

MULTIDISCIPLINARY COURSE-CHEMISTRY

COURSE DETAILS:

Course Title	Introductory Chemistry-I
Semester	Semester-I
Course Code	MDC-1
Course ID	240/CHE/MD/101
Total Credits	03 (Lecture: 02, Tutorial: 0, Practical: 01)
Total Marks	75
Marks Distribution	Theory External: 35 Theory Internal: 15 Practical External: 20 Practical Internal: 05

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 4	
Lectures (L) Hours per Week: 2	Practical (P) Hours per Week: 2

COURSE OBJECTIVES:

- To build foundational knowledge in chemistry for students from various disciplines.
- Illustrate the relevance of chemistry in various fields and everyday life.
- Provide a foundational understanding of the contributions of renowned Indian scientists to the field of chemistry.
- Understand the physical properties of matter and key chemical compounds.
- Examine the significance of soil and fertilizers in agriculture.
- Foster an understanding of chemical nomenclature and the organization of the periodic table.
- Highlight the applications of chemistry in food preservation and the use of artificial sweeteners.

COURSE OUTCOMES:

- Students will gain an appreciation for the historical context and contributions of renowned Indian scientists to the global field of chemistry.
- Develop critical thinking and analytical skills by exploring the classification of matter and understanding atomic structure.
- Enhance knowledge of chemical nomenclature and the periodic table's organization.
- Understand the chemical properties of everyday compounds and their applications in various industries.

- Improve scientific literacy by exploring the role of chemistry in food preservation and the use of artificial sweeteners.

DETAILED CONTENT OF COURSE:

Theory Syllabus: Total Contact Hours: 30

Unit	Topics	Contact Hours
I	Renowned Indian Scientists: Brief Biography of Renowned Indian Scientists (Hargobind Khurana, Dr. P.C. Ray, Sir C.V. Raman, Dr. A.P.J. Abdul Kalam, C. N. R. Rao, Dr. Vikram Sara Bhai, Dr. Homi Jahangir Bhabha, Dr. J.C. Bose, Dr. S. N. Bose)	8
II	States of Matter: Classification of matter: elements, compounds, and mixtures, Physical and chemical properties, Atomic models, Structure of the atom: protons, neutrons, and electrons, Atomic number and mass number, some important compounds (baking soda, washing soda, plaster of Paris, gypsum, glass).	8
III	The Periodic Table: Periodic table, Organization of the periodic table, Groups and periods, classification of elements, physical and chemical aspects of metals and non-metals, Ore and Minerals of Iron, Copper, Aluminium, alloys	7
IV	Food Preservatives: Elementary idea of natural and synthetic food preservatives, rancidity, uses and properties, different food preservation processes (pickle, Jam), artificial sweeteners, uses and properties	7
V	Practicals: 1. Chemical reactions of metals and non-metals with acids and bases 2. To measure the acid value of oil samples as an indicator of rancidity 3. To prepare Plaster of Paris 4. To prepare Potash Alum 5. To study the effect of acid on Baking and washing soda 6. Thermal decomposition of baking soda 7. To perform the action of water on quick lime and identify the nature of reaction (Exo/Endothermic)	30

COURSE EVALUATION METHODS

Theory Exams:

Total Marks: 50 (External: 35 + Internal: 15)

Internal Assessment: 15 Marks	• Class Participation: NIL • Seminar/Presentation/ Assignment: 05 Marks • Mid Term Exam: 10 Marks
External Assessment: 35 Marks (03 Hours)	• End Term Exam: 35 Marks

Practical Exam:**Total Marks: 25 (External: 20 + Internal: 5)**

Internal Assessment: 05 Marks	• Class Participation: NIL • Seminar/Lab record/Demonstration: 05 Marks
External Assessment: 20 Marks (03 Hours)	• End Term Practical Exam: 10 Marks • Lab record: 05 Marks • Viva Voce: 05 Marks

Instruction for End-Term Theory Exam:

The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-1 will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks. Log table and non-programmable calculator is allowed.

RECOMMENDED BOOKS

1. Chemistry In Daily Life: Third Edition by Kirpal Singh, PHI Learning
2. The Great Indian Scientists Paperback – 1 January 2017, Cengage Learning India
3. "Comprehensive Practical Chemistry for Class 12" by V.K. Ahluwalia, Sunita Dhingra, and Adarsh Gulati
4. NCERT Chemistry Textbook for class 11th and 12th.
5. Laboratory Manual Chemistry of NCERT for class 11th and 12th.
6. Principles of Physical Chemistry by M. S. Pathania, B. R. Puri and L. R. Sharma.

MDC Course
(To be effective from Session 2026-27)

Course Title	Knowledge of Rasayan-I	
Semester	Semester-I	
Course Code	MDC -I	
Course ID	260/CHE/MD102	
Total Credits	03 (Lecture: 02, Tutorial: 0, Practical: 01)	
Total Marks	75	
Marks Distribution	Theory External: 35	Theory Internal: 15
	Practical External: 20	Practical Internal: 05

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 4	
Lectures (L) Hours per Week: 2	Practicals (P) Hours per Week: 2

COURSE OBJECTIVES:

- Learn about the blocks, columns, periods of periodic table and variations in properties along them.
- Understand the atomic structure and subatomic particles.
- Learn about the different shapes of orbitals and rules for filling of electrons in different orbitals.
- Explore the different types of chemical bonding and their effects on properties of chemical compounds
- Enhance the knowledge of essential elements for life and about the basics of Physical Chemistry.

COURSE OUTCOMES:

- Students will learn the periodic table and trends of different properties along periods and columns.
- Students will understand the structure of atoms and their sub-atomic particles.
- Students will gain knowledge about shapes of orbitals and different rules of electron filling.
- Students will have idea to recognize the different types of chemical bonds and their effects on properties of compounds.
- Students will have understanding of essential Inorganic elements and also basics of Physical Chemistry.

DETAILED CONTENT OF COURSE:



Theory Syllabus: Total Contact Hours: 30

Unit	Topics	Contact Hours
I	Periodic properties: Significance of periods and groups. Introduction of s, p, d and f blocks. Study of different periodic trends: Atomic radii, ionisation energy, electron affinity, electronegativity, oxidation state. Elementary introduction of atomic structure. Quantum numbers, shapes of orbitals (s,p,d,f) and electron filling rules.	8
II	Chemical bonding: Definition, types of chemical bonds: Ionic bond, Covalent bond, Coordinate bond, Metallic bond, Hydrogen bond and types, Vander Waals interactions.	7
III	Everyday Inorganic compounds: Study of essential elements to life Carbon (C), Hydrogen (H), Nitrogen (N), Oxygen (O), Phosphorus (P), Sulfur (S). Importance of water (H ₂ O), table salt (NaCl), baking soda (NaHCO ₃), cleaning agent like ammonia (NH ₃), CaCO ₃ , gypsum, plaster of Paris.	8
IV	General of Physical Chemistry: States of matter: Solid (Crystalline and Amorphous), liquid (Polar and non-polar), gas (Ideal and non-ideal) (physical properties only), definition of different types of concentrations: molarity, molality, mole fraction, normality. Introduction of electrolytes and their types.	7
V	Practicals 1. To prepare 1 molar and 1 normal standard solutions of NaCl/ Na ₂ CO ₃ . 2. To prepare a sample of calcium carbonate by double displacement reaction of CaCl ₂ and Na ₂ CO ₃ . 3. To demonstrate Hydrogen bonding between filter paper and water vs alcohol through paper chromatography of ink. 4. To study simple tests (wet paper tearing) to see Hydrogen bonding interact with solid structure like Cellulose. 5. To study the conversion of gypsum into Plaster of Paris and hardening of POP. 6. To study the process of sublimation of Camphor and Phthalic acid.	30

COURSE EVALUATION METHODS

Theory Exams:

Total Marks: 50 (External: 35 + Internal: 15)

Internal Assessment: 15 Marks	• Class Participation: 05 Marks • Seminar/Presentation/ Assignment: 05 Marks • Mid Term Exam: 05 Marks
External Assessment: 35 Marks (02 Hours)	• End Term Exam: 35 Marks

Practical Exam:

Total Marks: 25 (External: 20 + Internal: 5)

Internal Assessment: 05 Marks	• Class Participation: 2.5 Marks • Seminar/Lab record/Demonstration: 2.5 Marks
External Assessment: 20 Marks (03 Hours)	• End Term Practical Exam: 10 Marks • Lab record: 05 Marks • Viva Voce: 05 Marks

Instruction for End Term Theory Exam:

The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-1 will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks.

RECOMMENDED BOOKS

1. Johnson, W.R.; (2007), **Atomic Structure Theory**, (1st ed.)Springer.
2. Kumar, A.; Rathore, V.S.; Chauhan, S.; (2024), **Atomic Structure & Bonding**, S. Dinesh & Co.
3. Greenwood, N.N.; Earnshaw, A.; (1997), **Chemistry of the Elements**, (2nd ed.) Elsevier.



4. Sharma, R.K.; (2007), **Chemistry of Chemical Bonding**, (1st ed.) Discovery Publishing House.
5. Kumar, J.; Sethi, S.; Shewate, V.T.; Mohan, V.; (2025), **Inorganic Chemistry: Structure, Bonding and Applications**, A.G. Publishing house.
6. Huheey, J.E.; Keiter, E.A.; Keiter, R.L.; Medhi, O.K.; (2022) **Inorganic Chemistry: Principles of Structure and Reactivity**, (4th ed.) Pearson Education.
7. Atkins, P.; Paula, J.D.; Keeler, J.; (2018), **Atkins Physical Chemistry**, (11th ed.) Oxford University Press.
8. Puri, B.R.; Sharma, L.R.; Pathania, M.S.; (2024), **Principles of Physical Chemistry**, Vishal Publishing Co.



