Department of Chemistry

Scheme of Examination and Syllabus for
Under Graduate Programme

Under Multiple Entry and Exit, Internship and
CBCS-LOCF as per NEP-2020
w.e.f. Session 2024-25 (in phased manner)

Subject: Chemistry

Guru Jambheshwar University of Science &Technology Hisar-125001, Haryana

(A+ NAAC Accredited State Govt. University)

Guru Jambheshwar University of Science and Technology Hisar-125001, Haryana
('A+' NAAC Accredited State Govt. University)

Scheme of Examination & Syllabus for affiliated Degree Colleges for UG Programme
According to National Education Policy-2020

Subject: Chemistry

SEMESTER – I

Type of Course	Course Code	Nomenclature	Credits	Hours/ Week	Marks			Exam hours
					Internal	External	Total	
Discipline Specific Course (DSC)	C24CHE101T/ C24MIN131T	Chemistry – I	3	3	20	50	70	2.5
	C24CHE101P/ C24MIN131P	Chemistry – I Lab	1	2	10	20	30	3
Discipline Specific Course # (DSC)	**C24CHE102T**	**General Chemistry - I**	**3**	**3**	**20**	**50**	**70**	**2.5**
	C24CHE102P	**General Chemistry - I Lab**	**1**	**2**	**10**	**20**	**30**	**3**
Discipline Specific Course # (DSC)	**C24CHE103T**	**General Chemistry - II**	**3**	**3**	**20**	**50**	**70**	**2.5**
	C24CHE103P	**General Chemistry - II Lab**	**1**	**2**	**10**	**20**	**30**	**3**
Minor Course (MIC)	C24MIC131T	Basic Chemistry – I	2	2	15	35	50	2
Minor Course # (MIN)	**C24MIN131T/ C24CHE101T**	**Chemistry – I**	**3**	**3**	**20**	**50**	**70**	**2.5**
	C24MIN131P/ C24CHE101P	**Chemistry – I Lab**	**1**	**2**	**10**	**20**	**30**	**3**
Multidisciplinary Course (MDC)	C24MDC104T	Chemistry of Oils and Dyes	2	2	15	35	50	2
	C24MDC104P	Chemistry of Oils and Dyes Lab	1	2	10	15	25	3
Skill Enhancement Course (SEC)	C24SEC128T	Basic Laboratory Techniques	2	2	15	35	50	2
	C24SEC128P	Basic Laboratory Techniques Lab	1	2	10	15	25	3
Value Added Course (VAC)	C24VAC111T	Chemistry in Everyday Life	2	2	15	35	50	2

 # for Scheme C only

SEMESTER – II

Type of Course	Course Code	Nomenclature	Credits	Hours/ Week	Marks			Exam hours
					Internal	External	Total	
Discipline Specific Course (DSC)	C24CHE201T/ C24MIN231T	Chemistry – II	3	3	20	50	70	2.5
	C24CHE201P/ C24MIN231P	Chemistry – II Lab	1	2	10	20	30	3
Discipline Specific Course # (DSC)	**C24CHE202T**	**General Chemistry – III**	**3**	**3**	**20**	**50**	**70**	**2.5**
	C24CHE202P	**General Chemistry – III Lab**	**1**	**2**	**10**	**20**	**30**	**3**
Discipline Specific Course # (DSC)	**C24CHE203T**	**General Chemistry – IV**	**3**	**3**	**20**	**50**	**70**	**2.5**
	C24CHE203P	**General Chemistry – IV Lab**	**1**	**2**	**10**	**20**	**30**	**3**
Minor Course (MIC)	C24MIC231T	Basic Chemistry – II	2	2	15	35	50	2
Minor Course # (MIN)	**C24MIN231T/ C24CHE201T**	**Chemistry – II**	**3**	**3**	**20**	**50**	**70**	**2.5**
	C24MIN231P/ C24CHE201P	**Chemistry – II Lab**	**1**	**2**	**10**	**20**	**30**	**3**
Multidisciplinary Course (MDC)	C24MDC204T	Chemistry of Soil and Everyday Compounds	2	2	15	35	50	2
	C24MDC204P	Chemistry of Soil and Everyday Compounds Lab	1	2	10	15	25	3
Skill Enhancement Course (SEC)	C24SEC228T	Chromatographic Techniques, Food and Water Analysis	2	2	15	35	50	2
	C24SEC228P	Chromatographic Techniques, Food and Water Analysis Lab	1	2	10	15	25	3
Value Added Course (VAC)	C24VAC111T	Chemistry in Everyday Life	2	2	15	35	50	2

for Scheme C only

Programme Outcomes

PO1 Sound knowledge about fundamental of Chemical Sciences.

PO2 Basic knowledge of Physical and Biological Sciences.

PO3 Basic understanding of Languages, Computer Science and Environmental Science.

PO4 Practical skills through theoretical knowledge of various instrumental techniques for analysis.

PO5 Eco-friendly methodologies in chemical sciences, understanding of material safety data and industrial processes.

PO6 Capability for designing, synthesis, isolation, separation, purification and characterization of chemical compounds.

PO7 Capability for solving scientific problems for socio-economic growth.

PO8 Better communication skills, teamwork and ethics as a life-long learner.

Chemistry
Discipline Specific Course (DSC)
Chemistry – I (Semester-I)

Paper Code: C24CHE101T/C24MIN131T
45 Hrs (3 Hrs /Week) **External Marks : 50**
Credits: 3 **Internal Marks : 20**
Exam. Time: 2.5 Hrs **Total Marks: 70**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit in addition to the compulsory Question No.1. All questions carry equal marks.

Objective*: This paper deals with the concept of atomic structure, bonding interactions, mechanism of chemical reactions, spatial arrangement of molecules and kinetic study of gaseous state.*

UNIT-I

Atomic Structure

Dual behaviour of matter and radiation, de-Broglie's relation, Heisenberg's uncertainty principle, Quantum mechanics. Time independent Schrodinger equation (Derivation Excluded). Significance of Ψ and Ψ^2, Normal and orthogonal wave functions, Concept of atomic orbitals, Significance of quantum numbers, shapes of *s*, *p* and *d* orbitals, Rules for filling electrons in various orbitals, Electronic configurations of the atoms, Stability of half-filled and completely filled orbitals.

UNIT-II

Structure and Bonding

Localized and delocalized chemical bond, Van der Waals interactions, Concept of resonance and its applications, Hyperconjugation, Inductive effect, Electromeric effect and their comparison.

Mechanism of Organic Reactions

Curved arrow notation, homolytic and heterolytic bond fission, Types of reagents: electrophiles and nucleophiles. Types of organic reactions: Substitution, Addition, Condensation, Elimination, Rearrangement, Isomerization. Reactive intermediates: Carbocations, Carbanions, Free radicals and Carbenes (structure & stability).

UNIT-III

Stereochemistry

Type of Streoisomers, Conformations with respect to ethane, butane and cyclohexane. Optical isomerism, Elements of symmetry, Concept of chirality (upto two carbon atoms). Enantiomerism, Diastereomerism, Threo and erythro diasteromers and Meso compounds; Configuration: (relative and absolute), sequence rules D and L; R and S (for upto 2 chiral carbon atoms) system of nomenclature; Geometrical isomerism; *cis* - *trans* nomenclature; and *E*/*Z* Nomenclature (for up to two C=C systems).

UNIT-IV

Gaseous State

Kinetic theory of gases and derivation of the kinetic gas equation. Maxwell's distribution of velocities and energies (Graphic representation - derivation excluded), Temperature dependence of these distributions, Most probable velocity, Average velocity and Root Mean Square Velocity (Derivations excluded), Relationship among three types of velocities, Collision diameter, Collision number, Collision frequency and Mean free path (with Derivations), Deviation of real gases from ideal behaviour, Compressibility factor, Causes of deviation, Derivation of Van der Waal's Equation of State, its application in the calculation of Boyle's temperature.

Chemistry – I Lab

Paper Code: C24CHE101P/C24MIN131P
30 Hrs (2 Hrs /Week) **External Marks: 20**
Credits: 1 **Internal Marks: 10**
Exam.Time: 3 Hrs **Total Marks: 30**

Objective*: Hands on practice to prepare solutions, perform experiments on titration, preparation and purification of compounds.*

Practical

1. Acid/Base titration: Determination of strength of oxalic acid using NaOH.
2. Redox titrations: Determination of Fe^{2+} ions using $KMnO_4$.
3. Determination of melting point of the given organic compound.
4. Purification of given organic compound by recrystallization.
5. Preparation of *m*-Dinitrobenzne from Nitrobenzene.
6. Detection of Extra element in the given organic compound.

Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Books Suggested:

1. Atkins, P. & de Paula, J. *Physical Chemistry*, 10th Ed., Oxford University Press, 2014.
2. Puri, B.R., Sharma, L.R. & Pathania, M.S. *Principles of Physical Chemistry*, 47th Ed., Vishal Publishing Co., 2017.
3. Eliel, E.L. & Wilen, S.H. *Stereochemistry of Organic Compounds*, 1st Ed., Wiley-Interscience, 1994.
4. Clayden, J., Greeves, N. & Warren, S. *Organic Chemistry*, 2nd Ed., Oxford University Press, 2012.
5. Singh, J. & Yadav, L.D.S. *Advanced Organic Chemistry*, 4th Ed., Pragati Prakashan, 2015.
6. Sykes, P. A Guide Book to Mechanism in Organic Chemistry, Orient Longman, (2005),
7. Lee, J. D. Concise Inorganic Chemistry, 5th Ed., Wiley India Pvt. Ltd. 2008
8. Puri, B.R., Sharma, L.R. & Kalia, K. C. *Principles of Inorganic Chemistry*, 32nd Ed., Milestone Publishers and Distributors, 2015.
9. Atkins, P. W.; Overton, T. L.; Rourke, J. P.; Weller, M. T.; Armstrong, F. A. (2010), Shriver and Atkins Inorganic Chemistry, 5th Edition, Oxford University Press.
10. Pandey, O.P., Bajpai, D.N. & Giri, S. *Practical Chemistry*, 1st Ed., S. Chand Publishing, 2012.
11. Vogel, A.I. *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Longman Scientific & Technical, 1989.
12. Vogel, A.I. *Vogel's Textbook of Quantitative Chemical Analysis*, 5th Ed., Longman Scientific & Technical, 1989.
13. Jagdamba *et al*., Advanced Practical Chemistry. 5th Ed., Pragati Prakashan, 2014.

Course outcomes:

At the end of the course, the students would be able to:

CO1 Understand the atomic structure and bonding concepts.
CO2 Acquaint with the mechanistic approach for chemical reactions.
CO3 Understand the spatial arrangement and orientation of atoms in the molecules.
CO4 Get the knowledge of Kinetic theory of gases (Real & Ideal) and Maxwell distribution law.
CO5 Apply the concepts of Chemistry in the preparation and estimation of compounds.
CO 6 Perform experiments, evaluate the results and defend viva.

Mapping of CO with PO
C24CHE101T/C24MIN131T, C24CHE101P/C24MIN131P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	M	M	S	M	S
CO2	S	S	M	M	M	S	M	S
CO3	S	S	M	M	M	S	S	S
CO4	S	S	S	M	M	S	S	S
CO5	S	S	S	S	S	S	S	S
CO6	S	S	S	S	S	S	S	S

S= Strong, M = Medium, W= Weak

Chemistry
Discipline Specific Course
General Chemistry – I (Semester-I)

Paper Code: C24CHE102T
45Hrs (3Hrs /week) **External Marks: 50**
Credits: 3 **Internal Marks: 20**
Exam. Time: 2.5 Hrs **Total Marks: 70**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit in addition to the compulsory Question No.1. All questions carry equal marks.
Objectives*: This paper deals with the concepts of atomic structure, periodic properties of elements & periodic trends, thermodynamics and bonding interactions.*

Unit-I

Atomic Structure
Dual behaviour of matter and radiation, de-Broglie's relation, Heisenberg's uncertainty principle, What is Quantum mechanics? Time independent Schrodinger equation (Derivation Excluded) and meaning of various terms in it. Significance of Ψ and Ψ^2, Normal and orthogonal wave functions, Concept of atomic orbitals, Significance of quantum numbers, shapes of *s, p* and *d* orbitals, Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Anomalous electronic configurations, Stability of half-filled and completely filled orbitals, concept of exchange energy.

Unit-II

Periodic Properties of Elements & Periodic Trends
Brief discussion of the following properties of the elements with reference to s- & p- block and their trends: (a) Effective nuclear charge, shielding or screening effect and Slater's rule (b) Atomic and ionic radii (c) Ionization enthalpy (Successive ionization enthalpies) (d) Electron gain enthalpy (e) Electronegativity, Pauling's scale of electronegativity. Variation of electronegativity with bond order and hybridization.

Unit-III

Thermodynamics -I
Definition of various thermodynamic terms: Types of systems, Intensive and Extensive properties. State and path functions. Thermodynamic process. Thermodynamic equilibrium, First law of thermodynamics: concepts of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Second law of thermodynamics, Carnot's cycle and its efficiency, Carnot's theorem. Gibbs function (G) and Helmholtz function (A), G as criteria for thermodynamic equilibrium and spontaneity. Concept of entropy, Third law of thermodynamics: Nernst heat theorem, concept of residual entropy.

Unit-IV

Basics of Organic Chemistry
Physical Effects (Van der Waals interactions and Hydrogen bonding), Electronic Displacements: Inductive Effect, Electromeric Effect, Localized and delocalized chemical bond, Concept of resonance and its applications, Hyperconjugation. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values.

General Chemistry – I Lab

Paper Code: C24CHE102P
30 Hrs (2 Hrs /Week) **External Marks: 20**
Credits: 1 **Internal Marks: 10**
Exam. Time: 3 Hrs **Total Marks: 30**

Objective*: Hands on practice to prepare solutions, perform experiments on titration, preparation and purification of compounds.*

Practical

1. Acid/Base titration: Determination of strength of oxalic acid using NaOH.
2. Determination of heat capacity of calorimeter.
3. Determination of melting point of the given organic compound.
4. Purification of given organic compound by recrystallization.
5. To prepare pure sample of Iodoform from ethanol or acetone.
6. Detection of Extra element in the given organic compound.

Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Books Suggested:

1. Atkins, P. & de Paula, J. *Physical Chemistry*, 10th Ed., Oxford University Press, 2014.
2. Puri, B.R., Sharma, L.R. & Pathania, M.S. *Principles of Physical Chemistry*, 47th Ed,,Vishal Publishing Co, 2017.
3. Clayden, J., Greeves, N. & Warren, S. *Organic Chemistry*, 2nd Ed., Oxford University Press, 2012.
4. Singh, J. & Yadav, L.D.S. *Advanced Organic Chemistry*, 4th Ed., Pragati Prakashan, 2015.
5. Sykes, P. (2005), A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
6. Lee, J. D. Concise Inorganic Chemistry, 5th Ed., Wiley India Pvt. Ltd. 2008
7. Puri, B.R., Sharma, L.R. & Kalia, K. C. *Principles of Inorganic Chemistry*, 32nd Ed., Milestone Publishers and Distributors, 2015.
8. Atkins, P. W.; Overton, T. L.; Rourke, J. P.; Weller, M. T.; Armstrong, F. A. (2010), Shriver and Atkins Inorganic Chemistry, 5th Edition, Oxford University Press.
9. Pandey, O.P., Bajpai, D.N. & Giri, S. *Practical Chemistry*, 1st Ed., S. Chand Publishing, 2012.
10. Vogel, A.I. *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Longman Scientific & Technical, 1989.
11. Vogel, A.I. *Vogel's Textbook of Quantitative Chemical Analysis*, 5th Ed., Longman Scientific & Technical, 1989.
12. Jagdamba *et al*., Advanced Practical Chemistry. 5th Ed., Pragati Prakashan, 2014.

Course outcomes:

At the end of the course, the students would be able to:

CO1 Understand the basics of atomic structure and bonding concepts.
CO2 Describe the periodic properties of the elements.
CO3 Explain the concepts of thermodynamics and laws of thermodynamics.
CO4 Understand the basics of organic chemistry.
CO5 Apply the concepts of basic chemistry in preparation and estimation compounds.
CO6 Perform experiments, evaluate the results and defend viva.

Mapping of CO with PO
C24CHE102T and C24CHE102P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	M	M	S	M	S
CO2	S	S	M	M	M	S	M	S
CO3	S	S	M	M	M	S	S	S
CO4	S	S	S	M	M	S	S	S
CO5	S	S	S	S	S	S	S	S
CO6	S	S	S	S	S	S	S	S

S= Strong, M = Medium, W= Weak

Chemistry
Discipline Specific Course
General Chemistry – II (Semester-I)

Paper Code: C24CHE103T
45Hrs (3Hrs /Week) **External Marks: 50**
Credits: 3 **Internal Marks: 20**
Exam. Time: 2.5 Hrs **Total Marks: 70**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit in addition to the compulsory Question No.1. All questions carry equal marks.

Objective*: This paper deals with the concepts of chemical bonding, mechanism of organic reactions, spatial arrangement of molecules and kinetic study of gaseous state.*

Unit-I

Chemical Bonding

Ionic Bonding:

General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding:

Valence bond theory approach, Various type of hybridisation and shapes of simple inorganic molecules and ions with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements with examples, Valence Shell Electron Pair Repulsion (VSEPR) theory with examples. Concept of resonance and resonating structures in various inorganic and organic compounds.

Unit-II

Mechanism of Organic Reactions

Curved arrow notation, Cleavage of Bonds: Homolysis and Heterolysis, Types of reagents: electrophiles and nucleophiles. Reactive Intermediates: carbocations, carbanions, carbenes and free radicals (Types, shape and relative stability). Types of organic reactions: Substitution, Addition, Condensation, Elimination, Rearrangement, Isomerization.

Unit-III

Stereochemistry

Type of Stereoisomers, Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations.

Geometrical isomerism: cis-trans nomenclature; and E / Z Nomenclature (for upto two C=C systems).

