to 4; K.L. Kapoor; MacMillan India Limited, 1984.
6. Thermodynamics for Chemists; S. Glasstone; East-West Press Limited, 2005.
7. An Introduction to Chemical Thermodynamics R.P.Rastogi, R.R. Misra; Vikas Publications, 6th Edition.

(For examinations to be held in May 2024, 2025 & 2026)

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 – **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 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)**

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

Syllabi and Courses of Study in Chemistry for Semester IV of Four Year Undergraduate Programme (FYUGP) Under NEP-2020 for the Examinations to be held in May 2024, 2025 & 2026

Programme :- Undergraduate Programme in Chemistry (FYUGP under NEP-2020)
Semester: 4th
Course Type: Major Theory Course
Course Title: Organic Chemistry - I
Course Code: UCHMJT 403

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 gives a better understanding of the organic compounds containing carbonyl functional group and nitrogen containing functional groups like amines and diazonium salts. Further the course introduces the students to heterocyclic compounds, organometallic reagents and C-C bond formation via enolates.

Learning Outcomes:

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

- *Understand the methods of preparation and properties of the alehydes and ketones.*
- *Understand the mechanism of nucleophilic addition reactions and factors affecting it.*
- *Understand the methods of preparation and chemical rections of carboxylic acids and their derivatives.*
- *Understand the mechanism and factors affecting nucleophilic acyl substitution reaction.*
- *Understand various methods of preparation and properties of amines and diazonium salts.*
- *Understand the reactions and importance of heterocyclic compounds.*
- *Understand the synthesis and reactions of enolates.*

Unit-I: Aldehydes and ketones **(12 Hours)**

Nomenclature and classification of aldehydes and ketones. Preparation from acid chlorides, nitriles, alcohols and alkenes, Etard reaction.

Reactions: Nucleophilic addition reactions with HCN, ROH, $NaHSO_3$, ammonia and its derivatives. Iodoform test, Aldol Condensation, Cannizzaro reaction, Wittig reaction,

Mannich reaction. Benzoin condensation. Knoevenagel condensation, Clemmensen reduction, Wolff-Kishner reduction. Meerwein-Pondorff-Verley reduction, $LiAlH_4$ and $NaBH_4$ reductions.

Unit-II: Carboxylic acids and their derivatives. (12 Hours)

Nomenclature and classification of carboxylic acids, Strength of organic acids; comparative study with emphasis on factors affecting their pK_a values.

Preparation of carboxylic acids*:* Acidic and alkaline hydrolysis of esters and nitriles, Arndt-Eistert homologation.

Reactions: Hell-Vohlard-Zelinsky reaction, decarboxylation, reduction, reaction with organolithium and organomagnesium compounds.

Carboxylic acid derivatives

Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion.

Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation.

Unit-III: Nitroalkanes/arenes, amines and diazonium salts (12 Hours)

Nitoalkanes/arenes: Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes, mechanism of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline media.

Amines:

Nomenclature and classification of amines, Strength of organic bases; comparative study with emphasis on factors affecting their pK_b values.

Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction, reductive amination of aldehydic and ketonic compounds.

Reactions: Hofmann elimination, Carbylamine test, Hinsberg test, reaction with nitrous acid, Schotten–Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination and sulphonation.

Diazonium salts: *Preparation:*from aromatic amines. *Reactions:* conversion to benzene, phenol, dyes, Balz-Schiemann reaction

Unit-IV: Heterocyclic Compounds-I (12 Hours)

Nomenclature and classification, Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine. Comparison of basicity of pyridine, piperidine and pyrrole.

Introduction to condensed five and six-membered heterocycles. Preparation and reactions of indole and quinoline with special reference to Fisher indole synthesis and Skraup synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline.

Unit-V: (12 Hours)

a) Organometallic compounds of Mg, Li, Zn & Cu:

Organomagnesium compounds: Grignard reagents – formation, structure and chemical reactions.

Organozinc compounds: formation and chemical reactions.

Organolithium compounds: formation and chemical reactions.

Organocopper compounds: formation and chemical reactions of Gillmann's reagent.

b) Organic Synthesis via enolates

Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism in ethyl acetoacetate. Alkylation of 1,3-dithianes, alkylation and acylation of enamines.

Reference Books:

1. Organic Chemistry; T.W. Graham Solomon, C.B. Fryhle & S.A. Dnyder; John Wiley & Sons, 2014.
2. Fundamentals of Organic Chemistry, 7th Ed. J.E. McMurry; Cengage Learning India Edition, 2013.
3. A Guidebook to Mechanism in Organic Chemistry; P. Sykes; Orient Longman, New Delhi, 1988.
4. Organic Chemistry (Vol. I & II); I.L. Finar; E.L.B.S.
5. Organic Chemistry; R.T. Morrison & R.N. Boyd; Pearson, 2010.
6. Advanced Organic Chemistry; A. Bahl & B.S. Bahl; S. Chand, 2010.
7. Organic Chemistry (2013), J. Clayden, N. Greeves, S. Warren, P. Wothers, Oxford University Press.