MDC Course
(To be Effective from Session 2026-27)

Course Title	Chemistry for Competitive Exams- I	
Semester	Semester-I	
Course Code	MDC-I	
Course ID	260/CHE/MD103	
Total Credits	03 (Lecture: 02, Tutorial: 0, Practical: 01)	
Total Marks	75	
Marks Distribution	Theory External: 35 Practical External: 20	Theory Internal: 15 Practical Internal: 05

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 4	
Lectures (L) Hours per Week: 2	Practicals (P) Hours per Week: 2

COURSE OBJECTIVES:

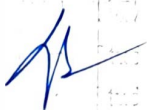
- Understand the atomic structure and subatomic particles.
- Explore trends in periodic table using different properties.
- Explore different types of chemical bonding and their effects on properties of chemical compounds.
- Learn about acids, bases, and the importance of pH in biological and industrial processes.
- Enhance practical laboratory skills through hands-on experiments.

COURSE OUTCOMES:

- Students will understand the structure of atoms and their sub-atomic particles.
- Students will get knowledge about the periodic table and different properties of elements.
- Students will have idea to recognize the different types of chemical bonds and their effects on properties of compounds.
- Learn about the importance of acids, bases, and pH in various biological and industrial processes.
- Personal experience of students will rise by doing experiments with their own hands.

DETAILED CONTENT OF COURSE:

Theory Syllabus: Total Contact Hours: 30



Unit	Topics	Contact Hours
I	Atomic structure: Elementary introduction of atomic structure, subatomic particles (electron, proton, neutron), Historical atomic models: Thomson's model, Rutherford model, Bohr's model, Quantum numbers, shapes of orbitals (s,p,d,f), electron filling rules. Isotopes, Isobars and Isotones (definitions).	8
II	Periodic properties and laws: Periodic table. Introduction of s, p, d and f blocks, periodic trends and properties: atomic and ionic radii, ionisation energy, electron gain enthalpy, electronegativity, oxidation state, colour, metallic character, magnetic and catalytic properties, ability to form complexes.	8
III	Chemical bonding: Definition, types of chemical bonds: Ionic bond, Covalent bond, Coordinate bond, Metallic bond, Hydrogen bond and types, Vander Waals' interactions Factors affecting the bonding, Comparison between covalent and ionic bond.	7
IV	Acids and Bases: Definition, types and properties of acids and bases. Different theories: Arrhenius theory, Bronsted-Lowry concept, Lewis theory. Concept of pH, Common daily life examples.	7
V	Practicals - Determine the nature of common household substances (e.g., vinegar, baking soda solution, lemon juice, milk, soap solution) whether acidic or alkaline using different indicators/ pH paper. - To study the neutralization reaction between a strong acid and a strong base through titration and determine the concentration of an acid solution. - Find the normality of an unknown HCl solution by titrating it against a 0.1 N NaOH solution. - Prepare 1 molar and 1 normal standard solution of NaCl/ Na₂CO₃. - To study the process of sublimation of camphor and phthalic acid. - To determine the pH of given acid and base using pH meter.	30

COURSE EVALUATION METHODS

Theory Exams:

Total Marks: 50 (External: 35 + Internal: 15)

Internal Assessment: 15 Marks	• Class Participation: 05 Marks • Seminar/Presentation/ Assignment: 05 Marks • Mid Term Exam: 05 Marks
External Assessment: 35 Marks (02 Hours)	• End Term Exam: 35 Marks

Practical Exam:

Total Marks: 25 (External: 20 + Internal: 5)

Internal Assessment: 05 Marks	• Class Participation: 2.5 Marks • Seminar/Lab record/Demonstration: 2.5 Marks
External Assessment: 20 Marks (03 Hours)	• End Term Practical Exam: 10 Marks • Lab record: 05 Marks • Viva Voce: 05 Marks

Instructions for End Term Theory Exam:

The Examiner is required to set nine questions in total, selecting two questions from each section. Question-I will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks.

RECOMMENDED BOOKS

1. Johnson, W.R.; (2007), **Atomic Structure Theory**, (1st ed.) Springer.
2. Kumar, A.; Rathore, V.S.; Chauhan, S.; (2024), **Atomic Structure & Bonding**, S. Dinesh & Co.
3. Greenwood, N.N.; Earnshaw, A.; (1997), **Chemistry of the Elements**, (2nd ed.) Elsevier.



4. Sharma, R.K.; (2007), **Chemistry of Chemical Bonding**, Discovery Publishing House.
5. Kumar, J.; Sethi, S.; Shewate, V.T.; Mohan, V.; (2025). **Inorganic Chemistry: Structure, Bonding and Applications**, A.G. Publishing house.
6. Lew, K.; (2008), **Acids and Bases**, (1st ed.) Chelsea House Publications.
7. Cox, B.G.; (2013). **Acids and Bases: Solvent Effects on Acid-Base Strength**, (1st ed.) Oxford University Press.
8. Huheey, J.E.; Keiter, E.A.; Keiter, R.L.; Medhi, O.K.; (2022) **Inorganic Chemistry: Principles of Structure and Reactivity**, (4th ed.) Pearson Education.



COURSE DETAILS:

Course Title	Introductory Chemistry-II
Semester	Semester-II
Course Code	MDC-2
Course ID	240/CHE/MD201
Total Credits	03 (Lecture: 02, Tutorial: 0, Practical: 01)
Total Marks	75
Marks Distribution	Theory External: 35 Theory Internal: 15 Practical External: 20 Practical Internal: 05

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 4	
Lectures (L) Hours per Week: 2	Practical (P) Hours per Week: 2

COURSE OBJECTIVES:

- Understand the principles of chemical bonding and molecular structure.
- Learn about hydrocarbons and their applications in everyday life.
- Gain insights into the properties and uses of natural and synthetic polymers.
- Explore environmental chemistry and the impact of human activities on the environment.

COURSE OUTCOMES:

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

- develop a comprehensive understanding of chemical bonding, including ionic, covalent, and hydrogen bonds, and their significance in molecular structures.
- Appreciate the diverse applications of hydrocarbons in daily life, from fuels to industrial chemicals.
- Gain insights into the world of polymers, their types, and their significance in everyday materials and products.
- Become more environmentally conscious, understanding the causes and effects of pollution and the importance of sustainable practices.

DETAILED CONTENT OF COURSE:

Theory Syllabus: Total Contact Hours: 30

Unit	Topics	Contact Hours
I	Chemical Bonding: Definition, Types of Chemical Bonds-Ionic Bond, Covalent Bond, coordinate bond, Hydrogen bonding and its types, Van der Waals's interactions Representation of elements/ atoms, Lewis	8

	structure, Electronic configurations (1-30)	
II	Hydrocarbons: Introduction, classification, types (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.)	8
III	Polymers: Introduction, elementary idea of synthetic and natural polymers, Homo polymers and copolymers, uses and properties (Natural rubber, Vulcanized rubber, Polyethene, PVC, Styrene, Teflon, PAN, Nylon-66)	7
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	7
V	Practicals: 1. Measure the conductivity of solutions of ionic compounds (e.g., NaCl, KCl) and covalent compounds (e.g., sugar, urea) using a conductivity meter 2. Test the solubility of compounds like NaCl, sugar and naphthalene in polar solvent (water) and organic solvents (e.g., ethanol, ether). 3. Identification of Aliphatic and aromatic organic compounds through flame test. 4. Identify the pH of the given water and Soil samples through pH strip. 5. Test for common pollutants (nitrates, phosphates) and water hardness in water samples to assess water quality. 6. Preparation of Artificial Silk. 7. To synthesize some polymers as per available resources.	30

COURSE EVALUATION METHODS

Theory Exams: Total Marks: 50 (External: 35 + Internal: 15)

Internal Assessment: 15 Marks	• Class Participation: NIL • Seminar/Presentation/ Assignment: 05 Marks • Mid Term Exam: 10 Marks
External Assessment: 35 Marks (02 Hours)	• End Term Exam: 35 Marks

Practical Exam: Total Marks: 25 (External: 20 + Internal: 5)

Internal Assessment: 05 Marks	• Class Participation: NIL • Seminar/Lab record/Demonstration: 05 Marks
External Assessment: 20 Marks (03 Hours)	• End Term Practical Exam: 10 Marks • Lab record: 05 Marks • Viva Voce: 05 Marks

Instruction for End Term Theory Exam:

The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-1 will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks. Log table and non-programmable calculator is allowed.

RECOMMENDED BOOKS

1. NCERT Chemistry Textbook for class 11th and 12th.
2. Laboratory Manual Chemistry of NCERT for class 11th and 12th.
3. Principles of Physical Chemistry by M. S. Pathania, B. R. Puri and L. R. Sharma
4. "Comprehensive Practical Chemistry for Class 12" by V.K. Ahluwalia, Sunita Dhingra, and Adarsh Gulati
5. Miller G.T., Environmental Science, 11th edition. Brooks/ Cole (2006).
6. Mishra, Environmental Studies, Selective and Scientific Books, New Delhi (2005)
7. De, A. K. Environmental Chemistry: New Age International Pvt., Ltd, New Delhi, 2010.
8. V. R. Gowarikar, Jayadev Sreedhar, N. V. Viswanathan, Polymer Science 1st Edition, New Age International Publishers, 1986.
9. Fred W. Billmeyer, Textbook of Polymer Science, 3rd ed. Wiley-Interscience (1984)

MDC Course
(To be effective from Session 2026-27)

Course Title	Knowledge of Rasayan-II	
Semester	Semester-II	
Course Code	MDC-2	
Course ID	260/CHE/MD202	
Total Credits	03 (Lecture: 02, Tutorial: 0, Practical: 01)	
Total Marks	75	
Marks Distribution	Theory External: 35	Theory Internal: 15
	Practical External: 20	Practical Internal: 05

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 4	
Lectures (L) Hours per Week: 2	Practicals (P) Hours per Week: 2

COURSE OBJECTIVES:

- Understand the chemical processes involved in food processing and preservation.
- Explore the types and side effects of adulteration of different foods in everyday life.
- Study about the different types of pollutions and their impact on human health.
- Enhance the knowledge of students about the soil factors, BOD and COD.
- Enhance the laboratory skills through observation and hands-on experiments.