Optical isomerism; Elements of symmetry, Concept of chirality (upto two carbon atoms), Enantiomerism, Diastereomerism, Threo and erythro diasteromers and Mesocompounds; Configuration: (relative and absolute), sequence rules D and L; R and S (for upto 2 chiral carbon atoms) system of nomenclature.

Unit-IV

Gaseous State

Kinetic theory of gases and derivation of the kinetic gas equation. Maxwell's distribution of velocities and energies (Graphic representation -derivation excluded), Temperature dependence of these distributions, Most probable velocity, Average velocity and Root Mean Square Velocity (Derivations excluded), Relationship among three type of velocities, Collision diameter, Collision number, Collision frequency and Mean free path (with Derivations), Deviation of real gases from ideal behaviour, Compressibility factor, Causes of deviation, Derivation of Van der Waal' s Equation of State and its application in the calculation of Boyle' s temperature.

General Chemistry – II Lab

Paper Code: C24CHE103P
30 Hrs (2 Hrs /Week) **External Marks: 20**
Credits: 1 **Internal Marks: 10**
Exam. Time: 3 Hrs **Total Marks: 30**

Objectives*: Hands on practice to prepare solutions, perform experiments on titration, preparation and purification of compounds.*

Practical

1. To determine the specific refractivity of the given liquid by Abbe's refractometer.
2. Paper chromatographic separation of Co (II) and Ni (II) ions.
3. Preparation of m-nitroaniline from m-dinitrobenzene.
4. Preparation of chrome alum.
5. Preparation of tetraamminecopper (II) sulphate monohydrate.
6. Preparation of Prussian blue

Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Books Suggested:

1. Atkins, P. & de Paula, J. *Physical Chemistry*, 10th Ed., Oxford University Press, 2014.
2. Puri, B.R., Sharma, L.R. & Pathania, M.S. *Principles of Physical Chemistry*, 47th Ed., Vishal Publishing Co., 2017.
3. Eliel, E.L. & Wilen, S.H. *Stereochemistry of Organic Compounds*, 1st Ed., Wiley-Interscience, 1994.
4. Clayden, J., Greeves, N. & Warren, S. *Organic Chemistry*, 2nd Ed., Oxford University Press, 2012.
5. Singh, J. & Yadav, L.D.S. *Advanced Organic Chemistry*, 4th Ed., Pragati Prakashan, 2015.
6. Sykes, P. A Guide Book to Mechanism in Organic Chemistry, Orient Longman, (2005)
7. Lee, J. D. Concise Inorganic Chemistry, 5th Ed., Wiley India Pvt. Ltd. 2008
8. Puri, B.R., Sharma, L.R. & Kalia, K. C. *Principles of Inorganic Chemistry*, 32nd Ed., Milestone Publishers and Distributors, 2015.
9. Atkins, P. W.; Overton, T. L.; Rourke, J. P.; Weller, M. T.; Armstrong, F. A. Shriver and Atkins Inorganic Chemistry, 5th Edition, Oxford University Press, (2010).
10. Pandey, O.P., Bajpai, D.N. & Giri, S. *Practical Chemistry*, 1st Ed., S. Chand Publishing, 2012.
11. Vogel, A.I. *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Longman Scientific & Technical, 1989.
12. Vogel, A.I. *Vogel's Textbook of Quantitative Chemical Analysis*, 5th Ed., Longman Scientific & Technical, 1989.
13. Jagdamba *et al*., *Advanced Practical Chemistry*. 5th ed., Pragati Prakashan, 2014.

Course outcomes:

At the end of the course, the students would be able to:

CO1 Understand the concepts ionic and covalent bonding.
CO2 Explain the mechanistic approach for chemical reactions.
CO3 Understand the spatial arrangement and orientation of molecules.
CO4 Describe kinetic theory of Real gases/Ideal gases and Maxwell distribution law.
CO5 Apply the concepts of chemistry in preparation and estimation of the compounds.
CO 6 Perform experiments, evaluate the results and defend viva.

Mapping of CO with PO
C24CHE103T and C24CHE103P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	M	M	S	M	S
CO2	S	S	M	M	M	S	M	S
CO3	S	S	M	M	M	S	S	S
CO4	S	S	S	M	M	S	S	S
CO5	S	S	S	S	S	S	S	S
CO6	S	S	S	S	S	S	S	S

S= Strong, M = Medium, W= Weak

Chemistry
Minor Course (MIC)
Basic Chemistry – I (Semester-I)

Paper Code: C24MIC131T
30 Hrs (2 Hrs /Week) **External Marks : 35**
Credits: 2 **Internal Marks : 15**
Exam. Time: 2 Hrs **Total Marks: 50**

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Objective*: This paper deals with the concept of bonding, shapes and hybridization in molecules, classification and preparation of alkanes.*

UNIT-I

Covalent Bond

Valence bond theory approach, Various type of hybridisation and shapes of simple inorganic molecules and ions with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements (BeF_2, BF_3, CH_4, PF_5, SF_6, IF_7, SO_4^{-2}, ClO_4^-, NO_3^-), Valence Shell Electron Pair Repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, ClF_3, H_2O, $SnCl_2$, ClO_3^- and ICl_2^-).

UNIT-II

Alkanes

Nomenclature, Classification of carbon atoms in alkanes and its structure. Isomerism in alkanes. Methods of formation: Wurtz reaction, Corey-House reaction. Kolbe electrolytic reaction, and decarboxylation of carboxylic acids. Mechanism of free radical halogenation of alkanes: reactivity and selectivity

Books Suggested:

1. Puri, B.R., Sharma, L.R. & Kalia, K. C. *Principles of Inorganic Chemistry*, 32nd Ed., Milestone Publishers and Distributors, 2015.
2. Malik, W. U., Tuli, G. D. and Madan R. D. Selected topics in Inorganic Chemistry. 8th Ed. S. Chand and Co. Ltd. 2019
3. Singh, J; Yadav, L.D.S. Under Graduate Organic Chemistry, Pragati Prakashan, Meerut (2010)
4. Bahl, A., Bahl, B. S. (2012), Advanced Organic Chemistry, S. Chand.
5. Morrison, R.T. & Boyd, R.N., revised by Bhatta charjee, S.K. *Organic Chemistry*, 7th Ed., Pearson, 2010.
6. Bruice, P.Y. *Organic Chemistry*, 8th Ed., Pearson, 2016.

Course outcomes:

At the end of the course, the students would be able to:

CO1 Understand the structure and bonding in molecules.
CO2 Understand the spatial arrangement and hybridization of molecules.
CO3 Understand the nomenclature and chemistry of Alkanes.
CO4 Understand the preparation reactions and mechanism of Alkanes.

Mapping of CO with PO

C24MIC131T

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	M	S	S	S
CO2	S	S	M	M	S	S	S	S
CO3	S	S	S	M	S	S	S	S
CO4	S	S	S	M	S	S	S	S

S= Strong, M = Medium, W= Weak

Chemistry
Minor Course (MIN)
Chemistry – I (Semester-I)

Paper Code: C24MIN131T/C24CHE101T
45 Hrs (3 Hrs /Week) **External Marks : 50**
Credits: 3 **Internal Marks : 20**
Exam. Time: 2.5 Hrs **Total Marks: 70**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit in addition to the compulsory Question No.1. All questions carry equal marks.

Objective*: This paper deals with the concept of atomic structure, bonding interactions, mechanism of chemical reactions, spatial arrangement of molecules and kinetic study of gaseous state.*

UNIT-I

Atomic Structure

Dual behaviour of matter and radiation, de-Broglie's relation, Heisenberg's uncertainty principle, Quantum mechanics. Time independent Schrodinger equation (Derivation Excluded). Significance of Ψ and Ψ^2, Normal and orthogonal wave functions, Concept of atomic orbitals, Significance of quantum numbers, shapes of *s*, *p* and *d* orbitals, Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals.

UNIT-II

Structure and Bonding

Localized and delocalized chemical bond, Van der Waals interactions, Concept of resonance and its applications, Hyperconjugation, Inductive effect, Electromeric effect and their comparison.

Mechanism of Organic Reactions

Curved arrow notation, homolytic and heterolytic bond fission, Types of reagents: electrophiles and nucleophiles. Types of organic reactions: Substitution, Addition, Condensation, Elimination, Rearrangement, Isomerization. Reactive intermediates: Carbocations, Carbanions, Free radicals and Carbenes (structure & stability).

UNIT-III

Stereochemistry

Type of Streoisomers, Conformations with respect to ethane, butane and cyclohexane. Optical isomerism, Elements of symmetry, Concept of chirality (upto two carbon atoms). Enantiomerism, Diastereomerism, Threo and erythro diasteromers and Meso compounds.; Configuration: (relative and absolute), sequence rules D and L; R and S (for upto 2 chiral carbon atoms) system of nomenclature; Geometrical isomerism; *cis* - *trans* nomenclature; and *E*/*Z* Nomenclature (for up to two C=C systems).

UNIT-IV

Gaseous State

Kinetic theory of gases and derivation of the kinetic gas equation. Maxwell's distribution of velocities and energies (Graphic representation - derivation excluded), Temperature dependence of these distributions, Most probable velocity, Average velocity and Root Mean Square Velocity (Derivations excluded), Relationship among three types of velocities, Collision diameter, Collision number, Collision frequency and Mean free path (with Derivations), Deviation of real gases from ideal behaviour, Compressibility factor, Causes of deviation, Derivation of Van der Waal' s Equation of State, its application in the calculation of Boyle's temperature.

