

SYLLABI AND SCHEME OF EXAMINATIONS FOR

(MULTIDISCIPLINARY COURSE FOR UNDER GRADUATE PROGRAMS
OFFERED BY THE DEPARTMENT OF CHEMISTRY)

B.Sc. (Life Sciences/Physical Sciences) with Hons. in Chemistry

(Based on Curriculum and Credit Framework for UG Programs under NEP)



WITH EFFECT FROM
THE
SESSION 2024-25

MAHARSHI DAYANAND UNIVERSITY
ROHTAK (HARYANA)

SCHEME OF EXAMINATIONS FOR MULTIDISCIPLINARY COURSE OFFERED BY THE DEPARTMENT OF CHEMISTRY

B.Sc. (Life Sciences/Physical Sciences Program)

Name of the Department	Nomenclature of Multidisciplinary Course (MDC) @ 3 credits	Course Code	Credits Distribution			Total Credits	Workload			Total Workload	Marks				Total Marks
			L	T	P		L	T	P		Theory		Practical		
											Internal	External	Internal	External	
Semester I (Session 2024-25)															
Chemistry	MDCI-Basics of Chemistry	24CHEX01MD01	2	0	0	03	2	0	0	04	15	35	---	---	75
	MDC Chemistry Practical-I		0	0	1		0	0	2		---	---	05	20	
Semester II (Session 2024-25)															
Chemistry	MDCII-Essentials of Chemistry	24CHEX02MD01	2	0	0	03	2	0	0	04	15	35	---	---	75
	MDC Chemistry Practical-II		0	0	1		0	0	2		---	---	05	20	
Semester III (Session 2025-26)															
Chemistry	MDCIII-Core Chemistry	25CHEX03MD01	2	0	0	03	2	0	0	04	15	35	---	---	75
	MDC Chemistry Practical-III		0	0	1		0	0	2		---	---	05	20	

Note:

A student has to opt for three Life Sciences/Physical Sciences Courses in first three semester from the pool of the courses offered in the disciplines other than those of Major disciplines and Minor disciplines and the one not studied at 10+2 or equivalent level.

Syllabi for Multidisciplinary Course Offered by the Department of Chemistry

B.Sc. (Life Sciences/Physical Sciences Program)

Semester — I (Session: 2024- 25)

Name of Program	B.Sc. (Life Sciences/Physical Sciences)	Program Code	
Paper No.	MDC Paper – I	Nomenclature	Basics of Chemistry
Name of the Course	Multidisciplinary Course	Course Code	24CHEX01MD01
Credits	02	Maximum Marks	50
Hours per Week	02	External Marks	35
Duration of Examination	02 Hrs.	Internal Marks	15
<p>Syllabus Objectives: The course aims to provide a foundational understanding of basic chemistry concepts such as Dalton's atomic theory, atomic structure, chemical reactions and states of matter. It is also infused with the atomic models, electronic configurations and laws governing gases, liquids, and solids. Additionally, it explores practical applications of chemistry in everyday life, including the classification of drugs, food additives and cleansing agents like soaps and detergents.</p>			
<p><i>Note: Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing seven short answer type questions covering the entire syllabus. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each unit. All questions will carry equal marks.</i></p>			
<p>Course Learning Outcomes (CLO): By the end of the course, the students will be able to: CLO1: Understand the fundamental principles of chemistry and classification of matter. CLO2: Demonstrate proficiency in molecular mass calculations and the mole concept for quantifying substances. CLO3: Analyse atomic structure, quantum numbers and the stability of orbitals. CLO4: Apply the knowledge of states of matter and characteristics of liquids and solids. CLO5: Know about drugs, food adulterants and preservatives.</p>			
Unit–I			
Basic Concepts of Chemistry			
Introduction, Dalton atomic theory, concept of atom, element and molecule, matter and its classification, chemical reactions, empirical and molecular formula, atomic mass, molecular mass, mole concept, ways of expressing concentration of solutions (molarity, normality, molality, mole fraction, strength).			
Unit–II			
Atomic Structure			
Thomson's model, Rutherford's model, Bohr's model, electron, proton, neutron and their characteristics, atomic number, atomic mass, isotopes, isobars and isotones, dual nature of matter and light, de Broglie's relationship, Heisenberg Uncertainty principle, concept of orbit and orbital, quantum numbers, shapes of s, p and d orbitals, rules for filling electrons in the orbitals (Aufbau principle, Pauli exclusion principle and Hund's rule), electronic configuration of atoms, extra stability of half-filled and completely filled orbitals.			

