

Ist Semester

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours L: Lecture P: Practical T: Tutorial				Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
				Total	Theory (Th)	Practical (P)	L	T	P	Total	Th	P	Th	P		Th	P
CC-1 MCC-1	Scheme A, B & C	26L4.5-CHE-101	Chemistry-I	4	3	1	3	0	2	5	25	5	50	20	100	3	2
MCC-2	Scheme C	26L4.5-CHE-102	Physical Chemistry-I	4	3	1	3	0	2	5	25	5	50	20	100	3	2
*CC-M1	Scheme A, B & D	26L4.5-CHE-103	Minor Chemistry-I	2	2	0	2	0	0	2	15	0	35	0	50	2	0
CC-M1	Scheme C	From Available CC-1/MCC-1 of 4 credits as per NEP															
MDC 1	Scheme A, B & C	From Available pool of Multidisciplinary Courses from a subject of different discipline as per NEP.															
AEC-1	A, B & C	From Available pool of Ability Enhancement Courses as per NEP															
SEC-1	A, B & C	From Available pool of Skill Enhancement Courses as per NEP															
VAC-1	A, B & C	From Available pool of Value Added Courses as per NEP															

Part A – Introduction			
Name of Programme	Chemistry		
Semester	I		
Nature of Course/Course Composition	Theory+ Practical		
Nomenclature of the Course	Chemistry-I		
Course Code	26L4.5-CHE-101		
Course Type	CC/MCC		
Course Level	100-199		
Pre-requisite for the course (if any)	4.0		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO₁: Understand the fundamental principles of quantum mechanics, atomic structure, periodic properties and their applications in explaining the electronic structure and properties of elements. CLO₂: Explain the behavior of gases, liquids and real gases under different conditions of temperature and pressure, and describe critical phenomena and related physical properties of matter. CLO₃: Interpret the concepts of chemical bonding, organic reaction mechanisms, reactive intermediates, and the structural characteristics of crystalline solids. CLO₄ (Practical): *Develop laboratory skills in the preparation of solutions and compounds, volumetric estimations, and determination of physical properties of chemical substances.		
	Theory	Practical	Total
Credits	3	1	4
Teaching Hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B – Contents of the Course			
<u>Instructions for Paper- Setter:</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
Unit	Topics	CLO/s Attempt	Contact Hours
I	Atomic Structure: Dual behaviour of matter and radiation, de Broglie relation, Heisenberg uncertainty principle, concept of atomic orbitals, significance of quantum numbers, radial and angular wave	CLO ₁	15

	functions, normal and orthogonal wave functions, significance of Ψ and Ψ^2, shapes of s, p, d and f orbitals, rules for filling electrons in various orbitals, effective nuclear charge and Slater's rules. Periodic Table and Atomic Properties: Classification of periodic table, atomic and ionic radii, ionization energy, electron affinity and electronegativity, periodic trends in s- and p-block elements, Pauling, Mulliken, Allred-Rochow and Mulliken-Jaffe electronegativity scales, Sanderson's electron density ratio.		
II	Gaseous State Kinetic theory of gases, Maxwell's distribution of velocities and energies (derivation excluded), root mean square velocity, average velocity and most probable velocity, collision diameter, collision number, collision frequency and mean free path (derivations excluded), deviation of real gases from ideal behaviour, Van der Waals equation of state, Boyle temperature and compression factor. Critical Phenomena: Critical temperature, critical pressure, critical volume and relationship between critical constants and Van der Waals constants (derivation excluded). Liquid State: Structure of liquids, surface tension, viscosity, refractive index, vapour pressure and optical rotation.	CLO ₂	15
III	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, hemolytic and heterolytic bond fission. Types of reagents: electrophiles and nucleophiles. Types of organic reactions: Substitution, Addition, Condensation, Elimination, Rearrangement, Isomerization and Pericyclic reactions. Reactive intermediates: Carbocations, carbanions, free radicals, carbenes (structure & stability).	CLO ₃	15
IV	Acid/Base titration: Determination of strength of oxalic acid using NaOH. Redox titrations: Determination of Fe²⁺ ions using KMnO₄. - To determine the surface tension of given liquid using Stalagmometer by drop number methods. - Preparation of m-Dinitrobenzene from Nitrobenzene (use 1:2 conc. HNO₃-H₂SO₄ mixture if fuming HNO₃ is not available). - Preparation of p-Bromoacetanilide from Acetanilide.	CLO ₄	30
	Total Contact hours		60