COURSE OUTCOMES:

- Students will understand the different types of chemical processes involved in food processing and preservation.
- Students will come to know the different types and side effects of adulteration of foods in daily life.
- Knowledge about the different types of pollutions and their impact on human health and environment.
- Students will get knowledge about the different factors of soil, contamination of water, BOD and COD.
- Laboratory skills of the students will improve through the observations and hands-on experiments.

DETAILED CONTENT OF COURSE:



- Theory Syllabus: Total Contact Hours: 30

Unit	Topics	Contact Hours
I	Food processing and adulteration: Introduction of food processing, Food processing techniques (pasteurization, sterilization, blanching, freezing, drying and irradiation), definition and types of food adulteration, adulteration in common foods.	8
II	Food preservatives: Types: natural and synthetic preservatives, Properties of food preservatives, preservation process of pickles and jams, artificial sweeteners.	8
III	Environmental Chemistry: Cause and effects of air pollution, water pollution, soil pollution and industrial pollution, greenhouse effect and global warming.	7
IV	Factors of Chemical Science in Geographical Components: Acid mine drainage (AMD), cause, consequences and remedial solution, role of pH measurement in soil, Contamination factors of water: Biological oxygen demand (BOD), Chemical oxygen demand (COD).	7
V	Practicals 1. To purify the impure sample of benzoic acid by recrystallization. 2. To synthesize an ester by reacting a carboxylic acid with an alcohol in the presence of acid catalyst. 3. To prepare 1 molar and 1 normal standard solutions of NaCl. 4. To find the normality of an unknown HCl solution by titrating it against a 0.1 N NaOH solution. 5. To determine the BOD of given water sample. 6. Determine the dissolved oxygen in the given sample of water.	30

COURSE EVALUATION METHODS

Theory Exams:

Total Marks: 50 (External: 35 + Internal: 15)

Internal Assessment: 15 Marks	• Class Participation: 05 • Seminar/Presentation/ Assignment: 05 Marks • Mid Term Exam: 05 Marks
External Assessment: 35 Marks (02 Hours)	• End Term Exam: 35 Marks

Practical Exam:

Total Marks: 25 (External: 20 + Internal: 5)

Internal Assessment: 05 Marks	• Class Participation: 2.5 Marks • Seminar/Lab record/Demonstration: 2.5 Marks
External Assessment: 20 Marks (03 Hours)	• End Term Practical Exam: 10 Marks • Lab record: 05 Marks • Viva Voce: 05 Marks

Instruction for End Term Theory Exam:

The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-I will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks.

RECOMMENDED BOOKS

1. Sinha, S.P.; (2012), **Principles of Food Processing**, (1st ed.) Adhyayan Publishers and Distributors.
2. Sivasankar, B.; (2002), **Food Processing and Preservation**, (1st ed.) Prentice Hall India Learning Private Limited.
3. Ram, P.M.; Ram, V.R.; (2023), **Food Adulteration**, Lap Lambert Academic Publishing.
4. Sharma, G.K.; Xavier, J.R.; Singh, A.; (2024), **Food Adulterants and Contaminants**, New India Publishing Agency.
5. Subramanian, V.; (2020), **Environmental Chemistry**, Dreamtech Press.



6. Girard, J.; (2013), **Principles of Environmental Chemistry**, (2nd ed.) Jones & Bartlett Learning.

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MDC Course
(To be effective from Session 2026-27)

Course Title	Chemistry for Competitive Exams-II	
Semester	Semester-II	
Course Code	MDC-2	
Course ID	260/CHE/MD203	
Total Credits	03 (Lecture: 02, Tutorial: 0, Practical: 01)	
Total Marks	75	
Marks Distribution	Theory External: 35 Practical External: 20	Theory Internal: 15 Practical Internal: 05

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 4	
Lectures (L) Hours per Week: 2	Practicals (P) Hours per Week: 2

COURSE OBJECTIVES:

- Investigate the different types of states of matter and factors affecting.
- Learn about metals, non-metals, different types of alloys and their applications.
- Understand the basics of carbon compounds and oxygen containing functional groups.
- Learn about the different types of metallurgical process and corrosion.
- Enhance the knowledge about handling of chemicals, glass apparatus and instruments in labs through experiments.

COURSE OUTCOMES:

- Students will be able to describe the properties of solid, liquid and gases.
- Students will have knowledge of different metals, non-metals, alloys and their applications.
- Students will understand the basics of carbon compounds and important functional groups.
- Students will understand the process of extraction of metal and prevention of corrosion.
- Importance of safety and careful handling of chemicals, instruments in labs will be well understood.

DETAILED CONTENT OF COURSE:

Theory Syllabus: Total Contact Hours: 30



Unit	Topics	Contact Hours
I	States of matter: Introduction of different states of matter. Gas: Introduction to ideal and real gases. Difference between ideal and real gases. Introduction of different laws: Boyle's law, Charles' law, Gay Lussac's law, Avogadro's law (no derivations). Liquid: Introduction and effect of temperature and pressure on surface tension, viscosity, vapour pressure (no derivations), Polar and non-polar liquids. Solid: Types of solids: Amorphous solid and Crystalline solid (Brief description and differences).	8
II	Metals, non-metals and alloys: Definition and physical properties of metals, non-metals and alloys. Discuss different types of alloys and common examples (Steel, Stainless Steel, Brass, Bronze, Duralumin, Alnico).	7
III	Metallurgy and corrosion: General modes of occurrence of metals in nature, Extraction of metals- Crushing and grinding, Concentration of ores (gravity separation and froth flotation), Conversion to metal oxide (calcination and roasting), Reduction of metal oxide, Refining of metal (brief description) Corrosion: Definition, Cause of corrosion, Effect and factors of corrosion, Electrochemical mechanism of rusting of iron, Prevention of corrosion	8
IV	Carbon and its compounds: Introduction and types of hydrocarbons, study of carbon compounds and catenation, Introduction of important Oxygen containing functional groups: alcohol, aldehyde, ketone, carboxylic acid, ester, ether (only physical properties, exclude chemical properties).	7

V	Practicals 1. To synthesize an ester by reacting a carboxylic acid with an alcohol in the presence of acid catalyst. 2. To purify the impure sample of benzoic acid by recrystallization. 3. To detect the presence of starch in a sample (potato/rice/bread) by using a potassium iodide-iodine solution as an indicator. 4. To compare the viscosity of various liquids (honey, dish soap, milk, water) by pouring race method. 5. To observe the existence of surface tension and demonstrate how soap reduce it (By needle floating method). 6. To study the effect of air, moisture and electrolytes (NaCl) on rusting of iron.	30

COURSE EVALUATION METHODS

Theory Exams:

Total Marks: 50 (External: 35 + Internal: 15)

Internal Assessment: 15 Marks	• Class Participation: 05 Marks • Seminar/Presentation/ Assignment: 05 Marks • Mid Term Exam: 05 Marks
External Assessment: 35 Marks (02 Hours)	• End Term Exam: 35 Marks

Practical Exam:

Total Marks: 25 (External: 20 + Internal: 5)

Internal Assessment: 05 Marks	• Class Participation: 2.5 Marks • Seminar/Lab record/Demonstration: 2.5 Marks
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External Assessment: 20 Marks (03 Hours)	• End Term Practical Exam: 10 Marks • Lab record: 05 Marks • Viva Voce: 05 Marks
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Instructions for End Term Theory Exam:

The Examiner is required to set nine questions in total, selecting two questions from each section. Question-1 will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks.

RECOMMENDED BOOKS

1. Goodstein, D.L.; (2014), **States of Matter**, Dover Publications.
2. Powell, P.; Timms, P.L.; (1974), **The Chemistry of the Non-metals**, Chapman & Hall.
3. Walker, D.; (2007), **Metals and Non-metals (Core Chemistry)**, Evans Brothers Ltd.
4. Schweitzer, P.A.; (2009), **Fundamentals of Corrosion**, (2nd ed.) CRC Press.
5. Dieter, G.E.; (1986), **Mechanical Metallurgy**, (3rd ed.) McGraw-Hill.
6. Atkins, P.; Paula, J.D.; Keeler, J.; (2018), **Atkins Physical Chemistry**, (11th ed.) Oxford University Press.
7. Puri, B.R.; Sharma, L.R.; Pathania, M.S.; (2024), **Principles of Physical Chemistry**, Vishal Publishing Co.
8. Morrison, R.T.; Boyd, R.N.; (2010), **Organic Chemistry**, (7th ed.) Pearson Education.
9. Patai, S.; (2010), **Chemistry of Functional Groups**, Wiley Online Library.