Unit-III

States of Matter

Introduction to the three states of matter and intermolecular interactions. Gaseous state: Boyle's law, Charles' law, Gay Lussac's law and Avogadro's Law with practical implications. Elementary idea of kinetic energy, molecular speeds, ideal gas equation and deviation from ideal behavior.

Liquid state: Melting and boiling points, vapor pressure, viscosity and surface tension.

Solid state: General characteristics of solid state, crystalline and amorphous solids, classification of crystalline solids.

Unit-IV

Chemistry in Everyday Life

Drugs and their classification with suitable examples, food adulterants and preservatives, artificial sweetening agents, antioxidants, soaps and detergents and their cleansing action.

Books Recommended/References:

1. Text Books of N.C.E.R.T for 11th and 12th class.
2. Principles of Physical Chemistry by M. S. Pathania, B. R. Puri and L. R. Sharma.
3. Advanced Physical Chemistry by G. Raj.
4. Chemistry in Everyday Life by R. Tyagi.
5. A Textbook of Organic Chemistry by B. S. Bahl and A. Bahl.
6. Chemistry in Everyday Life by O. P. Agarwal.

Name of Program	B.Sc. (Life Sciences/Physical Sciences)	Program Code	
Paper No.	MDC Paper – I	Nomenclature	MDC Chemistry Practical – I
Name of the Course	Multidisciplinary Course	Course Code	24CHEX01MD01
Credits	01	Maximum Marks	25
Hours per Week	02	External Marks	20
Duration of Examination	02 Hrs.	Internal Marks	05

Syllabus Objectives: This course aims to provide a fundamental knowledge of calibration and use of apparatus, preparation of solution of titrants of different molarity/normality, acidity and basicity. It further develops a clear understanding of pH and its determination. Students will gain a comprehensive understanding of the fundamental principles of distillation. This course also provides an overview of the purification of organic compounds and the criteria of purity.

Note: Examiner will set two experiments for practical examinations.

(7×2) Marks

Course Learning Outcomes (CLO): By the end of the course, the students will be able to:

- CLO1:** Prepare different types of solution.
CLO2: Calibrate and use the apparatus properly.
CLO1: Determine the pH, acidity and basicity of water samples.
CLO2: Analyse the pH of soil samples.
CLO3: Learn lime water test.
CLO4: Check adulteration in different food materials.
CLO5: Purify impure sample of water by using simple distillation.

List of Experiments	
1. Titrimetric analysis: a) Calibration and use of apparatus. b) Preparation of solution of different molarity/normality. 2. To check acidity, alkalinity and pH of water by litmus paper or pH strips. 3. To determine pH of soil. 4. Lime water test: for the detection of CO ₂ . 5. Checking the adulteration in given food materials (Milk, edible oil, sugar, turmeric and chilli powder). 6. To obtain pure water from impure water containing ink by simple distillation method.	
Viva-Voce	(03 Marks)
Note Book	(03 Marks)
Books Recommended/References:	
1. Laboratory Manual Chemistry of NCERT for class 11 th and 12 th . 2. Food Processing and Preservation by G. Subbulakshmi. 3. Basic Concepts: Physical Chemistry Experiments by N. Seedher. 4. B.Sc. Chemistry Practical by S. Goyal.	

Semester — II (Session: 2024- 25)

Name of Program	B.Sc. (Life Sciences/Physical Sciences)	Program Code	
Paper No.	MDC Paper – II	Nomenclature	Essentials of Chemistry
Name of the Course	Multidisciplinary Course	Course Code	24CHEX02MD01
Credits	02	Maximum Marks	50
Hours per Week	02	External Marks	35
Duration of Examination	02 Hrs.	Internal Marks	15
Syllabus Objectives: The course aims to provide a comprehensive understanding of classification of elements and periodic properties, emphasizing on the importance of the periodic table and periodic trends. Additionally, it covers the utility of hydrocarbons in daily life, including their nomenclature, structure and use as fuels. Furthermore, the course includes polymers, their classification, synthesis methods and environmental implications, including strategies for pollution control.			
<i>Note: Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing seven short answer type questions covering the entire syllabus. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each unit. All questions will carry equal marks.</i>			
Course Learning Outcomes (CLO): By the end of the course, the students will be able to: CLO1: Understand the periodic law and periodic properties. CLO2: Know the classification and properties of different hydrocarbons. CLO3: Understand the preparation and uses of polymers. CLO4: Know about causes and effects of environmental pollution.			