Chemistry – I Lab

Paper Code: C24MIN131P/C24CHE101P
30 Hrs (2 Hrs /Week) **External Marks : 20**
Credits: 1 **Internal Marks : 10**
Exam. Time: 3 Hrs **Total Marks: 30**

Objective*: Hands on practice to prepare solutions, perform experiments on titration, preparation and purification of compounds.*

Practical

1. Acid/Base titration: Determination of strength of oxalic acid using NaOH.
2. Redox titrations: Determination of Fe^{2+} ions using $KMnO_4$.
3. Determination of melting point of the given organic compound.
4. Purification of given organic compound by recrystallization.
5. Preparation of *m*-Dinitrobenzne from Nitrobenzene.
6. Detection of Extra element in the given organic compound

Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Books Suggested:

1. Atkins, P. & de Paula, J. *Physical Chemistry*, 10th Ed., Oxford University Press, 2014.
2. Puri, B.R., Sharma, L.R. & Pathania, M.S. *Principles of Physical Chemistry*, 47th Ed., Vishal Publishing Co., 2017.
3. Eliel, E.L. & Wilen, S.H. *Stereochemistry of Organic Compounds*, 1st Ed., Wiley-Interscience, 1994.
4. Clayden, J., Greeves, N. & Warren, S. *Organic Chemistry*, 2nd Ed., Oxford University Press, 2012.
5. Singh, J. & Yadav, L.D.S. *Advanced Organic Chemistry*, 4th Ed., Pragati Prakashan, 2015.
6. Sykes, P. (2005), A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
7. Lee, J. D. Concise Inorganic Chemistry, 5th Ed., Wiley India Pvt. Ltd. 2008
8. Puri, B.R., Sharma, L.R. & Kalia, K. C. *Principles of Inorganic Chemistry*, 32nd Ed., Milestone Publishers and Distributors, 2015.
9. Atkins, P. W.; Overton, T. L.; Rourke, J. P.; Weller, M. T.; Armstrong, F. A. (2010), Shriver and Atkins Inorganic Chemistry, 5th Edition, Oxford University Press.
10. Pandey, O.P., Bajpai, D.N. & Giri, S. *Practical Chemistry*, 1st Ed., S. Chand Publishing, 2012.
11. Vogel, A.I. *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Longman Scientific & Technical, 1989.
12. Vogel, A.I. *Vogel's Textbook of Quantitative Chemical Analysis*, 5th Ed., Longman Scientific & Technical, 1989.
13. Jagdamba *et al*., Advanced Practical Chemistry. 5th Ed., Pragati Prakashan, 2014.

Course outcomes:

At the end of the course, the students would be able to:

CO1 Understand the atomic structure and bonding concepts.
CO2 Aquent with the mechanistic approach for chemical reactions.
CO3 Understand the spatial arrangement and orientation of atoms in the molecules.
CO4 Get the knowledge of Kinetic theory of gases (Real & Ideal) and Maxwell distribution law.
CO5 Apply the concepts of Chemistry in the preparation and estimation of compounds.
CO 6 Perform experiments, evaluate the results and defend viva.

Mapping of CO with PO
C24CHE101T and C24CHE101P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	M	M	S	M	S
CO2	S	S	M	M	M	S	M	S
CO3	S	S	M	M	M	S	S	S
CO4	S	S	S	M	M	S	S	S
CO5	S	S	S	S	S	S	S	S
CO6	S	S	S	S	S	S	S	S

S= Strong, M = Medium, W= Weak

Chemistry
Multidisciplinary Course (MDC)
Chemistry of Oils and Dyes (Semester-I)

Paper Code: C24MDC104T
30 Hrs (2 Hrs /Week) **External Marks : 35**
Credits: 2 **Internal Marks : 15**
Exam. Time: 2 Hrs **Total Marks: 50**

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Objective: *This paper deals with the chemistry of Oils, Fats and Dyes.*

UNIT-1

Chemistry of Oils
Introduction to oils and fats, classification, common fatty acids present in oils and fats, difference between fats and oils, Saponification value, acid value and iodine value (Only definitions). Applications and uses of different oils and fats

UNIT-II

Chemistry of Dyes
Definition; Colour and constitution; Classification on the basis of origin & application methods, applications and uses of the following dyes: Methyl orange (azo dye); Malachite green (tiphenylmethane dye), Phenolphthalein (Phthalein dye), Alizarin (anthraquinone dye), Indigo dye.

Chemistry of Oils and Dyes Lab

Paper Code: C24MDC104P
30 Hrs (2 Hrs /Week) **External Marks : 15**
Credits: 1 **Internal Marks : 10**
Exam. Time: 3 Hrs **Total Marks: 25**

Objectives: *Hands on practice for the preparation, extraction, separation and determination of properties of Oils/Fats and Dyes.*

Practical

1. Extraction of oil from seeds using a solvent.
2. Preparation of soap from oil and alkali.
3. To determine the iodine value, saponification value, acid value of a given sample of oil/fat.
4. Synthesis of azo dyes (*e.g.* Methyl orange, Malachite Green) etc.
5. Separation and identification of dye components using paper chromatography.

Note: Student will perform at least five experiments. The examiner will allot one practical at the time of end term examination. Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Books Suggested:

1. Soni, P.L. & Chawla, H.M. *Textbook of Organic Chemistry*, 22nd Ed., Sultan Chand & Sons, 2018.
2. Bahl, A. & Tuli, G.D. *Essentials of Physical Chemistry*, 25th Ed., S. Chand Publishing, 2012.
3. Chatwal, G.R. *Synthetic Organic Chemistry*, 2nd Ed., Himalaya Publishing House, 2012.
4. Vogel, A.I. *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Longman Scientific & Technical, 1989.
5. Jagdamba *et al*., Advanced Practical Chemistry. 5th Ed., Pragati Prakashan, 2014.
6. Dieffenbacher, A and Pocklington, W. D. Standard Methods for the Analysis of Oils, Fats and Derivatives 1st Supplement to the 7th Revised and Enlarged Edition.

Course outcomes:

At the end of the course, the students would be able to:

CO1 Understand chemistry of natural and synthetic oils.
CO2 Understand the classification of Dyes and their applications for industries.
CO3 Apply the preparation and separation techniques of oils and fats.
CO4 Perform experiments, evaluate the results and defend viva.

Mapping of CO with PO
C24MDC104T and C24MDC104P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	M	S	S	S
CO2	S	S	M	M	S	S	M	S
CO3	S	S	M	M	S	S	S	S
CO4	S	S	S	M	S	S	S	S

S= Strong, M = Medium, W= Weak

Chemistry
Skill Enhancement Course (SEC)
Basic Laboratory Techniques (Semester-I)

Paper Code: C24SEC128T
30 Hrs. (2 Hrs /Week) **External Marks: 35**
Credits: 2 **Internal Marks: 15**
Exam. Time: 2 Hrs **Total Marks: 50**

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Objective: *This paper deals with the concept of chemical labeling of solutions, preparation of compounds and their purification techniques.*

UNIT-I

Chemical Labeling and basic chemical concepts:
Chemical labeling and Chemical concepts related to solution preparation: Equivalent mass, molar mass, specific gravity, concentration (Normality, Molarity, Molality, %w/v, %w/w, %v/v, ppm solutions).

UNIT-II

Solution Preparation and Purification of compounds:
Standardization of solutions using Volumetric Titrations, Primary and Secondary standards. Indicators and preparation of indicator solutions: (Phenolphthalein, Starch Solution, Eriochrome Black T, N-Phenylanthranilic acid), Buffer Solutions, Types of Buffer Solutions, Henderson Hasselbalch Equation, Preparation and determination of pH of buffer solutions, Complexometric Titrations using EDTA. Purification of compounds through distillation, crystallization and sublimation.

Basic Laboratory Techniques Lab

Paper Code: C24SEC128P
30 Hrs (2 Hrs /Week) **External Marks : 15**
Credits: 1 **Internal Marks : 10**
Exa. Time: 3 Hrs **Total Marks: 25**

Objective: *Hands on practice on preparation of compounds and purification techniques.*
Practical

1. Preparation of different indicator solutions: (Phenolphthalein, Starch solution, Eriochrome Black T, N-Phenylanthranilic acid).
2. Determination of Mg^{2+} or Zn^{2+} ions in a solution by complexometric titration with EDTA.
3. Purification of chemical compounds by crystallization using water and alcohol.
4. Preparation of solution of acids/bases of different normalities and molarities.
5. Determination of pH of aerated drinks, shampoos and soaps.
6. Preparation of acidic (CH_3COONa and CH_3COOH) and basic buffer solutions (NH_4Cl and NH_4OH).