MINOR COURSE-CHEMISTRY

COURSE DETAILS:

Course Title	GREEN CHEMISTRY	
Semester	Semester-1	
Course Code	MIC-1	
Course ID	240/CHE/MI/101	
Total Credits	02 (Lecture: 02, Tutorial: 0, Practical: 0)	
Total Marks	50	
Marks Distribution	Theory External: 35 Practical External: --	Theory Internal: 15 Practical Internal: --

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 2	
Lectures (L) Hours per Week: 2	Practical (P) Hours per Week: --

COURSE OBJECTIVES:

- Introduce students to the fundamentals and scope of Green Chemistry.
- Teach practical techniques and tools used in Green Chemistry
- To understand the concept of Sustainability through Green Chemistry
- To make student aware about the recent development in the field of Green Chemistry

COURSE OUTCOMES:

Upon completing this course, students will be able to:

- Understand the fundamentals of Green Chemistry.
- Apply the principles of Green Chemistry in sustainable chemical design.
- Recognize the role of Green Chemistry in sustainability.
- Utilize Green Chemistry techniques and tools.
- Explore future trends and research in Green Chemistry.

DETAILED CONTENT OF COURSE:

Theory Syllabus: Total Contact Hours: 30

Unit	Topics	Contact Hours
I	Introduction to Green Chemistry-I Overview of Green Chemistry: Definition and scope of green chemistry, History and evolution of green chemistry	8

	Principles of Green Chemistry (The 12 principles of green chemistry, Importance of each principle in sustainable chemical design).	
II	Introduction to Green Chemistry-II Sustainability in Chemistry [Concept of sustainability, Role of chemistry in achieving sustainable development goals (SDGs)]. Environmental Impact of Chemical Processes: Pollution and its sources, Life cycle assessment (LCA) of chemical products	8
III	Green Chemistry Techniques and Tools Green Synthesis Methods: Alternative solvents and reaction conditions, Use of renewable feedstocks; Catalysis in Green Chemistry: Types of catalysis (homogeneous, heterogeneous, biocatalysis), Benefits of using catalysts in reducing waste and energy consumption	7
IV	Future Trends and Research Emerging Technologies: Advances in green chemistry research and technology, Nanotechnology and its applications in green chemistry	7

COURSE EVALUATION METHODS

Theory Exams: Total Marks: 50 (External: 35 + Internal: 15)

Internal Assessment: 15 Marks	• Class Participation: NIL • Seminar/Presentation/ Assignment: 05 Marks • Mid Term Exam: 10 Marks
External Assessment: 35 Marks (03 Hours)	• End Term Exam: 35 Marks

Instruction for End Term Theory Exam:

The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-1 will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks. Log table and non-programmable calculator is allowed.

RECOMMENDED BOOKS

1. Anastas, P.T. & Warner, J.K. *Green Chemistry- Theory and Practical*, Oxford University Press (1998).
2. Matlack, A.S. *Introduction to Green Chemistry*, Marcel Dekker (2001).
3. Cann, M.C. & Connely, M.E. *Real-World cases in Green Chemistry*, American Chemical Society, Washington (2000).
4. Ryan, M.A. & Tinnesand, M. *Introduction to Green Chemistry*, American Chemical Society, Washington (2002).
5. Sharma, R.K.; Sidhwani, I.T. & Chaudhari, M.K. *Green Chemistry Experiments: A monograph* I.K. International Publishing House Pvt Ltd. New Delhi, Bangalore.
6. Lancaster, M. *Green Chemistry: An introductory text* RSC publishing, 2nd Edition.
7. Ahluwalia, V.K. & Kidwai, M.R. *New Trends in Green Chemistry*, Anamalaya Publishers (2005).

(Curriculum effective from Session 2026-27)

MINOR COURSE-CHEMISTRY

COURSE DETAILS:

Course Title	Molecules of Life – I
Semester	Semester-I
Course Code	MIC-I
Course ID	260/CHE/MI/102
Total Credits	02 (Lecture: 02, Tutorial: 0, Practical: 0)
Total Marks	50
Marks Distribution	Theory External: 35 Theory Internal: 15 Practical External: -- Practical Internal: --

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 2	
Lectures (L) Hours per Week: 02	Practical (P) Hours per Week: --

COURSE OBJECTIVES:

- To study the structure, classification, and chemical behavior of carbohydrates.
- To understand glycosidic linkages, stereochemistry, and structures of disaccharides, polysaccharides.
- To understand chemical nature of water, pH systems, buffers.
- To learn about the structure, classification, and properties of amino acids.
- To study peptide bond formation, methods of peptide synthesis, and structural organization of proteins.

COURSE OUTCOMES:

Upon completing this course, students will be able to:

- Classify carbohydrates, explain open chain and cyclic structures of important monosaccharides, and describe their reactions, interconversions, and qualitative tests.
- Explain α and β linkages and compare structures of sucrose, lactose, maltose, starch, and cellulose.
- Explain pH, pK_a , buffer action, and ionization of water.
- Classify amino acids and interpret zwitterion formation and isoelectric points.
- Describe peptide bond formation and determine terminal amino acids using analytical methods.

DETAILED CONTENT OF COURSE:



Theory Syllabus: Total Contact Hours: 30

Unit	Topics	Contact Hours
I	Carbohydrates – 1 Introduction and classification – monosaccharides, oligosaccharides and polysaccharides, aldose and ketose, reducing and non-reducing sugars. Open chain and cyclic structure of D (+)-glucose, D (–)-fructose, D-(+)-ribose and D-2-deoxyribose. Reactions of glucose and fructose with HCN, hydroxylamine and phenylhydrazine (osazone). Analytical tests for glucose – effect of heating, conc. H ₂ SO ₄ , Fehling's Test, Tollen's Test, Molisch's Test. Basic idea of epimers, anomers, and Erythro and Threo Diastereomer. Inter-conversion of glucose and fructose.	8
II	Carbohydrates – 2 Linkage between monosaccharides (α and β): D-L configuration of disaccharides (sucrose, maltose, lactose) and polysaccharides (starch and cellulose) including their structure. Water Structure of water, weak interactions in aqueous systems, water as biological solvents. Ionization of water, dissociation constant, concept of pH, pK _a and pK _b and buffer. Buffer action – acidic and basic.	7
III	Amino Acids Definition and Classification of amino acids – Acidic, basic and neutral; aliphatic and aromatic; and essential and non essential, zwitterion structure, isoelectric point and amphoteric nature of Amino acids. Peptide Introduction and basic formation of peptide. Determination of primary structure of peptides, determination of N-terminal amino acid (by Sanger's method) and C-terminal amino acid (with carboxypeptidase enzyme).	8
IV	Proteins Definition, classification of proteins based on molecular structure, hydrolysis product. Structure of proteins- peptide bond, primary, secondary, tertiary and quaternary structure of proteins, forces that determine folding and conformation and structural organization. Physical properties: denaturation and renaturation. Detection of Protein – Millon's test, Xantho protein test, Ninhydrin test, and Biuret test.	7

COURSE EVALUATION METHODS**Theory Exams: Total Marks: 50 (External: 35 + Internal: 15)**

Internal Assessment: 15 Marks	• Class Participation: 05 Marks • Seminar/ Presentation/ Assignment: 05 Marks • Mid Term Exam: 05 Marks
External Assessment: 35 Marks (02 Hours)	• End Term Exam: 35 Marks

Instructions for End Term Theory Exam:

The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-I will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks.

RECOMMENDED BOOKS

1. Morrison, R. N. and Boyd, R. N., *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Nelson, D. L., and Cox, M. M. (2021), *Lehninger Principles of Biochemistry* (8th ed.). W. H. Freeman and Company.
3. Satyanarayan, U. and Chakrapani, U. (2013), *Biochemistry* (4th ed.) Elsevier.
4. Sheela, K. et al. (2021), *Textbook of Biomolecules* (1st ed.) AIB Saliha Publications, Tamil Nadu.
5. Saini, G and Khanna, G. (2024), *Textbook of Chemistry of Biomolecules* (1st ed.) Prestige Publishers.



COURSE DETAILS:

Course Title	Bioinorganic Chemistry
Semester	Semester-2
Course Code	MIC-2
Course ID	240/CHE/MI201
Total Credits	02 (Lecture: 02, Tutorial: 0, Practical: 0)
Total Marks	50
Marks Distribution	Theory External: 35 Theory Internal: 15 Practical External: -- Practical Internal: --

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 2	
Lectures (L) Hours per Week: 2	Practical (P) Hours per Week: --

COURSE OBJECTIVES:

- To understand the definition, scope, and historical development of bioinorganic chemistry.
- To analyze the structure and function of various important proteins
- To comprehend the role and functioning of the sodium-potassium pump in biological systems.
- To investigate the applications of metals in medicine, including metal-based drugs and diagnostic agents.

COURSE OUTCOMES:

By the end of the course, students will have a comprehensive understanding of:

- The fundamental principles of bioinorganic chemistry.
- The roles of metal ions in biological systems.
- The structure and function of key bioinorganic molecules.
- The applications of bioinorganic chemistry in medicine.