Evaluation Methods					
Internal Assessment	TH-25	PR-05	End Term Examination : 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/ assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva- voce/Lab records etc.:	NA	05	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10

Part C – Learning Resources

Recommended Books/e-resources/LMS:

1. Lee, J.D.; (2010), **Concise Inorganic Chemistry**, Wiley India.
2. Kapoor, K.L. (2015), **A Text book of Physical Chemistry**, Vol 1, 6th Edition, McGraw Hill Education.
3. Clayden, J.; Greeves, N.; Warren, S.(2012), **Organic Chemistry**, Oxford.
4. Morrison, R. N.; Boyd, R. N. **Organic Chemistry**, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Khosla, B. D.; Garg, V. C.; Gulati, A. (2015), **Senior Practical Physical Chemistry**, R. Chand & Co, New Delhi.
6. Jeffery, G. H.; Bassett, J.; Mendham, J.; Denney, R. C. (1989), **Vogel's Text book of Quantitative Chemical Analysis**, John Wiley and Sons.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	3	2	-	1	-	1	2	2	3	1	-
CLO ₂	3	2	-	1	-	1	2	3	2	1	-
CLO ₃	3	2	1	1	1	1	2	3	3	1	2
CLO ₄	2	2	2	2	2	3	3	3	2	3	3

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	8
Entrepreneurship	2
Skill Enhancement	20
Communication Development	4
Indian Knowledge System	2
Environmental Awareness/SDGs	4
Current Issues and Social Awareness	4
Gender issues	0
Public policies	0
Any Other	16

Part A – Introduction			
Name of Programme	Chemistry		
Semester	I		
Nature of Course/Course Composition	Theory + Practical		
Nomenclature of the Course	Physical Chemistry		
Course Code	26L4.5-CHE-102		
Course Type	MCC		
Course Level	4.0		
Pre-requisite for the course (if any)	100-199		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ : Explain chemical kinetics, rate laws and reaction mechanisms. CLO ₂ : Apply thermodynamic laws and functions to physical and chemical processes. CLO ₃ : Interpret optical, electrical and magnetic properties of molecules and correlate them with structure. CLO ₄ : Develop laboratory skills in volumetric analysis, surface tension measurements and purification		
	Theory	Practical	Total
Credits	3	1	4
Teaching Hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B – Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s	Contact Hours
Unit-I	Chemical Kinetics: Rate of reaction, rate equation and its types, factors affecting reaction rate, order and molecularity of reaction, integrated rate equations for zero, first, second and third order reactions (equal and unequal concentrations), methods of determination of order, half-life period, Arrhenius equation and temperature dependence of reaction rates. Theories of Reaction Rates: Simple collision theory for	CLO ₁	15

	unimolecular reactions and transition state theory for bimolecular reactions.				
Unit-II	Thermodynamics: System, surroundings, intensive and extensive properties, state and path functions, thermodynamic processes, thermodynamic equilibrium, heat and work, first law of thermodynamics, internal energy and enthalpy, heat capacities at constant pressure and volume and their relationship. Joule–Thomson coefficient for ideal and real gases, inversion temperature, calculation of w, q, ΔU and ΔH for isothermal and adiabatic reversible expansion of ideal gases.	CLO ₂	15		
Unit-III	Physical Properties and Molecular Structure: Optical activity, polarization (Clausius–Mossotti equation – derivation excluded), orientation of dipoles in electric field, dipole moment, induced dipole moment, measurement of dipole moment (temperature and refractivity methods), dipole moment and molecular structure. Magnetic permeability, magnetic susceptibility and its determination, applications of magnetic susceptibility, paramagnetism, diamagnetism and ferromagnetism.	CLO ₃	15		
Practical	1. Determination of strength of HCl using standard NaOH solution. 2. Determination of C ₂ O ₄ ²⁻ ions using KMnO ₄ . 3. Determination of surface tension of a liquid using stalagmometer (drop weight method). 4. Study of the effect of surfactant on surface tension of water. 5. Study of sublimation of camphor and phthalic acid.	CLO ₄	30		
	ContactHours	75			
Evaluation Methods					
Internal Assessment	TH-25	PR-05	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	05	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C – Learning Resources					
Recommended Books/e-resources/LMS:					
1. Atkins, P.W.; Paula, J.de. (2014), Atkin’s Physical Chemistry Ed. , 10 th Edition, Oxford University Press.					
2. Ball, D.W. (2017), Physical Chemistry , 2 nd Edition, Cengage Learning, India.					
3. Castellan, G.W. (2004), Physical Chemistry , 4 th Edition, Narosa.					
4. Kapoor, K.L. (2015), A Text book of Physical Chemistry , Vol 1, 6 th Edition, McGraw Hill Education.					
5. Khosla, B.D.; Garg, V.C.; Gulati, A. (2015), Senior Practical Physical Chemistry , R. Chand & Co, New Delhi.					
6. Garland, C.W.; Nibler, J.W.; Shoemaker, D.P. (2003), Experiments in Physical Chemistry , 8 th Edition, McGraw-Hill, New York.					