Note: Student will perform at least six experiments. The examiner will allot one practical at the time of end term examination. Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules

Books Suggested:

1. Jeffery, G.H.; Bassett, J.; Mendham, J. & Denney, R.C. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley and Sons (1989).
2. Bahl, B.S., Bahl, A., & Tuli, G.D. *Essentials of Physical Chemistry*, 25th Ed., S. Chand Publishing, 2012.
3. Soni, P.L., Dharmarha, O.P., & Dash, U.N. *A Textbook of Physical Chemistry*, 22nd Ed., Sultan Chand & Sons, 2020.
4. Yadav, J.B. *Advanced Practical Physical Chemistry*, 27th Ed., Krishna Prakashan Media, 2014.
5. Ahluwalia, V.K. & Dhingra, S. *Comprehensive Practical Chemistry*, University Press, 2000.
6. Khosla, B.D.; Garg, V.C.; Gulati, A. (2015), Senior Practical Physical Chemistry, R. Chand & Co, New Delhi.

Course outcomes:

At the end of the course, the students would be able to:

CO1 Explain the Chemistry and preparation of various solutions.

CO2 Get knowledge of the quantitative aspects of chemicals and purification techniques.

CO3 Perform experiments, evaluate the results and to defend viva.

Mapping of CO with PO

C24SEC128T and C24SEC128P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	M	S	S	S
CO2	S	S	M	M	S	S	M	S
CO3	S	S	S	M	S	S	S	S

S= Strong, M = Medium, W= Weak

Chemistry
Value Aided Courses (VAC)
Chemistry in Everyday Life (Semester-I/Semester-II)

Paper code: C24VAC111T
30 Hrs. (2 Hrs /week) **External Marks: 35**
Credits: 2 **Internal Marks: 15**
Exam. Time: 2 Hrs **Total Marks: 50**

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Objective: *This paper deals with the chemistry of soaps, detergent, dye and some daily life medicines.*

UNIT-I

Soaps and Detergents
Cleansing action of soap, Cleansing action of detergents.
Propellants
Solid propellant, liquid propellants, hybrid propellants.
Dyes
Cause of exhibition of color, chromophore, auxochrome, classification of dyes.

UNIT-II

Types of Medicines
Definition and examples of Antipyretics, Analgesics, Antidepressants, Antiseptics and disinfectants, Antiviral drugs, Antacids, Antimalarial, Anesthetics, Tranquilizers, Hypnotics and sedatives, Antiallergic drugs and Histamines

Books Suggested:

1. Bahl, A. & Bahl, B.S. *Textbook of Organic Chemistry*, 22nd Ed., Sultan Chand & Sons, 2018.
2. Soni, P.L., Dharmarha, O.P., & Dash, U.N. *A Textbook of Physical Chemistry*, 22nd Ed., Sultan Chand & Sons, 2020.
3. Ramamurthi, K. Rocket Propulsion, 1st Ed., Macmillan India Limited, New Delhi, 2010.
4. Jain, P.C. & Jain, M. *Principles of Engineering Chemistry*, 9th Ed., VK Global Publications, 2017.
5. Alagarsamy, V. (2010), Textbook of Medicinal Chemistry, Volume II, Second Edition, Reed Elsevier India Private Limited.
6. Chatwal, G.R. *Synthetic Organic Chemistry*, 2nd Ed., Himalaya Publishing House, 2012.
7. Singh, K. Chemistry in Daily Life 3rd Ed., PHI Learning (2010)
8. Soni, P.L. & Chawla, H.M. *Textbook of Organic Chemistry*, 22nd Ed., Sultan Chand & Sons, 2018.

Course outcomes:
At the end of the course, the students would be able to:

CO1 Understand the cleaning action of soaps and detergents.
CO2 Explain the concepts of Propellants, Dyes and their applications.
CO3 Understand the classifications of various medicines and their use.

Mapping of CO with PO
C24VAC111T

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	M	S	S	S
CO2	S	S	M	M	S	S	M	S
CO3	S	S	S	M	S	S	S	S

S= Strong, M = Medium, W= Weak

Chemistry
Discipline Specific Course (DSC)
Chemistry – II (Semester-II)

Paper Code: C24CHE201T/C24MIN231T
45 Hrs (3 Hrs /week) **External Marks: 50**
Credits: 3 **Internal Marks: 20**
Exam. Time: 2.5 Hrs **Total Marks: 70**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit in addition to the compulsory Question No.1. All questions carry equal marks.

Objective: *This paper deals with the concept bonding interactions, hybridization, shapes of simple molecules, mechanism of chemical reactions and concept of chemical kinetics.*

UNIT-I

Covalent Bond

Valence bond theory approach, Various type of hybridization and shapes of simple inorganic molecules and ions with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements (BeF_2, BF_3, CH_4, PF_5, SF_6, IF_7, SO_4^{2-}, ClO_4^-, NO_3^-), Valence Shell Electron Pair Repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, ClF_3, H_2O, $SnCl_2$, ClO_3^- and ICl_2^-.

UNIT-II

Alkanes

Nomenclature, Classification of carbon atoms in alkanes and its structure. Isomerism in alkanes. Methods of Preparation: Wurtz reaction, Corey-House reaction, Kolbe electrolytic reaction, and decarboxylation of carboxylic acids. Mechanism of free radical halogenation of alkanes: reactivity and selectivity.

Alkenes

Nomenclature of alkenes and its structure. Methods of Preparation: dehydration of alcohols and dehydrohalogenation of alkyl halide with mechanism. The Saytzeff rule and relative stabilities of alkenes. Chemical reactions: electrophilic and free radical additions: addition of halogens, halogen acids, hydroboration–oxidation, ozonolysis.

Alkynes

Nomenclature, structure and bonding. Methods of Preparation: From Calcium carbide and from acetylene, Chemical reactions: Acidity of terminal alkynes, Cause of acidity, Reactivity of alkenes versus alkynes towards electrophilic addition reaction.

UNIT-III

Chemical Kinetics

Concept of reaction rates, Rate equation, Rate law, Law of mass action, Factors influencing the rate of reaction, Order and molecularity of a reaction, Derivation of Integrated rate expression for zero, first and second order reaction (for equal concentration of reactants), Half-life period of a reaction, Methods of determination of order of a reaction, Concept of Activation Energy and its calculation from Arrhenius equation.

UNIT-IV

Thermodynamics

Definition of various thermodynamic terms: Types of systems, Intensive and Extensive properties. State and path functions. Thermodynamic process. Thermodynamic equilibrium, First law of thermodynamics: concepts of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Second law of thermodynamics, Carnot's cycle and its efficiency, Carnot's theorem. Gibbs function (G) and Helmholtz function (A), G as criteria for thermodynamic equilibrium and spontaneity. Concept of entropy. Third law of thermodynamics: Nernst heat theorem, concept of residual entropy

Chemistry – II Lab

Paper Code: C24CHE201P/C24MIN231P
30 Hrs (2 Hrs /Week) **External Marks: 20**
Credits: 1 **Internal Marks: 10**
Exam. Time: 3 Hrs **Total Marks: 30**

Objective*: Hands on practice on determination of rate of hydrolysis, to perform calorimetric experiments and detection of functional group of organic compounds.*

Practical

1. Study the kinetics of hydrolysis of ethyl acetate in acidic medium.
2. Determination of heat capacity of calorimeter
3. Determination of enthalpy of neutralization of HCl *vs*. NaOH
4. Determination of degree of Ionization of CH_3COOH *vs*. NaOH
5. To detect the functional group present in a given organic compound: Carboxylic acid, phenolic, carbonyl compounds, amides.

Note: Student will perform at least five experiments. The examiner will allot one practical at the time of end term examination. Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Books Suggested:

1. Atkins, P. & de Paula, J. *Physical Chemistry*, 11th Ed., Oxford University Press, 2018.
2. Puri, B.R., Sharma, L.R. & Pathania, M.S. *Principles of Physical Chemistry*, 47th Ed., Vishal Publishing Co., 2017.
3. Bahl, B.S., Tuli, G.D., & Bahl, A. *Essentials of Physical Chemistry*, 27th Ed., S. Chand & Co., 2019.
4. Clayden, J., Greeves, N. & Warren, S. *Organic Chemistry*, 2nd Ed., Oxford University Press, 2012.
5. Singh, J. & Yadav, L.D.S. *Advanced Organic Chemistry*, 4th Ed., Pragati Prakashan, 2015.
6. Morrison, R.T. & Boyd, R.N., revised by Bhattacharjee, S.K. *Organic Chemistry*, 7th Ed., Pearson, 2010.
7. Solomons, T.W.G., Fryhle, C.B., Snyder, S.A. (2017), Organic Chemistry, 12th Edition, Wiley.
8. Lee, J. D. Concise Inorganic Chemistry, 5th Ed., Wiley India Pvt. Ltd. 2008
9. Puri, B.R., Sharma, L.R. & Kalia, K. C. *Principles of Inorganic Chemistry*, 32nd Ed., Milestone Publishers and Distributors, 2015.
10. Prakash, S., Tuli, G.D., Basu, S.K., & Madan, R.D. *Advanced Inorganic Chemistry*, 2nd Ed., S. Chand & Co., 2018.
11. Pandey, O.P., Bajpai, D.N. & Giri, S. *Practical Chemistry*, 1st Ed., S. Chand Publishing, 2012.
12. Vogel, A.I. *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Longman Scientific & Technical, 1989.
13. Yadav, J.B. *Advanced Practical Physical Chemistry*, 3rd Ed., Goel Publishing House, 2015.
14. Khosla, B.D.; Garg, V.C.; Gulati, A. (2015), Senior Practical Physical Chemistry, R. Chand & Co, New Delhi.