DETAILED CONTENT OF COURSE:**Theory Syllabus: Total Contact Hours: 30**

Unit	Topics	Contact Hours
I	Fundamentals of Bioinorganic Chemistry Overview and History: Definition and scope of bioinorganic chemistry, Historical development and key discoveries. Biological Roles of Metal Ions: Essential and trace metal ions in biology; Coordination chemistry of metal ions in biological systems	8

II	Oxygen Transport and Storage Proteins Hemoglobin and Myoglobin: Structure and function of hemoglobin and myoglobin, Oxygen binding and transport mechanisms; Other Oxygen Carriers: Hemocyanin and hemerythrin, Comparative analysis of oxygen carriers	8
III	Transport and Storage Proteins Ferritin, Transferrin and Ceruloplasmin-Structure and Functioning; Cytochrome- Structure and Functioning, Role and Functioning of Sodium Potassium Pump	7
IV	Medicinal Bioinorganic Chemistry and Applications Metals in Medicine: Metal-based drugs (cisplatin, ruthenium complexes), Diagnostic agents (MRI contrast agents, radiopharmaceuticals); Toxicity and Chelation Therapy: Toxic effects of metal ions, Chelation therapy for metal poisoning.	7

COURSE EVALUATION METHODS

Theory Exams: Total Marks: 50 (External: 35 + Internal: 15)

Internal Assessment: 15 Marks	• Class Participation: NIL • Seminar/Presentation/ Assignment: 05 Marks • Mid Term Exam: 10 Marks
External Assessment: 35 Marks (02 Hours)	• End Term Exam: 35 Marks

Instruction for End Term Theory Exam:

The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-1 will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks. Log table and non-programmable calculator is allowed.

RECOMMENDED BOOKS

1. Purcell, K.F & Kotz, J.C. Inorganic Chemistry W.B. Saunders Co, 1977.
2. Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
3. Lippard, S.J. & Berg, J.M. Principles of Bioinorganic Chemistry Panima Publishing Company 1994.
4. Cotton, F.A. & Wilkinson, G, Advanced Inorganic Chemistry. Wiley-VCH, 1999
5. Basolo, F, and Pearson, R.C., Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY, 1967.
6. Greenwood, N.N. & Earnshaw A., Chemistry of the Elements, Butterworth-Heinemann, 1997.
7. B.R. Puri, L.R. Sharma, K.C. Kalia, Principles of Inorganic Chemistry, Vishal Publishing CO.

Minor Course
(To be Effective from Session 2026-27)

MINOR COURSE-CHEMISTRY

COURSE DETAILS:

Course Title	Basic Chemistry I	
Semester	Semester-I	
Course Code	MIC-I	
Course ID	260/CHE/MI/103	
Total Credits	02 (Lecture: 02, Tutorial: 0, Practical: 0)	
Total Marks	50	
Marks Distribution	Theory External: 35 Practical External: --	Theory Internal: 15 Practical Internal: --

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 2		
Lectures (L.)	Hours per Week: 02	Practical (P) Hours per Week: --

COURSE OBJECTIVES:

- To develop a conceptual understanding of atomic structure including de Broglie waves, uncertainty principle, quantum numbers, and atomic orbitals.
- To study ionic and covalent bonding using Valence Bond Theory, Molecular Orbital Theory, VSEPR theory, and hybridization.
- To understand periodic properties such as atomic size, ionization energy, electron affinity and electronegativity.
- To introduce electronic effects, reactive intermediates, and types of organic reactions for understanding reactivity and mechanisms in organic chemistry.

COURSE OUTCOMES:

Upon completing this course, students will be able to:

- Explain atomic structure, describe orbital shapes and probability distributions, and apply quantum numbers to determine electronic structure of atoms.
- Predict molecular shapes, explain bonding using MO theory, calculate bond order, and analyze bonding in simple and complex molecules.
- Interpret periodic trends, compare properties of s and p block elements, and explain concepts such as inert pair effect and diagonal relationship.
- Explain reaction mechanisms using inductive, resonance, and hyperconjugation effects, identify nucleophiles and electrophiles, and classify organic reactions and intermediates.

DETAILED CONTENT OF COURSE:

Theory Syllabus: Total Contact Hours: 30

Unit	Topics	Contact Hours
I	Atomic Structure Idea of de Broglie matter waves, Heisenberg's uncertainty principle, atomic orbitals, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, and d orbitals, Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements, effective nuclear charge and Slater's rules.	8
II	Covalent Bonding and Ionic Bonding Valence bond theory and its limitations, hybridization and shapes of simple inorganic molecules (BeF_2 , BF_3 , CH_4 , PF_5 , SF_6 , IF_7); VSEPR theory (NH_3 , SF_4 , ClF_3 , and H_2O); Molecular orbital treatment of homonuclear and heteronuclear (CO & NO) diatomic molecules; HOMO, LUMO, Bond order. General characteristics of ionic compounds: ionization energy, electron affinity, sizes of ions, radius ratio rule and its limitation, lattice energy; Born-Haber cycle.	8
III	Periodic Properties and Trends Atomic and ionic radii, ionization energy, electron affinity and electronegativity – trends in periodic table (in s & p block elements). Comparative study of physical and chemical properties of s and p-block elements - Group trends in electronic configuration, common oxidation states, inert pair effect and diagonal relationship.	7
IV	Fundamentals of Organic Chemistry Electronic displacements: inductive effect, resonance and hyperconjugation; nucleophiles and electrophiles; reactive intermediates: carbocations (S_N1 and S_N2), carbanions, free radicals, carbene and nitrene.	7

COURSE EVALUATION METHODS

Theory Exams: Total Marks: 50 (External: 35 + Internal: 15)

Internal Assessment: 15 Marks	• Class Participation: 05 Marks • Seminar/ Presentation/ Assignment: 05 Marks • Mid Term Exam: 05 Marks
External Assessment: 35 Marks (02 Hours)	• End Term Exam: 35 Marks

Instructions for End Term Theory Exam:



The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-1 will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks.

RECOMMENDED BOOKS

1. Lee, J.D. (2008), *Concise Inorganic Chemistry*, (5th ed.) Wiley India.
2. Dhawan S. N. (2019) *Organic Chemistry*, Vol I, (18th ed.) Pradeep Publications.
3. Clayden, J.; Greeves, N. and Warren, S. (2012), *Organic Chemistry*, (2nd ed.) Oxford.
4. Morrison, R. N. and Boyd, R. N. (2010), *Organic Chemistry*, (7th ed.) Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Huheey, J.E., Keiter, E.A.; Keiter, R. L. and Medhi, O.K. (1997), *Inorganic Chemistry- Principles of Structure and Reactivity*, (4th ed.) Pearson education.



Minor Course
(To be Effective from Session 2026-27)

MINOR COURSE-CHEMISTRY

COURSE DETAILS:

Course Title	Molecules of Life – II
Semester	Semester-2
Course Code	MIC-2
Course ID	260/CHE/MI202
Total Credits	02 (Lecture: 02, Tutorial: 0, Practical: 0)
Total Marks	50
Marks Distribution	Theory External: 35 Theory Internal: 15 Practical External: -- Practical Internal: --

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 2	
Lectures (L) Hours per Week: 02	Practical (P) Hours per Week: --

COURSE OBJECTIVES:

- To study the chemical components, structure, and organization of nucleic acids including nucleosides, nucleotides, DNA, and RNA.
- To understand classification, structure, and chemical behavior of lipids including fatty acids, phospholipids, and cholesterol.
- To understand the importance and role of chemistry in enzyme action.
- To study classification, sources, physiological roles, and deficiency/toxicity effects of vitamins and minerals in biological systems.

COURSE OUTCOMES:

Upon completing this course, students will be able to:

- Identify nitrogenous bases, explain the structure of nucleosides, nucleotides, DNA and RNA
- To classify lipids, explain properties of fatty acids, and describe their chemical reactions.
- Explain enzyme specificity, describe catalytic mechanisms, and analyze factors affecting enzyme activity.
- Have better understanding of vitamins and minerals for human body and implications of its deficiency and toxicity.

DETAILED CONTENT OF COURSE:



Theory Syllabus: Total Contact Hours: 30

Unit	Topics	Contact Hours
I	Chemistry of Nucleic Acids Components of Nucleic acids: Adenine, guanine, thymine, cytosine and uracil (structure only), other components of nucleic acids, nucleosides and nucleotides (nomenclature), structure of polynucleotides; structure of DNA (Watson-Crick model) and RNA (types of RNA - tRNA, mRNA and rRNA), difference between DNA and RNA.	8
II	Chemistry of Lipids Introduction, definition and classification of lipids- simple, compound (phospholipids) and derived lipids (cholesterol). Classification of fatty acids – saturated fatty acids, unsaturated fatty acids. Physical property-emulsification. Chemical properties- hydrogenation of fats and oil, saponification number, Rancidity, acid number, and Iodine number.	8
III	Enzymes Classification of enzymes and their uses (mention Ribozymes). Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and cofactors and their role in biological reactions, specificity of enzyme action (including stereospecificity), enzyme inhibitors and their importance, phenomenon of inhibition (competitive and non-competitive inhibition including allosteric inhibition).	7
IV	Vitamins & Minerals Vitamins: Introduction and classification - fat-soluble vitamins (Vitamin A, D, E, K) & water-soluble vitamins (B and C). Minerals: Introduction, classification and their sources: macro-minerals (Ca, P, Mg) & micro-minerals (Se, Fe, I, Co, Zn, Cu, Se, Cr). Deficiency and toxicity; physiological importance of vitamins and minerals, effect of food processing on vitamins and minerals.	7

COURSE EVALUATION METHODS

Theory Exams: Total Marks: 50 (External: 35 + Internal: 15)

Internal Assessment: 15 Marks	• Class Participation: 05 Marks • Seminar/ Presentation/ Assignment: 05 Marks • Mid Term Exam: 05 Marks
External Assessment: 35 Marks (02 Hours)	• End Term Exam: 35 Marks

Instructions for End Term Theory Exam:

The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-I will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks.