Unit-I
Classification of Elements and Periodic Properties Importance of classification of elements, overview and history of periodic system, modern periodic law and periodic table, periodic properties of elements, atomic and ionic size, ionization energy, electron affinity and electronegativity.
Unit-II
Hydrocarbons and their Utility in Daily Life Introduction of hydrocarbons, classification of hydrocarbons, types of hydrocarbons (aliphatic and aromatic hydrocarbons). Nomenclature, structure, physical properties of alkanes, alkenes and alkynes and their uses in everyday life. Aromatic hydrocarbons- Nomenclature, structure of benzene, resonance and aromaticity. Combustion and pyrolysis, hydrocarbon as fuels (natural gas, petrol, LPG, kerosene, diesel and CNG.)
Unit-III
Polymer Introduction to polymers, classification of polymers, natural and synthetic polymers, biodegradable and non-biodegradable polymers, methods of polymerization (addition and condensation polymers), preparation and use of polythene, nylon, PVC, teflon and bakelite.
Unit-IV
Environmental Chemistry Causes and effects of air, water and soil pollution, greenhouse effect and global warming, smog formation, acid rain, depletion of ozone layer, pollution due to industrial waste, strategies to control environmental pollution.
Books Recommended/References:
<ol style="list-style-type: none"> 1. Text Books of N.C.E.R.T for 11th and 12th class. 2. Textbook of Inorganic Chemistry by O.P. Tandon. 3. Organic Chemistry by M. S. Chouhan. 4. Polymer Science by V. R. Gowariker, N. V. Viswanathan and J. Sreedhar. 5. Environmental Chemistry by B. K. Sharma and M. Sharma.

Name of Program	B.Sc. (Life Sciences/Physical Sciences)	Program Code	
Paper No.	MDC Paper – II	Nomenclature	MDC Chemistry Practical – II
Name of the Course	Multidisciplinary Course	Course Code	24CHEX02MD01
Credits	01	Maximum Marks	25
Hours per Week	02	External Marks	20
Duration of Examination	02 Hrs.	Internal Marks	05
Syllabus Objectives: This course provides the understanding of pH measurement. Students will be able to understand the chemistry behind the suspected bribery case. It further helps students to prepare hand sanitizer and shampoo. Students will be able to determine acid value of oils and fats. Also able to determine chloride in water sample.			
Note: Examiner will set two experiments for practical examinations.			(7×2) Marks

Course Learning Outcomes (CLO): By the end of the course, the students will be able to:	
CLO1: Determine the nature of some salt solutions and their pH values.	
CLO2: Understand chemistry of phenolphthalein used in suspected bribery case.	
CLO3: Prepare the hand sanitizer.	
CLO4: Determine R_f value of oils and fats.	
CLO5: Determine chloride in water sample by $AgNO_3$ method.	
CLO6: Determination of carbonates and bicarbonates in given solution.	
List of Experiments	
1. Determination of the pH and nature of solution of some salts using pH paper or universal indicator. (NH_4Cl , Na_2CO_3 , CH_3COONa , $NaCl$, unknown salt).	
2. Chemistry of phenolphthalein used in suspected bribery case: A forensic investigation.	
3. Preparation of hand sanitizer.	
4. Determination of retention factor (R_f value) of oils and fats.	
5. Determination of chloride in water sample by $AgNO_3$ method.	
6. Determination of carbonates and bicarbonates in given solution.	
Viva-Voce	(03 Marks)
Note Book	(03 Marks)
Books Recommended/References:	
1. Practical Chemistry by O. P. Pandey, D. N. Bajpai and S. Giri.	
2. Dissociation of phenolphthalein helps in solving Bribe Trap Case: Forensic approach by R. Verma and S. Manik.	
3. Hand Sanitizer, Easy Guide to Make Anti-Bacterial and Anti-Viral Homemade Hand Sanitizers by H. Miller.	
4. Practical Organic Chemistry – A Primer by V. Peesapati.	
5. Practical Organic Chemistry by A. K. Manna.	
6. Senior Practical Physical Chemistry by B. D. Khosla.	