Course outcomes:

At the end of the course, the students would be able to:

CO1 Understand the basic concepts of bonding, hybridization and shapes of molecules.
CO2 Understand the nomenclature, preparation and properties of hydrocarbons.
CO3 Understand the concept of reaction rates, rate equation and Kinetics of reactions.
CO4 Understand the thermodynamic terms and properties.
CO5 Perform experiments, evaluate the results and defend viva.

Mapping of CO with PO
C24CHE201T and C24CHE201P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	M	S	S	S
CO2	S	S	M	M	S	S	M	S
CO3	S	S	M	M	S	S	S	S
CO4	S	S	S	M	S	S	S	S
CO5	S	S	S	M	S	S	S	S

S= Strong, M = Medium, W= Weak

Chemistry
Discipline Specific Course
General Chemistry – III (Semester-II)

Paper Code: C24CHE202T
45Hrs (3Hrs /week) **External Marks: 50**
Credits: 3 **Internal Marks: 20**
Exam. Time: 2.5 Hrs **Total Marks: 70**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit in addition to the compulsory Question No.1. All questions carry equal marks.

Objective: *This paper deals with the understanding general characteristics and properties of s- & p-block elements, methods of preparation & chemical reactions of aliphatic hydrocarbons and concepts of chemical kinetics.*

Unit-I

s-block elements

General characteristics of *s*-block metals like density, melting and boiling points, flame colour and reducing nature.
Oxidation states of *s*-block elements, diagonal relationships and anomalous behaviour of first member of each group.
Common features, such as ease of formation, solubility and stability of oxides, peroxides, superoxides, sulphates and carbonates of *s*-block metals.

p-block elements-I

General characteristics of *p*-block elements: Oxidation states of *p*-block elements, inert-pair effect, diagonal relationships and anomalous behaviour of first member of each group. Allotropy in C, P and S.

Unit-II

Aliphatic Hydrocarbons - I

Alkanes

Nomenclature, Classification of carbon atoms in alkanes and its structure. Isomerism in alkanes. Methods of Preparation: Wurtz reaction, Corey-House reaction, Kolbe electrolytic reaction, and decarboxylation of carboxylic acids. Mechanism of free radical halogenation of alkanes: reactivity and selectivity.

Alkenes

Nomenclature of alkenes and its structure. Methods of Preparation: dehydration of alcohols and dehydrohalogenation of alkyl halide with mechanism. The Saytzeff rule and relative stabilities of alkenes. Chemical reactions: electrophilic and free radical additions: addition of halogens, halogen acids, hydroboration–oxidation, ozonolysis.

Unit-III

Aliphatic Hydrocarbons - II

Alkynes

Nomenclature, structure and bonding. Methods of Preparation: From Calcium carbide and from acetylene, Chemical reactions: Acidity of terminal alkynes, Cause of acidity, Reactivity of alkenes versus alkynes towards electrophilic addition reaction.

Unit-IV

Chemical Kinetics

Concept of reaction rates, Rate equation, Rate law, Law of mass action, Factors influencing the rate of reaction, Order and molecularity of a reaction, Derivation of Integrated rate expression for zero, first and second order reaction (for equal concentration of reactants), Half-life period of a reaction, Methods of determination of order of a reaction, Concept of Activation Energy and its calculation from Arrhenius equation.

General Chemistry – III Lab

Paper Code: C24CHE202P
30 Hrs (2 Hrs /Week) **External Marks: 20**
Credits: 1 **Internal Marks: 10**
Exam. Time: 3 Hrs **Total Marks: 30**

Objective*: Hands on practice on determination of rate of hydrolysis, calorimetric experiments and detection of functional group of organic compounds.*

Practical

1. To Study the kinetics of hydrolysis of ethyl acetate in acidic medium.
2. Redox titrations: Determination of Fe^{2+}ions using $KMnO_4$.
3. Determine volumetrically the number of water molecules in given sample of Mohr's salt using $K_2Cr_2O_7$.
4. Identification of Pb(II), Cu(II) and Cd(II) ions using paper chromatography
5. Preparation of standard normal solutions of acids and bases.

Note: Student will perform at least five experiments. The examiner will allot one practical at the time of end term examination. Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Books Suggested:

1. Atkins, P. & de Paula, J. *Physical Chemistry*, 11th Ed., Oxford University Press, 2018.
2. Puri, B.R., Sharma, L.R. & Pathania, M.S. *Principles of Physical Chemistry*, 47th Ed., Vishal Publishing Co., 2017.
3. Bahl, B.S., Tuli, G.D., & Bahl, A. *Essentials of Physical Chemistry*, 27th Ed., S. Chand & Co., 2019.
4. Clayden, J., Greeves, N. & Warren, S. *Organic Chemistry*, 2nd Ed., Oxford University Press, 2012.
5. Singh, J. & Yadav, L.D.S. *Advanced Organic Chemistry*, 4th Ed., Pragati Prakashan, 2015.
6. Singh, J; Yadav, L.D.S. *Under Graduate Organic Chemistry*, Pragati Prakashan, Meerut (2010)
7. Morrison, R.T. & Boyd, R.N., revised by Bhattacharjee, S.K. *Organic Chemistry*, 7th Ed., Pearson, 2010.
8. Solomons, T.W.G., Fryhle, C.B., Snyder, S.A. (2017), Organic Chemistry, 12th Edition, Wiley.
9. Lee, J. D. Concise Inorganic Chemistry, 5th Ed., Wiley India Pvt. Ltd. 2008.
10. Puri, B.R., Sharma, L.R. & Kalia, K. C. *Principles of Inorganic Chemistry*, 32nd Ed., Milestone Publishers and Distributors, 2015.
11. Prakash, S., Tuli, G.D., Basu, S.K., & Madan, R.D. *Advanced Inorganic Chemistry*, 2nd Ed., S. Chand & Co., 2018.
12. Pandey, O.P., Bajpai, D.N. & Giri, S. *Practical Chemistry*, 1st Ed., S. Chand Publishing, 2012.
13. Vogel, A.I. *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Longman Scientific & Technical, 1989.
14. Yadav, J.B. *Advanced Practical Physical Chemistry*, 3rd Ed., Goel Publishing House, 2015.
15. Khosla, B.D.; Garg, V.C.; Gulati, A. (2015), Senior Practical Physical Chemistry, R. Chand & Co, New Delhi.

Course outcomes:

At the end of the course, the students would be able to:

CO1 Understand the general characteristics and properties of s- & p-block elements.
CO2 Description of the nomenclature, preparation and properties of aliphatic hydrocarbons.
CO3 Understanding the concept of reaction rates, rate equation and kinetics of reactions.
CO4 Apply the concepts of basic chemistry in preparation of solutions of acids and bases.
CO5 Perform experiments, evaluate the results and to defend viva.

Mapping of CO with PO
C24CHE202T and C24CHE202P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	M	S	S	S
CO2	S	S	M	M	S	S	M	S
CO3	S	S	M	M	S	S	S	S
CO4	S	S	S	M	S	S	S	S
CO5	S	S	S	M	S	S	S	S

S= Strong, M = Medium, W= Weak

Chemistry
Discipline Specific Course
General Chemistry – IV (Semester-II)

Paper Code: C24CHE203T
45 Hrs (3 Hrs /Week) **External Marks: 50**
Credits: 3 **Internal Marks: 20**
Exam. Time: 2.5 Hrs **Total Marks: 70**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit in addition to the compulsory Question No.1. All questions carry equal marks.

Objective: *This paper deals with the concepts of structure, bonding and properties of p-block elements, noble gases & compounds of noble gases, methods of preparation & chemical reactions of aromatic hydrocarbons and basics of thermochemistry.*

Unit-I

p-block elements- II

Structure, bonding and properties (acidic/ basic nature, oxidizing/ reducing nature and hydrolysis) of the following compounds: Diborane and concept of multicentre bonding, hydrides of Groups 13 (EH_3), 14, 15, 16 and 17. Oxides of N and P, Oxoacids of P, S and Cl. Halides and oxohalides of P and S (PCl_3, PCl_5, $SOCl_2$ and SO_2Cl_2) Interhalogen compounds. A brief idea of pseudohalides.

Unit-II

Noble Gases

Rationalization of inertness of noble gases, clathrates, preparation and properties of Oxides, Flourides and oxyflourides, bonding in these compounds using VBT and shapes of noble gas compounds using VSEPR Theory.

Unit-III

Aromatic Hydrocarbons

Aromaticity: Benzenoids and Hückel's rule.
Preparation of benzene: from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid.
Reactions of benzene: Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

Unit-IV

Thermodynamics-II

Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation.