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	3	2	1	1	-	1	3	3	2	1	-
CLO ₂	3	2	1	1	1	1	3	3	3	2	1
CLO ₃	3	2	1	1	-	1	2	2	3	3	1
CLO ₄	2	2	2	2	2	3	3	3	2	3	3

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	12
Entrepreneurship	2
Skill Enhancement	24
Communication Development	4
Indian Knowledge System	2
Environmental Awareness/SDGs	5
Current Issues and Social Awareness	4
Gender issues	0
Public policies	0
Any Other	22

Part A – Introduction			
Name of Programme	Chemistry		
Semester	I		
Nature of Course/Course Composition	Theory		
Nomenclature of the Course	Minor Chemistry-I		
Course Code	26L4.5-CHE-103		
Course Type	CC-M		
Course Level	100-199		
Pre-requisite for the course (if any)	4.0		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO₁: Explain the fundamental concepts of chemical bonding, molecular geometry, molecular orbital theory, dipole moment, chemical kinetics, and factors affecting reaction rates. CLO₂: Describe the nomenclature, preparation, properties, and reactions of alkanes, and explain the basic concepts of metallic bonding, conductors, semiconductors, and insulators.		
	Theory	Practical	Total
Credits	2	0	2
Teaching Hours per week	2	0	2
Internal Assessment Marks	15	0	15
End Term Exam Marks	35	0	35
Max. Marks	50	0	50
Examination Duration (in Hours)	02	0	
Part B – Contents of the Course			
<u>Instructions for Paper- Setter:</u>			
The paper setter shall prepare 5 questions selecting two questions from each of the two units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 07 short answer type questions carrying one mark each (total 07 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 1 question from the each of the two units.			
Unit	Topics	CLO/s Attempt	Contact Hours
I	Chemical Bonding and Chemical Kinetics: Valence Bond Theory, VSEPR theory, hybridization and shapes of molecules (linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral), Molecular Orbital Theory of homonuclear (N₂, O₂) and heteronuclear (CO, NO) molecules, dipole moment and percentage ionic character. Chemical kinetics: concept of reaction rates, rate equation, factors affecting reaction rates, order and molecularity, integrated rate equations for zero, first and second order reactions (equal concentrations), half-life period.	CLO ₁	15
II	Alkanes and Metallic Bonding: Alkanes (up to five carbon atoms), nomenclature, classification of carbon atoms, isomerism, sources and methods of preparation (Wurtz, Kolbe, Corey–	CLO ₂	15

	House and decarboxylation reactions), physical properties, free radical halogenation, reactivity and selectivity. Metallic bond, valence bond and band theories, conductors, semiconductors and insulators, types and applications of semiconductors.		
	Total Contact hours	30	
Evaluation Methods			
Internal Assessment: 15 Marks		End Term Examination: 35 Marks	
• Class Participation:	5	Written Examination: 35	
• Seminar/presentation/assignment/quiz/ class test etc.:	5		
• Mid-Term Exam:	5		
Part C – Learning Resources			
Recommended Books/e-resources/LMS: Dhawan S. N., Organic Chemistry, Vol 1, Pardeep Publication.			