Semester — III (Session: 2025- 26)

Name of Program	B.Sc. (Life Sciences/Physical Sciences)	Program Code	
Paper No.	MDC Paper – III	Nomenclature	Core Chemistry
Name of the Course	Multidisciplinary Course	Course Code	25CHEX03MD01
Credits	02	Maximum Marks	50
Hours per Week	02	External marks	35
Duration of Examination	02 Hrs.	Internal Marks	15

Syllabus Objectives: The course aims to elucidate the types of chemical bonding, including ionic, covalent, coordinate, hydrogen bonding and Van der Waals interactions. It covers valence electrons, hybridization, molecular shapes, VSEPR theory and molecular orbital theory. Additionally, it explores organic chemistry principles, corrosion mechanisms and biomolecules such as carbohydrates, proteins and nucleic acids, emphasizing their structures, functions and significance in biological processes.

Note: Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing seven short answer type questions covering the entire syllabus. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each unit. All questions will carry equal marks.

<p>Course Learning Outcomes (CLO): By the end of the course, the students will be able to:</p> <p>CLO1: Understand the types of chemical bonding.</p> <p>CLO2: Understand the basic principles of organic chemistry.</p> <p>CLO3: Know the causes and prevention of corrosion.</p> <p>CLO4: Know the types and functions of biomolecules.</p>
Unit-I
<p>Chemical Bonding</p> <p>Types of chemical bonding- ionic bond, covalent bond, coordinate bond, hydrogen bonding, Van der Waals interactions, Valence bond theory, concept of hybridization and shapes of simple molecules, VSEPR theory, Molecular orbital theory.</p>
Unit-II
<p>Basic Principles of Organic Chemistry</p> <p>Types of organic reactions, electrophiles and nucleophiles, homolytic and heterolytic fission of a covalent bond, inductive effect, electromeric effect and resonance effect.</p>
Unit-III
<p>Corrosion</p> <p>Introduction and causes of corrosion, types of corrosion, dry and wet corrosion, factors affecting corrosion, methods to prevent corrosion.</p>
Unit-IV
<p>Biomolecules</p> <p>Carbohydrates- Classification of carbohydrates, structure and importance of monosaccharides, importance of disaccharides and polysaccharides.</p> <p>Proteins- Amino acids, peptide linkage, primary, secondary, tertiary and quaternary structure of proteins, importance of proteins, denaturation of proteins.</p> <p>Nucleic Acids- Structure and function of DNA and RNA.</p>
<p>Books Recommended/References:</p> <ol style="list-style-type: none"> 1. NCERT Chemistry Textbook for class 11th and 12th. 2. Inorganic Chemistry by O. P. Tandon. 3. Organic Chemistry by M. S. Chouhan. 4. Corrosion and Corrosion Control Dr. R. K. Upadhyay. 5. Biochemistry by U. Satyanarayana and U. Chakrapani.

Name of Program	B.Sc. (Life Sciences/Physical Sciences)	Program Code	
Paper No.	MDC Paper – III	Nomenclature	MDC Chemistry Practical – III
Name of the Course	Multidisciplinary Course	Course Code	25CHEX03MD01
Credits	01	Maximum Marks	25
Hours per Week	02	External marks	20
Duration of Examination	02 Hrs.	Internal Marks	05
<p>Syllabus Objectives: The aim of this paper is to make the students learn about the purity of organic compounds. This course will also help the students to understand role of emulsifying agent in stabilizing the emulsion of an oil. It also encompasses the detection of alcohol and CO₂. It also includes the preparation of colloidal solution.</p>			

<i>Note: Examiner will set two experiments for practical examinations.</i>	(7×2) Marks
Course Learning Outcomes (CLO): By the end of the course, the students will be able to:	
CLO1: Check purity of organic compounds.	
CLO2: Understand role of emulsifying agent in stabilizing the emulsion of an oil.	
CLO3: Detect the alcohol by ester formation.	
CLO4: Prepare colloidal solution of starch and albumin each.	
CLO5: Determination of carbonates and bicarbonates in given solution.	
List of Experiments	
<ol style="list-style-type: none"> 1. To check the purity of compounds (determination of melting and boiling points). 2. Study of role of emulsifying agent in stabilizing the emulsion of an oil. 3. Alcohol detection test by ester formation (fruity smell). 4. Preparation of colloidal solution of starch and albumin each. 5. Determination of carbonates and bicarbonates in given solution. 	
Viva-Voce	(03 Marks)
Note Book	(03 Marks)
Books Recommended/References:	
<ol style="list-style-type: none"> 1. Basic Concepts: Physical Chemistry Experiments by N. Seedher. 2. Senior Practical Physical Chemistry by B. D. Khosla. 3. Practical Chemistry by O. P. Pandey, D. N. Bajpai and S. Giri. 4. Practical Organic Chemistry – A Primer by V. Peesapati. 5. Practical Organic Chemistry by A. K. Manna. 	