General Chemistry – IV Lab

Paper Code: C24CHE203P
30 Hrs (2 Hrs /Week) **External Marks: 20**
Credits: 1 **Internal Marks: 10**
Exam. Time: 3 Hrs **Total Marks: 30**

Objective*: Hands on practice of experiments on calorimetric, neutralization reactions and distinction between sugars.*

Practical

1. To verify Beer Lamberts law for $KMnO_4$ and determine the concentration of the given $KMnO_4$ solution.
2. To verify Beer Lamberts law for $K_2Cr_2O_7$ and determine the concentration of the given $K_2Cr_2O_7$ solution.
3. Determination of enthalpy of neutralization of HCl vs. NaOH
4. Determination of enthalpy of neutralization and degree of ionization of CH_3COOH vs. NaOH
5. To distinguish between reducing and non-reducing sugars

Note: Student will perform at least five experiments. The examiner will allot one practical at the time of end term examination. Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules.

Books Suggested:

1. Atkins, P. & de Paula, J. *Physical Chemistry*, 11th Ed., Oxford University Press, 2018.
2. Puri, B.R., Sharma, L.R. & Pathania, M.S. *Principles of Physical Chemistry*, 47th Ed., Vishal Publishing Co., 2017.
3. Bahl, B.S., Tuli, G.D., & Bahl, A. *Essentials of Physical Chemistry*, 27th Ed., S. Chand & Co., 2019.
4. Clayden, J., Greeves, N. & Warren, S. *Organic Chemistry*, 2nd Ed., Oxford University Press, 2012.
5. Singh, J. & Yadav, L.D.S. *Advanced Organic Chemistry*, 4th Ed., Pragati Prakashan, 2015.
6. Singh, J; Yadav, L.D.S. *Under Graduate Organic Chemistry*, Pragati Prakashan, Meerut (2010)
7. Morrison, R.T. & Boyd, R.N., revised by Bhattacharjee, S.K. *Organic Chemistry*, 7th Ed., Pearson, 2010.
8. Solomons, T.W.G., Fryhle, C.B., Snyder, S.A. (2017), Organic Chemistry, 12th Edition, Wiley.
9. Lee, J. D. Concise Inorganic Chemistry, 5th Ed., Wiley India Pvt. Ltd. 2008
10. Puri, B.R., Sharma, L.R. & Kalia, K. C. *Principles of Inorganic Chemistry*, 32nd Ed., Milestone Publishers and Distributors, 2015.
11. Prakash, S., Tuli, G.D., Basu, S.K., & Madan, R.D. *Advanced Inorganic Chemistry*, 2nd Ed., S. Chand & Co, 2018.
12. Pandey, O.P., Bajpai, D.N. & Giri, S. *Practical Chemistry*, 1st Ed., S. Chand Publishing, 2012.
13. Vogel, A.I. *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Longman Scientific & Technical, 1989.
14. Yadav, J.B. *Advanced Practical Physical Chemistry*, 3rd Ed., Goel Publishing House, 2015.
15. Khosla, B.D.; Garg, V.C.; Gulati, A. (2015), Senior Practical Physical Chemistry, R. Chand & Co, New Delhi.

Course outcomes:

At the end of the course, the students would be able to:

CO1 Understand the *concepts of structure, bonding and properties of p-block elements*.
CO2 Describe *noble gases & compounds of noble gases*.
CO3 Explain the nomenclature, preparation and properties of aromatic hydrocarbons.
CO4 Understand the basics of thermochemistry.
CO5 Perform experiments, evaluate the results and defend viva.

Mapping of CO with PO
C24CHM202T and C24CHM202P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	M	S	S	S
CO2	S	S	M	M	S	S	M	S
CO3	S	S	M	M	S	S	S	S
CO4	S	S	S	M	S	S	S	S
CO5	S	S	S	M	S	S	S	S

S= Strong, M = Medium, W= Weak

Chemistry
Minor Course (MIC)
Basic Chemistry – II (Semester-II)

Paper Code: C24MIC231T
30 Hrs. (2 Hrs /Week) **External Marks: 35**
Credits: 2 **Internal Marks: 15**
Exam. Time: 2 Hrs **Total Marks: 50**

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Objective*: This paper deals with the understanding of concept of Chemical Kinetics and Ionic Liquids.*

UNIT-I

Chemical Kinetics
Concept of reaction rates, Rate equation, Rate law, Law of mass action, Factors influencing the rate of reaction, Order and molecularity of a reaction, Integrated rate expression for zero, first and second order reaction (For equal concentration of reactants), Half-life period of a reaction, Arrhenius equation, Determination of Activation Energy.

UNIT-II

Ionic Solids
General characteristics of ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy (Derivation excluded), Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, Ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character, Crystal Defects.

Suggested Books:

1. Atkins, P. & de Paula, J. *Physical Chemistry*, 10th Ed., Oxford University Press, 2014.
2. Cotton, F.A., Wilkinson, G., Murillo, C.A. & Bochmann, M. *Advanced Inorganic Chemistry*, 6th Ed., John Wiley & Sons, 1999.
3. Bahl, B.S., Tuli, G.D. & Bahl, A. *Essentials of Physical Chemistry*, 28th Ed., S. Chand & Company, 2014.
4. J.D. Lee *Concise Inorganic Chemistry*, 5th Ed., Oxford University Press, 1996.
5. Prakash, S., Tuli, G.D., Basu, S.K. & Madan, R.D. *Advanced Inorganic Chemistry*, S. Chand & Company, 2000.

Course outcomes:
At the end of the course, the students would be able to:

CO1 Understand the rate equation and kinetics of reactions.
CO2 Understand the general characteristics and properties of ionic compounds.
CO3 Understand the concept of defects in solids.

Mapping of CO with PO
C24MIC231T

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	M	S	S	S
CO2	S	S	M	M	S	S	M	S
CO3	S	S	S	M	S	S	S	S

S= Strong, M = Medium, W= Weak

Chemistry
Minor Course (MIN)
Chemistry – II (Semester-II)

Paper Code: C24MIN231T/ C24CHE201T
45 Hrs (3 Hrs /week) **External Marks: 50**
Credits: 3 **Internal Marks: 20**
Exam. Time: 2.5 Hrs **Total Marks: 70**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit in addition to the compulsory Question No.1. All questions carry equal marks.

Objective: *This paper deals with the concept bonding interactions, hybridization, shapes of simple molecules, mechanism of chemical reactions and concept of chemical kinetics.*

UNIT-I

Covalent Bond

Valence bond theory approach, Various type of hybridization and shapes of simple inorganic molecules and ions with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements (BeF_2, BF_3, CH_4, PF_5, SF_6, IF_7, SO_4^{2-}, ClO_4^-, NO_3^-), Valence Shell Electron Pair Repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, ClF_3, H_2O, $SnCl_2$, ClO_3^- and ICl_2^-.

UNIT-II

Alkanes

Nomenclature, Classification of carbon atoms in alkanes and its structure. Isomerism in alkanes. Methods of Preparation: Wurtz reaction, Corey-House reaction, Kolbe electrolytic reaction, and decarboxylation of carboxylic acids. Mechanism of free radical halogenation of alkanes: reactivity and selectivity.

Alkenes

Nomenclature of alkenes and its structure. Methods of Preparation: dehydration of alcohols and dehydrohalogenation of alkyl halide with mechanism. The Saytzeff rule and relative stabilities of alkenes. Chemical reactions: electrophilic and free radical additions: addition of halogens, halogen acids, hydroboration–oxidation, ozonolysis.

Alkynes

Nomenclature, structure and bonding. Methods of Preparation: From Calcium carbide and from acetylene, Chemical reactions: Acidity of terminal alkynes, Cause of acidity, Reactivity of alkenes versus alkynes towards electrophilic addition reaction.

UNIT-III

Chemical Kinetics

Concept of reaction rates, Rate equation, Rate law, Law of mass action, Factors influencing the rate of reaction, Order and molecularity of a reaction, Derivation of Integrated rate expression for zero, first and second order reaction (for equal concentration of reactants), Half-life period of a reaction, Methods of determination of order of a reaction, Concept of Activation Energy and its calculation from Arrhenius equation.

UNIT-IV

Thermodynamics

Definition of various thermodynamic terms: Types of systems, Intensive and Extensive properties. State and path functions. Thermodynamic process. Thermodynamic equilibrium, First law of thermodynamics: concepts of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Second law of thermodynamics, Carnot's cycle and its efficiency, Carnot's theorem. Gibbs function (G) and Helmholtz function (A), G as criteria for thermodynamic equilibrium and spontaneity. Concept of entropy. Third law of thermodynamics: Nernst heat theorem, concept of residual entropy

Chemistry – II Lab

Paper Code: C24MIN231P/ C24CHE201P
30 Hrs (2 Hrs /Week) **External Marks : 20**
Credits: 1 **Internal Marks : 10**
Exam. Time: 3 Hrs **Total Marks: 30**

Objective*: Hands on practice on determination of rate of hydrolysis, to perform calorimetric experiments and detection of functional group of organic compounds.*

Practical

1. Study the kinetics of hydrolysis of ethyl acetate in acidic medium.
2. Determination of heat capacity of calorimeter
3. Determination of enthalpy of neutralization of HCl *vs*. NaOH
4. Determination of degree of Ionization of CH_3COOH *vs*. NaOH
5. To detect the functional group present in a given organic compound: Carboxylic acid, phenolic, carbonyl compounds, amides.