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	3	2	1	1	1	1	2	3	3	1	-
CLO ₂	3	2	1	2	1	1	2	2	2	2	1

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	5
Entrepreneurship	1
Skill Enhancement	8
Communication Development	2
Indian Knowledge System	1
Environmental Awareness/SDGs	3
Current Issues and Social Awareness	2
Gender issues	0
Public policies	0
Any Other	8

Part A – Introduction			
Name of Programme	Chemistry		
Semester	I		
Nature of Course/Course Composition	Theory + Practical		
Nomenclature of the Course	Introductory Chemistry-I		
Course Code	26L4.5-MDC-CHE-101		
Course Type	MDC		
Course Level	0-99		
Pre-requisite for the course (if any)	Higher secondary other than science discipline		
Course Learning Outcomes (CLOs ₁) After completing this course, the learner will be able to:	CLO₁: Explain the basic concepts of atomic structure, chemical bonding, carbon compounds, hydrocarbons, and their significance in everyday life. CLO₂: Describe the properties, applications, and societal importance of polymers, food preservatives, and food preservation techniques. CLO₃: Perform simple chemistry experiments related to pH determination, food preservation, artificial silk preparation, and polymer synthesis.		
	Theory	Practical	Total
Credits	2	1	3
Teaching hours per week	2	2	4
Internal Assessment Marks	15	05	20
End Term Exam Marks	35	20	55
Max. Marks	50	25	75
Examination Duration (in Hours)	02	02	
Part B – Contents of the Course			
Instructions for Theory Paper-Setter			
The paper setter shall prepare 5 questions selecting two questions from each of the two units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 7 short answer type questions carrying one mark each (total 07 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 1 question from the each of the two units.			
Instructions for Practical Examiner			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics		Contact Hours
Unit-I	Atomic Structure and Carbon Compounds: Introduction to atomic structure, representation of elements/atoms, Lewis structures, electronic configurations (1–30), elementary concept of chemical bonding. Carbon and its compounds: tetravalency of carbon, allotropes of carbon and their properties, hydrocarbons (1–5 carbon atoms), nomenclature of linear hydrocarbons and applications of hydrocarbons.	CLO ₁	15
Unit-II	Polymers and Food Preservatives: Introduction to natural	CLO ₂	15

	and synthetic polymers, homopolymers and copolymers, uses and properties of natural rubber, vulcanized rubber, polyethylene, PVC, polystyrene, Teflon, PAN and Nylon-66. Food preservatives: natural and synthetic preservatives, rancidity, food preservation methods (pickles, jam), artificial sweeteners, uses and properties.		
Practical Components	1. Identify the pH of the given samples through pH strip. 2. Experiments related to persevering food items. 3. Preparation of Artificial Silk. 4. To synthesize some polymers as per available resources.	CLO ₃	30
Total		60	

Evaluation Methods

Internal Assessment	TH-15	PR-5	End Term Examination: 55	TH-35	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	35	NA
Mid-Term Exam:	5	NA	Write-up and execution of the practical	NA	10

Part C – Learning Resources

Recommended Books/e-resources/LMS:

1. Dhawan S.N., Organic Chemistry, Vol 1, Pardeep Publication.
2. Subbulakshmi G, Food processing and preservation, New Age International Publishers.
3. Manas Chanda, 2013, Introduction to Polymer Science and Chemistry 2nd Edition,
4. Making Rayon Fiber - Artificial silk, chemical experiment, How to make silk from cotton wool (Artificial silk " experiment)
5. Neelam Seedher, 2021, Basic Concepts: Physical Chemistry Experiments, Kindley Edition

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	3	2	1	2	1	1	1	2	2	1	-
CLO ₂	3	2	1	3	1	2	1	2	2	1	1
CLO ₃	2	2	2	2	2	3	3	2	2	3	2

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	8
Entrepreneurship	3
Skill Enhancement	18
Communication Development	4
Indian Knowledge System	2
Environmental Awareness/SDGs	6
Current Issues and Social	4

Awareness	
Gender issues	0
Public policies	1
Any Other	14