RECOMMENDED BOOKS

1. Morrison, R. N. and Boyd, R. N., *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Nelson, D. L., and Cox, M. M. (2021), *Lehninger Principles of Biochemistry* (8th ed.). W. H. Freeman and Company.
3. Satyanarayan, U. and Chakrapani, U. (2013), *Biochemistry* (4th ed.) Elsevier.
4. Sheela, K. *et al.* (2021), *Textbook of Biomolecules* (1st ed.) AIB Saliha Publications, Tamil Nadu.
5. Sami, G and Khanna, G. (2024), *Textbook of Chemistry of Biomolecules* (1st ed.) Prestige Publishers.



Minor Course
(To be effective from Session 2026-27)

MINOR COURSE-CHEMISTRY

COURSE DETAILS:

Course Title	Basic Chemistry II		
Semester	Semester-2		
Course Code	MIC-2		
Course ID	260/CHE/MI203		
Total Credits	02 (Lecture: 02, Tutorial: 0, Practical: 0)		
Total Marks	50		
Marks Distribution	Theory External: 35 Practical External: --	Theory Internal: 15 Practical Internal: --	

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 2	
Lectures (L) Hours per Week: 02	Practical (P) Hours per Week: --

COURSE OBJECTIVES:

- Introduce students to the fundamentals of alkanes, alkenes, and aromatic hydrocarbons.
- To study kinetic theory of gases, real gas behavior.
- To study properties of liquids such as surface tension and viscosity.
- To understand the concept of chemical kinetics with emphasis on rate constant and order of reaction.

COURSE OUTCOMES:

Upon completing this course, students will be able to:

- Understand nomenclature, classification and chemical reactions of hydrocarbons.
- Learn about role of temperature and pressure to establish the state of gases and describe the concept of critical constants of real gases.
- To determine and interpret properties like surface tension and viscosity along with their temperature dependence.
- Get the knowledge of concepts of rates of chemical reactions and its application in determination of order up to 2nd order reaction.

DETAILED CONTENT OF COURSE:

Theory Syllabus: Total Contact Hours: 30



Unit	Topics	Contact Hours
I	Hydrocarbons Alkanes - IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes, methods of formation (with special reference to Wurtz reaction and Kolbe reaction). Alkenes Nomenclature of alkenes, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, Saytzeff rule, electrophilic and free radical additions, Markownikoff's and anti- Markownikoff's rule. Aromaticity: Aromaticity and Huckel rule – aromatic, non-aromatic and anti-aromatic. A general concept of molecular orbital picture of benzene.	8
II	Gaseous State Kinetic theory of gases, ideal gas laws based on kinetic theory, collision in a gas: mean free path, collision diameter, collision number. Behavior of real gases - the Van der Waal's equation. Critical phenomena - critical constants of a gas and their determination, the Van der Waal's equation and critical state.	8
III	Liquid State Surface tension of liquids - capillary action, experimental determination of surface tension, temperature effect on surface tension. Viscosity of liquids, experimental determination of viscosity coefficient, its variation with temperature.	7
IV	Chemical Kinetics Rate of reaction, factors affecting the rate of a reaction concentration, temperature, pressure, solvent, light, catalyst, law of mass action and rate law Order of a reaction, integrated rate expression for zero order, first order, pseudo first order and second order. Half Life period of a reaction. Difference between "Order and Molecularity" of chemical reactions. Determination of the rate constant and order of reaction from kinetic data. Effect of temperature on rate of reaction. Arrhenius equation.	7

COURSE EVALUATION METHODS

Theory Exams: Total Marks: 50 (External: 35 + Internal: 15)

Internal Assessment: 15 Marks	• Class Participation: 05 Marks • Seminar/ Presentation. Assignment: 05 Marks • Mid Term Exam: 05 Marks
External Assessment: 35 Marks (02 Hours)	• End Term Exam: 35 Marks

Instructions for End Term Theory Exam:

The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-I will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks.

RECOMMENDED BOOKS

1. Morrison, R. N. and Boyd, R. N. (2010), *Organic Chemistry*, (7th ed.) Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
 2. Puri, B. R., Sharma, L. R. and Pathania, M. S. (2020) *Principles of Physical Chemistry*, (49th ed.) Vishal Publishing Co.
 3. Kheterpal, S. C. (2019), *Physical Chemistry*, Vol 1, (18th ed.) Pradeep Publications.
 4. Dhawan S. N. (2019), *Organic Chemistry*, Vol 1, (18th ed.) Pradeep Publications.
 5. Kapoor, K. L. (2015), *A Textbook of Physical Chemistry*, Vol 1, (6th ed.), McGraw Hill Education.
 6. Atkins, P.W. and Paula, J.de. (2014), *Atkin's Physical Chemistry*, (10th ed.), Oxford University Press.
 7. Kapoor, K. L. (2015), *A Textbook of Physical Chemistry*, Vol 1, (6th ed.), McGraw Hill Education.
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SKILL COURSES- CHEMISTRY

COURSE DETAILS:

Course Title	Chemistry Lab Operation and Safety Measures	
Semester	Semester-I	
Course Code	SEC-1	
Course ID	240/CHE/SE/101	
Total Credits	03 (Lecture: 02, Tutorial: 0, Practical: 01)	
Total Marks	75	
Marks Distribution	Theory External: 35 Practical External: 20	Theory Internal: 15 Practical Internal: 05

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 4	
Lectures (L) Hours per Week: 2	Practical (P) Hours per Week: 2

COURSE OBJECTIVES:

- To build foundational knowledge in chemistry lab operations for students.
- To develop laboratory skills and techniques for safe laboratory operations.
- To illustrate the various components of chemical handling and safety measures.
- Awareness of emergency procedures and first aid techniques

COURSE OUTCOMES:

- Understanding of basic laboratory operations and laboratory management.
- Enhanced laboratory skills and the ability to perform sophisticated complex experiments by the knowledge of chemical handling and safety measures.
- Understanding of emergency procedures and risk assessment.

DETAILED CONTENT OF COURSE:

Theory Syllabus: Total Contact Hours: 30

Unit	Topics	Contact Hours
I	Introduction to Laboratory Operations; Overview of laboratory types and functions; Organization of a chemistry laboratory; Common laboratory equipment and their uses; Standard operating procedures (SOPs); Good Laboratory Practices (GLP)	8

II	Laboratory Safety Principles; Importance of laboratory safety; Safety data sheets (SDS); Personal protective equipment (PPE); Laboratory ventilation and fume hoods; Chemical hygiene plan	8
III	Chemical Handling and Disposal; Proper storage of chemicals; Labelling and documentation; Handling of hazardous chemicals; Waste management and disposal procedures; Spill response and cleanup	7
IV	Emergency Procedures and First Aid; Fire safety and emergency exits; Use of fire extinguishers and fire blankets; First aid procedures for chemical exposure; Emergency eyewash and shower stations; Reporting accidents and incidents	7
V	Practicals: 1. To demonstrate the correct method for preparing and labelling chemical solutions, including calculating concentrations and volumes. 2. To teach students how to safely handle and dispose of chemical waste, including segregating different types of waste and using appropriate disposal methods. 3. To perform a risk assessment of a laboratory experiment, identifying potential hazards and implementing control measures to minimize risk. 4. To demonstrate the proper technique for performing a titration, including preparing the titrant and analyte, and accurately determining the endpoint. 5. To teach students how to perform a standardization of a solution using a primary standard, ensuring the accuracy of concentration measurements. 6. To illustrate the process of filtering and recrystallizing a compound to purify it, highlighting safety precautions and waste disposal procedures.	30

COURSE EVALUATION METHODS

Theory Exams:

Total Marks: 50 (External: 35 + Internal: 15)

Internal Assessment: 15 Marks	• Class Participation: NIL • Seminar/Presentation/ Assignment: 05 Marks • Mid Term Exam: 10 Marks
External Assessment: 35 Marks (03 Hours)	• End Term Exam: 35 Marks

Practical Exam:

Total Marks: 25 (External: 20 + Internal: 5)

Internal Assessment: 05 Marks	• Class Participation: NIL • Seminar/Lab record/Demonstration: 05 marks
External Assessment: 20 Marks (03 Hours)	• End Term Practical Exam: 10 Marks • Lab record: 05 Marks • Viva Voce: 05 Marks

Instruction for End Term Theory Exam:

The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-1 will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks. Log table and non-programmable calculator is allowed.

RECOMMENDED BOOKS

1. "Laboratory Techniques in Organic Chemistry" by S. V. Sharma
2. "Laboratory Safety: Theory and Practice" by S. S. Mathur
3. "Chemical Safety Data Sheets - Volume 1: Solvents" by CRC Press
4. "Good Laboratory Practice Regulations" by Sandy Weinberg (CRC Press)
5. "Laboratory Quality Management System: Handbook" by World Health Organization (WHO)
6. "Laboratory Management: Principles and Processes" by Denise M. Harmening (Pearson)
7. "Laboratory Management: Principles and Processes" by Bruce R. Kowalski (Springer)
8. "Practical Chemistry" by V. K. Ahluwalia and R. P. Sharma
9. "Quantitative Techniques in Laboratory Management" by V. R. Rajaraman
10. "Experimental Techniques in Physical Chemistry" by S. P. Purohit
11. Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards by the National Research Council, National Academies Press.
12. Laboratory Safety for Chemistry Students by Robert H. Hill and David C. Finster, Wiley.
13. Manual of Laboratory Safety by Nigam R. and Nigam P., Laxmi Publications.
14. CRC Handbook of Laboratory Safety by A. Keith Furr, CRC Press.
15. Chemistry: Principles and Practice by Reger, Goode, and Ball, Cengage Learning.
16. Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards by the National Research Council
17. Laboratory Safety for Chemistry Students by Robert H. Hill and David C. Finster
18. CRC Handbook of Laboratory Safety by A. Keith Furr
19. Hazards in Chemical Laboratory- G.D. Muir

(To be Effective from Session 2026-27)

SKILL COURSES- CHEMISTRY

COURSE DETAILS:

Course Title	Laboratory Skills for Chemist	
Semester	Semester-I	
Course Code	SEC-1	
Course ID	260/CHE/SE/102	
Total Credits	03 (Lecture: 02, Tutorial: 0, Practical: 01)	
Total Marks	75	
Marks Distribution	Theory External: 35 Practical External: 20	Theory Internal: 15 Practical Internal: 05

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 4	
Lectures (L) Hours per Week: 2	Practical (P) Hours per Week: 2

COURSE OBJECTIVES:

- To develop a fundamental understanding of chemistry laboratory organization, safety rules, precautions, and maintenance practices.
- To understand the classification and chemical behavior of reagents, solvents, and their role in various chemical reactions.
- To learn different concentration terms and acquire skills for accurate preparation of chemical solutions.
- To gain knowledge of principles and methodologies involved in titrimetric analysis including acid-base, redox, complexometric, and precipitation titrations.
- To build competence in quantitative analysis techniques applicable to chemical and pharmaceutical systems.