Note: Student will perform at least five experiments. The examiner will allot one practical at the time of end term examination. Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules

Books Suggested:

1. Atkins, P. & de Paula, J. *Physical Chemistry*, 11th Ed., Oxford University Press, 2018.
2. Puri, B.R., Sharma, L.R. & Pathania, M.S. *Principles of Physical Chemistry*, 47th Ed., Vishal Publishing Co., 2017.
3. Bahl, B.S., Tuli, G.D., & Bahl, A. *Essentials of Physical Chemistry*, 27th Ed., S. Chand & Co., 2019.
4. Clayden, J., Greeves, N. & Warren, S. *Organic Chemistry*, 2nd Ed., Oxford University Press, 2012.
5. Singh, J. & Yadav, L.D.S. *Advanced Organic Chemistry*, 4th Ed., Pragati Prakashan, 2015.
6. Morrison, R.T. & Boyd, R.N., revised by Bhattacharjee, S.K. *Organic Chemistry*, 7th Ed., Pearson, 2010.
7. Solomons, T.W.G., Fryhle, C.B., Snyder, S.A. (2017), Organic Chemistry, 12th Edition, Wiley.
8. Lee, J. D. Concise Inorganic Chemistry, 5th Ed., Wiley India Pvt. Ltd. 2008
9. Puri, B.R., Sharma, L.R. & Kalia, K. C. *Principles of Inorganic Chemistry*, 32nd Ed., Milestone Publishers and Distributors, 2015.
10. Prakash, S., Tuli, G.D., Basu, S.K., & Madan, R.D. *Advanced Inorganic Chemistry*, 2nd Ed., S. Chand & Co., 2018.
11. Pandey, O.P., Bajpai, D.N. & Giri, S. *Practical Chemistry*, 1st Ed., S. Chand Publishing, 2012.
12. Vogel, A.I. *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Longman Scientific & Technical, 1989.
13. Yadav, J.B. *Advanced Practical Physical Chemistry*, 3rd Ed., Goel Publishing House, 2015.
14. Khosla, B.D.; Garg, V.C.; Gulati, A. (2015), Senior Practical Physical Chemistry, R. Chand & Co, New Delhi.

Course outcomes:

At the end of the course, the students would be able to:

CO1 Understand the basic concepts of bonding, hybridization and shapes of molecules.
CO2 Understand the nomenclature, preparation and properties of hydrocarbons.
CO3 Understand the concept of reaction rates, rate equation and Kinetics of reactions.
CO4 Understand the thermodynamic terms and properties.
CO5 Perform experiments, evaluate the results and defend viva.

Mapping of CO with PO
C24CHE201T and C24CHE201P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	M	S	S	S
CO2	S	S	M	M	S	S	M	S
CO3	S	S	M	M	S	S	S	S
CO4	S	S	S	M	S	S	S	S
CO5	S	S	S	M	S	S	S	S

S= Strong, M = Medium, W= Weak

Chemistry
Multidisciplinary Course (MDC)
Chemistry of Soil and Everyday Compounds (Semester-II)

Paper Code: C24MDC204T
30 Hrs. (2Hrs /Week) **External Marks: 35**
Credits: 2 **Internal Marks: 15**
Exam. Time: 2 Hrs **Total Marks: 50**

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Objective*: This paper deals with the chemistry of soil and fertilizers, preparation and use of compounds in everyday life.*

UNIT-I

Soil and fertilizers
Types of soils, Acidity and alkalinity of soil and its determination.
Types of fertilizers- Chemical and Biofertilizers with examples.

UNIT-II

Preparation, properties and uses of some common compounds
Baking soda, Baking powder, Washing soda, Plaster of Paris, Gypsum, Glass.

Chemistry of Soil and Everyday Compounds Lab

Paper Code: C24MDC204P
30 Hrs (2 Hrs /Week) **External Marks : 15**
Credits: 1 **Internal Marks : 10**
Time: 3 Hrs **Total Marks: 25**

Objective*: Hands on practice on the preparation and use of compounds useful in everyday life.*

Practical
1. To Prepare the Plaster of Paris.
2. To Determine the acidity/alkalinity of soil samples.
3. To study the effect of acid on Baking and Washing soda
4. To study the action of water on quick lime and identify the nature of reaction (Exo/Endothermic).

Note: Student will perform at least four experiments. The examiner will allot one practical at the time of end term examination. Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rules

Books Suggested:

1. Brady, N.C. & Weil, R.R. *The Nature and Properties of Soils*, 15th Ed., Pearson, 2016.
2. Cotton, F.A., Wilkinson, G., Murillo, C.A. & Bochmann, M. *Advanced Inorganic Chemistry*, 6th Ed., John Wiley & Sons, 1999.
3. Mishra, B.B. & Banerjee, S.K. *Soil Chemistry*, 2nd Ed., Vikas Publishing House, 1988.
4. Subba Rao, N.S. *Biofertilizers in Agriculture and Forestry*, 3rd Ed., Oxford & IBH Publishing Co. Pvt. Ltd., 2003.
5. Bockhurst, J.R. & Harker, J.H. *Industrial Chemistry*, 1st Ed., Butterworth-Heinemann, 1976.
6. Martin, P.M. *Chemistry of Glass*, 1st Ed., Springer, 2008.
7. Laddha, R.S. Industrial Chemistry, 1st Ed., Himalaya Publishing House, 1995.
8. Soni, P.L., Dharmarha, O.P. & Dash, U.N. *A Textbook of Physical Chemistry*, 23rd Ed., Sultan Chand & Sons, 2020.
9. Singh, K. *Chemistry in Daily Life* 3rd Ed., PHI Learning (2010)
10. Vogel, A.I. *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Pearson, 1996.
11. Pandey, O.P., Bajpai, D.N. & Giri, S. *Practical Chemistry*, S. Chand & Company, 2012.

Course outcomes:

At the end of the course, the students would be able to:

CO1 Understand the types and properties of soils and fertilizers.

CO2 Understand the preparation, properties and uses of compounds.

CO3 Perform experiments, evaluate the results and defend viva.

Mapping of CO with PO

C24MDC204T and C24MDC204P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	M	S	S	S
CO2	S	S	M	M	S	S	M	S
CO3	S	S	S	M	S	S	S	S

S= Strong, M = Medium, W= Weak

Chemistry
Skill Enhancement Course (SEC)
Chromatographic Techniques, Food and Water Analysis (Semester-II)

Paper Code: C24SEC228T
30 Hrs. (2Hrs /Week) **External Marks: 35**
Credits: 2 **Internal Marks: 15**
Exam. Time: 2 Hrs **Total Marks: 50**

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Objective*: This paper deals with the basic principle of chromatography, analysis of water and food adulteration.*

UNIT-I

Chromatography: Definition, Principles of Chromatography, Column chromatography, Paper Chromatography and Thin Layer Chromatography (TLC).

UNIT-II

Analysis of water: Sources responsible for contamination of water, Water sampling methods, Water purification methods. Determination of adulterants in food items.

Chromatographic Techniques, Food and Water Analysis Lab

Paper Code: C24SEC228P
30 Hrs (2 Hrs /Week) **External Marks : 15**
Credits: 1 **Internal Marks : 10**
Exam. Time: 3 Hrs **Total Marks: 25**

Objectives: Hands on practice on chromatographic, water analysis and food adulterations experiments.

Practical

1. Separation of mixture of metal ions using Paper chromatography.
2. Separation of mixture of sugars/amines using Paper chromatography.
3. Analysis of components of a mixture by TLC.
4. Determination of pH, acidity and alkalinity of water samples.
5. Identification of adulterants in some common food items like Coffee powder, Asafoetida, Chilli powder, Turmeric powder, Coriander powder and pulses.

Note: Student will perform at least five experiments. The examiner will allot one practical at the time of end term examination. Candidates are required to obtain minimum passing marks separately in practical component and theory as per the University rule.

Books Suggested:

1. Skoog, D.A., Holler, F.J. & Crouch, S.R. *Principles of Instrumental Analysis*, 6th Ed., Cengage Learning, 2007.
2. Skoog, D.A.; West, D.M. & Holler, F.J. Fundamentals of Analytical Chemistry 6th Ed., Saunders College Publishing, Fort Worth (1992).
3. Chatwal G R, Analytical Chromatography, 4th ed, 2010, Himalaya Publishing House.
4. Manivasakam, N. *Physicochemical Examination of Water, Sewage and Industrial Effluents*, Pragati Prakashan, 2011.
5. Kalia, M. *Food Analysis and Quality Control*, Kalyani Publishers, 2015.
6. Vogel, A. I. *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Pearson, 1996.
7. Pandey, O. P., Bajpai, D. N. & Giri, S. *Practical Chemistry*, S. Chand & Company, 2012.

Course outcomes:

At the end of the course, the students would be able to:

CO1 Understand the principle and applications of chromatographic techniques
CO2 Explain the qualitative analysis of water and purification techniques
CO3 Understand various types of adulterants in food items.
CO4 Perform experiments, evaluate the results and defend viva.

Mapping of CO with PO
C24SEC228T and C24SEC228P

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	S	S	M	S	M	S	S	S
CO2	S	S	M	M	S	S	M	S
CO3	S	S	S	M	S	S	S	S

S= Strong, M = Medium, W= Weak