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

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)**

SEMESTER-IV

(For examinations to be held in May 2024, 2025 & 2026)

Course Title:- Major Practical Course - IV

Course Code: UCHMJP 401 **Maximum Marks: 50**

Credits: 02 **External Examination: 25 marks**

Time: 4 Hours **Internal Examination: 25 marks**

Learning Outcomes: *The students will be trained in qualitative salt analysis. In addition, the students will be able to synthesize and purify organic compounds.*

7. **Inorganic chemistry**

Semi-micro qualitative analysis of mixtures - not more than four ionic species (two anions and two cations excluding insoluble salts) out of the following:

Cations: NH_4^+, Pb^{2+}, Ag^+, Bi^{3+}, Cu^{2+}, Cd^{2+}, Sn^{2+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Na^+, K^+

Anions: CO_3^{2-}, HCO_3^-, S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, NO_2^-, CH_3COO^-, Cl^-, Br^-, I^-, NO_3^-, SO_4^{2-}, PO_4^{3-}, $C_2O_4^{2-}$.

2. Organic Chemistry

I.

i) Preparation of iodoform from ethanol and acetone

ii) Preparation of 4-nitroacetanilide from acetanilide

iii) Preparation of 4-bromoacetanilide from acetanilide

iv) Preparation of aspirin from salicylic acid

v) Preparation of dibenzalacetone from benzaldehyde (Claisen-Schmidt reaction)

II. Separation of mixtures by Chromatography: Measure the R_f value in each case (combination of two compounds to be given)

(a) Identify and separate the components of a given mixture of 2 amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography

(b) Identify and separate the sugars present in the given mixture by paper chromatography.

(For examinations to be held in May 2024, 2025 & 2026)

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, 5th 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.
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

E.	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
F.	External Examination (100% syllabus)	Examination: 20 marks Two practicals of 10 marks each (However, question number 1 is compulsory).
		Viva-voce: 05 marks

SEMESTER-IV

(For examinations to be held in May 2024, 2025 & 2026)

Course Title:- Major Practical Course - V

Course Code: UCHMJP 402 **Maximum Marks: 50**

Credits: 02 **External Examination: 25 marks**

Time: 4 Hours **Internal Examination: 25 marks**

Learning Outcomes: The students will be trained in synthesizing metal complexes and separation of metal ions. Further the students will be able to measure the pH of different solutions, prepare different buffer solutions, determine critical solution temperature and construct phase diagrams.

I. Inorganic Chemistry

1. Preparation of sodium trioxalato ferrate (III), Na_3 Fe $(C_2O_4)_3$.
2. Preparation of Ni-DMG complex, Ni $(DMG)_2$.
3. Preparation of copper tetra-ammine complex, $Cu(NH_3)_4SO_4$.
4. Preparation of cis-and trans-dioxalato diaquachromate (III) ion.
5. Analysis of Cu as CuSCN and Ni as Ni (dimethylglyoxime).

(b) Ion Exchange Method

Separation and estimation of Mg(II) and Zn(II).

(c) Solvent Extraction

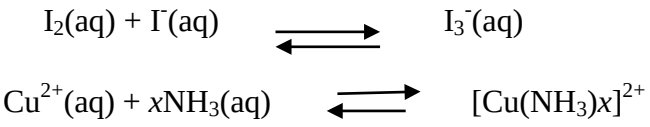
Separation and estimation of Mg(II) and Fe(II)

II. Physical Chemistry

1. **Ionic equilibrium**
   a) Measurements of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
   b) Preparation of buffer solutions:
      i. Sodium acetate-acetic acid
      ii. Ammonium chloride-ammonium hydroxide
      Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

2. Determination of critical solution temperature and composition at CST of the phenolwater system and to study the effect of impurities of sodium chloride and succinic acid on it.
3. Phase equilibria: Construction of the phase diagram using cooling curves or ignition tube method: a. simple eutectic and b. congruently melting systems.

4. Distribution of acetic/ benzoic acid between water and chloroform or cyclohexane.
5. Study of the equilibrium of one of the following reactions by the distribution method:



$$I_2(aq) + I^-(aq) \rightleftharpoons I_3^-(aq)$$

$$Cu^{2+}(aq) + xNH_3(aq) \rightleftharpoons [Cu(NH_3)x]^{2+}$$

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, 5th 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.
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

G.	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
H.	External Examination (100% syllabus)	Examination: 20 marks (Two practicals of 10 marks each)
		Viva-voce: 05 marks