COURSE OUTCOMES:

- Demonstrate safe laboratory practices, proper handling of chemicals, and effective use and

maintenance of laboratory apparatus.

- Classify reagents based on their chemical properties and explain their functions in different types of reactions.
- Prepare standard solutions and perform calculations using various concentration units such as molarity, normality, molality, ppm, and percentage compositions.
- Perform titrimetric analyses including acid-base, redox (permanganometry and dichrometry), and complexometric (EDTA) titrations with appropriate indicators.
- Apply quantitative analytical methods for estimation of substances, including reducing agents in pharmaceutical preparations.

DETAILED CONTENT OF COURSE:

Theory Syllabus: Total Contact Hours: 30

Unit	Topics	Contact Hours
I	Chemistry Laboratory and Laboratory Apparatus: General introduction to chemistry lab, safety rules and precautions in the chemistry laboratory, storage, ventilation, lighting, fumes, cupboard, hazards, precautions, maintenance of laboratory, cleaning of laboratory. Basic idea about equipment/apparatus. (glass apparatus, Heating apparatus, Stirrer, Oven, Melting point apparatus, Kipp's apparatus).	8
II	Laboratory Reagents and Solvents: Reagents-classification of reagents according to their action (i) acids (ii) bases (iii) salts (iv) complexing agents (v) oxidizing and reducing agents (vi) precipitating agents (vii) chelating agents. Chemical reactions, Quantification of Reducing Agents in Pharmaceuticals.	7
III	Concentration Terms and Solution Preparation: Percentage (Mass, Volume, Mass-Volume), Mole percent, Mole fraction, Mass ppm, ppb, g/L, molarity, normality, molality; Solution Preparation: Solutions, components of a solution, types of solution, solubility, calculation of masses and volumes for preparation of solutions.	8
IV	Introduction to Titrimetry: Definition of titrant, tetrad, analyte, indicator, equivalent point and end point, Primary and Secondary Standards, Types of Titrations, Acid-Base Titrations with titration curves, indicators, Redox Titration : Permanganometry and dichrometry, Complexometric Titration: Formation of metal ion complex, EDTA titration, A basic idea of	8

	Precipitation titrations.	
V	Practical: 1. Preparation of standard solutions: Preparing molar (M), molal (m) and normal (N) solutions of primary and secondary standards (e.g. Sodium Hydroxide, Sodium Carbonate, Oxalic Acid) 2. Standardization of HCl solution using Sodium Carbonate as primary standard 3. To determine the melting point of given solid compound. 4. To determine the boiling point of the liquid components. 5. Calibration of laboratory apparatus. 6. Test the solubility of compounds like (NaCl, Sugar, Napthalene) in polar solvent(water) and organic solvent (ethanol, ether). 7. Effect of impurities on melting point- mixed melting point of two unknown organic compound. 8. Purification of organic compounds by crystallization using the following solvents (water, alcohol, alcohol-water).	30

COURSE EVALUATION METHODS

Theory Exams:

Total Marks: 50 (External: 35 + Internal: 15)

Internal Assessment: 15 Marks	• Class Participation: 05 • Seminar/Presentation/ Assignment: 05 Marks • Mid Term Exam: 05 Marks
External Assessment: 35 Marks (02 Hours)	• End Term Exam: 35 Marks

Practical Exam:

Total Marks: 25 (External: 20 + Internal: 5)



Skill Enhancement Course
(To be effective from Session 2026-27)

SKILL COURSES- CHEMISTRY

COURSE DETAILS:

Course Title	Food Safety and Quality Assurance	
Semester	Semester-I	
Course Code	SEC-1	
Course ID	260/CHE/SE/103	
Total Credits	03 (Lecture: 02, Tutorial: 0, Practical: 01)	
Total Marks	75	
Marks Distribution	Theory External: 35 Practical External: 20	Theory Internal: 15 Practical Internal: 05

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 4	
Lectures (L) Hours per Week: 2	Practical (P) Hours per Week: 2

COURSE OBJECTIVES:

- To understand the principles, techniques, and importance of food preservation, processing, and packaging.
- To gain knowledge of food analysis, nutritional value of foods, and their relationship with human health.
- To study food additives, their chemical nature, functions, safety aspects, and applications in food systems.
- To understand food adulteration, its types, methods, and impact on food quality and human health.
- To develop skills for detection of common food adulterants and understand regulatory policies and quality control measures.

COURSE OUTCOMES:



- Explain various methods of food preservation, processing, and packaging, and evaluate their significance in extending shelf life.
- Analyze the nutritional composition of food and explain its relationship with health and food safety principles.
- Describe different food additives, their chemical nature, functions, and assess their safety in food applications.
- Identify types and methods of food adulteration and evaluate their adverse effects on food quality and human health.
- Detect common adulterants in food products such as milk, oils, spices, and pulses using standard techniques and interpret their health impacts.

DETAILED CONTENT OF COURSE:

Theory Syllabus: Total Contact Hours: 30

Unit	Topics	Contact Hours
I	Food Preservation: Introduction, techniques of food preservation, physical and chemical methods, the importance of food preservation, type of food preservatives and food packing. , idea about food processing. Food analysis-Need and its importance, Nutritional value of foods, relationship between Nutrition and health, Principle of food safety and quality assurance.	8
II	Food Additive: Introduction, Need and safety aspects, chemical nature and its function. Application of chemical and Instrumental methods in food analysis. Adulterants in Food Products: Introduction, definition, types of food adulteration, methods of food adulteration, effect of food adulteration	8
III	Adulterants, Detection and their impact on health: Adulterants in milk and milk products, oil, fats, mustard oil and, sweetening agents (natural and artificial), Common Adulterants and their impact on health, Detection and their testing techniques, Policy and control measures. Case Study : A study on status of milk adulterants.	7

IV	Adulteration in spices and pulses: Turmeric powder, coriander powder, Chili Powder, food grains and their products, (gram flour etc.) Common Adulterants and their impact on health, Detection and their testing techniques, Policy and control measures. Case Study : Adulteration in Indian spices: An alarming concern and silent health hazard.	7
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V	Practical: 1. To Analyze the acidity of milk and milk products by using pH strip. 2. To determine the total solids content in given milk sample. 3. To determine total nitrogen (Kjeldahl method) content in given milk sample. 4. To determine urea, starch and Detergent adulteration in given milk sample. 5. To analyze the protein in given milk sample (Biuret test). 6. To determine the saponification value and iodine value of given oil sample. 7. Identification of adulterants in some common food items: Edible oil, Ghee, Milk, Coffee powder, Chili powder, Turmeric powder, Coriander powder, Asafoetida and Pulses. 8. To measure the thermal decomposition of baking soda.	30
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COURSE EVALUATION METHODS

Theory Exams:

Total Marks: 50 (External: 35 + Internal: 15)

Internal Assessment: 15 Marks	• Class Participation: 05 Marks • Seminar/Presentation/ Assignment: 05 Marks • Mid Term Exam: 05 Marks
External Assessment: 35 Marks (02 Hours)	• End Term Exam: 35 Marks

Practical Exam:

Total Marks: 25 (External: 20 + Internal: 5)

Internal Assessment: 05 Marks	• Class Participation: 2.5 • Seminar/Lab record/Demonstration: 2.5 marks
External Assessment: 20 Marks (03 Hours)	• End Term Practical Exam: 10 Marks • Lab record: 05 Marks • Viva Voce: 05 Marks

Instructions for End Term Theory Exam:

The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-1 will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks.

RECOMMENDED BOOKS

1. J. Scott Smith & Y. H. Hui, 2004, *Food Processing : Principles and Applications*, Blackwell Publishing, 1st Edition.
2. William H. Butz and Henry J. Noebels, 1961, *Instrumental Methods for the Analysis of Food Additives*, Interscience Publishers.
3. M. Kalia and S. Sood, 1996, *Food Preservation and Processing*, Kalyani Publishers.
4. F.D. Snell & F.M. Biffen, 1964, *Commercial methods of analysis*, chemical publishing.
5. S. K. Sharma, 2012, *Food Preservation: Physical and Chemical Methods*, New India Publishing Agency.
6. A. L. Branen, P.M. Davidson, 2001, *Food Additives*, CRC press, 2nd Edition.
7. Titus A. M., 2012, *The Chemistry of Food Additives and Preservatives*, Wiley Blackwell.
8. V. Khader, 2001, *Textbook of Food Science and Technology*, Indian Council of Agricultural Research New Delhi.
9. S. Ghodke, 2023, *Food Adulteration and Hygiene*, AG Publishing House.
10. D.D. Patange, D.K. Kamble and R.C. Ranveer, 2018, *A Text Book on Milk and Milk Products*, Narendra Publishing House.
11. R. Sharma, Y.S. Rajput, A.K. Barui, L. Naik, 2012, *Detection of Adulterants in Milk - A Laboratory Manual*, ICAR - NDRI.
12. M.L. Nolle, J. Ahmad, 2023, *Analysis of Food Spices: Identification and Authentication*, CRC Press.

Case Study:

1. Kumar, A., Goyal, S.K., Pradhan, R.C. and Goyal, R.K. (2015). *A study on status of milk adulterants using in Milk of District Varanasi*. South Asian J. Food Technol. Environ. 1(2): 140-143.
2. Sahoo, J. P., & Samal, K. C. (2024). Adulteration in Indian spices: An alarming concern and a silent health hazard. *Int. J. Adulteration*, 8, e4ijad3043.

COURSE DETAILS:

Course Title	Analytical Chemistry
Semester	Semester-II
Course Code	SEC-2
Course ID	240/CHE/SE201
Total Credits	03 (Lecture: 02, Tutorial: 0, Practical: 01)
Total Marks	75
Marks Distribution	Theory External: 35 Theory Internal: 15 Practical External: 20 Practical Internal: 05

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 4	
Lectures (L) Hours per Week: 2	Practical (P) Hours per Week: 2

COURSE OBJECTIVES:

- Understanding of various important components of analytical chemistry in terms of sampling, calibration and quality
- Knowledge of various volumetric analytical methods for qualitative and quantitative analysis.
- Understanding of chromatographic techniques.
- Analysis of food products

COURSE OUTCOMES:

Students will be able to learn:-

- A foundational understanding of the role and scope of analytical chemistry in various scientific fields
- Proficiency in various titration techniques, enabling them to accurately determine the concentrations of different substances in diverse samples
- Comprehensive understanding of various chromatographic techniques and their applications in separating and analysing complex mixtures.
- Understanding of nutritional value of food products, food processing and preservation techniques, and identify and prevent food adulteration.

DETAILED CONTENT OF COURSE:

Theory Syllabus: Total Contact Hours: 30

Unit	Topics	Contact Hours
I	Introduction to Analytical Chemistry Overview of Analytical Chemistry, Classification of Analytical Methods Sampling Techniques: Types of Samples and Sample Preparation Techniques; Errors in Analytical Measurements: Sources and Types of Analytical Errors Calibration Methods: Internal and External Standards in Calibration Quality Assurance and Quality Control: Role of ISO Standards in Analytical Laboratories	8
II	Volumetric Analysis Acid-Base Titrations: Theory of Acid-Base Reactions, Indicator Selection and pH Range; Applications: Determination of Acids and Bases in Real Samples Redox Titrations Redox Reactions: Oxidizing and Reducing Agents, Indicator Electrodes and Potentiometric Titrations; Applications: Quantification of Reducing Agents in Pharmaceuticals Complexometric Titrations: Formation Constants of Complexes, EDTA as a Complexing Agent; Applications: Determination of Metal Ions in Complex Matrices Precipitation Titrations: Solubility Product and Precipitation Reactions; Applications: Analysis of Halides and Sulfates in Water Samples	8
III	Chromatography Definition, general introduction on principles of chromatography, Column chromatography, paper chromatography, TLC & ion-exchange chromatography.	7
IV	Analysis of food products, Nutritional value of foods, idea about food processing and food preservations and adulteration.	7
V	Practicals: 1. Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}). 2. Determination of the Concentration of an Unknown Acid Solution using a Standard Base (e.g., NaOH) using pH meter. 3. Quantitative Analysis of Iron(II) in a Sample Solution using Potassium Permanganate as the Titrant and Ferroin as the Indicator. 4. To analyze the hardness of water by performing complexometric titration with ethylenediaminetetraacetic acid (EDTA). 5. Precipitation Titrations (determining chloride content using silver nitrate) 6. Determination of pH, acidity and alkalinity of a water.	30

COURSE EVALUATION METHODS**Theory Exams:****Total Marks: 50 (External: 35 + Internal: 15)**

Internal Assessment: 15 Marks	• Class Participation: NIL • Seminar/Presentation/ Assignment: 05 Marks • Mid Term Exam: 10 Marks
External Assessment: 35 Marks (02 Hours)	• End Term Exam: 35 Marks

Practical Exam:

Total Marks: 25 (External: 20 + Internal: 5)

Internal Assessment: 05 Marks	• Class Participation: NIL • Seminar/Lab record/Demonstration: 05 Marks
External Assessment: 20 Marks (03 Hours)	• End Term Practical Exam: 10 Marks • Lab record: 05 Marks • Viva Voce: 05 Marks

Instruction for End Term Theory Exam:

The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-1 will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks. Log table and non-programmable calculator is allowed.

RECOMMENDED BOOKS

1. "Principles of Instrumental Analysis" by Douglas A. Skoog, F. James Holler, and Stanley R. Crouch (Cengage Learning)
2. "Environmental Chemistry" by Stanley E. Manahan (CRC Press)
3. "Chromatographic Analysis of Environmental and Food Toxicants" by S. S. Nagarkar
4. "Analytical Techniques in Environmental Chemistry" by S. K. Kataria
5. "Food Analysis" by S. S. Narayanan and M. M. Sharma
6. "Chromatography: Concepts and Contrasts" by James M. Miller (Wiley)
7. "Soil Analysis Handbook of Reference Methods" by J. Benton Jones Jr. (CRC Press)
8. "Principles and Practice of Soil Science: The Soil as a Natural Resource" by Robert E. White (Wiley)
9. "Food Analysis" by S. Suzanne Nielsen (Springer)
10. "Food Chemistry" by H.-D. Belitz, W. Grosch, P. Schieberle (Springer)
11. "Practical Manual of Chromatography Techniques" by R. S. Khandpur
12. "Analytical Techniques for Soil and Water Analysis" by A. K. Sharma
13. "Practical Food Chemistry" by A. K. Singh and K. L. Yadav
14. "Experiments in Analytical Chemistry: A Hands-on Approach" by Ian M. Smallwood (Cambridge University Press)

Skill Enhancement Course
(To be effective from Session 2026-27)

SKILL COURSES- CHEMISTRY

COURSE DETAILS:

Course Title	Soil and Water Analysis	
Semester	Semester-II	
Course Code	SEC-2	
Course ID	260/CHE/SE/202	
Total Credits	03 (Lecture: 02, Tutorial: 0, Practical: 01)	
Total Marks	75	
Marks Distribution	Theory External: 35 Practical External: 20	Theory Internal: 15 Practical Internal: 05

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 4		
Lectures (L) Hours per Week: 2	Practical (P) Hours per Week: 2	

COURSE OBJECTIVES:

- To impart fundamental knowledge of environmental pollution, types of chemical pollutants including e-waste, their toxic effects on ecosystems, and global environmental issues.
- To explain the concept of water quality, physical and chemical properties of water, sources of water for domestic use, and conventional treatment methods.
- To train students in standard analytical methods for determination of key water quality parameters as per BIS and WHO specifications, including BOD, COD, DO, hardness, alkalinity, TDS, and industrial water treatment techniques.
- To develop understanding of soil composition, physico-chemical properties, soil profile, ion exchange phenomena, essential nutrients, and standard analytical techniques for soil testing relevant to fertility and environmental assessment.

COURSE OUTCOMES:

- Students will be able to classify different types of pollutants and chemical pollutants, assess toxic effects of e-waste, and chemistry behind global warming, greenhouse effect, acid rain, water footprint.
- Students will be able to evaluate properties of water, differentiate municipal and drinking water sources, and describe chemical principles of water treatment processes for domestic purposes.
- Students will be able to perform quantitative determination of water quality parameters, drinking water standards, and softening techniques.
- Students will be able to describe soil texture, structure, inorganic and organic components, soil profile and soil organisms, and estimate essential macronutrients and micronutrients.

DETAILED CONTENT OF COURSE:

Theory Syllabus: Total Contact Hours: 30

Unit	Topics	Contact Hours
I	Pollution: Climate change: The study of chemical processes that contribute to climate processes, contribute to climate change such as the release of green house gases and the change in the carbon cycle. Environmental toxicology: The study of the effects of chemical pollutants on living organism, including humans. Environmental fate and transport: The study of how chemical pollutants move through the environment and how they are transformed by chemical and biological processes. Environmental remediation: the study of methods for cleaning up contaminated environments. Concept of carbon foot print and water footprint.	8
II	Water Analysis: Source of water (surface, ground, sea water). Introduction to water quality, its parameters, physical and chemical properties, chemical analysis of water (principal of volumetric and instrumental methods), water for domestic purpose: Municipal water/ Drinking water standards, water treatment (primary, secondary, tertiary), Disinfection method (chlorination, UV, ozonation).	7
III	Important water quality parameters as per BIS and WHO and methods for their determination: turbidity, color, taste, pH, acidity, alkalinity, metals, hardness of water (Temporary and permanent), dissolved oxygen, standard for drinking water as per WHO specifications. Determination of BOD, COD, DO, alkalinity, total hardness of drinking water, TDS, Boiler feed water, Desalination of Brackish water, Water softening technique (ion exchange, reverse osmosis, lime softening, zeolite process).	8
IV	Soil Analysis: Introduction, soil sampling technique, characteristics (soil texture and structure), composition (inorganic, organic components, water and air in soil), soil organisms, soil profile, soil reactions (cation and anion exchange reactions), essential elements (macronutrients and micronutrients) only qualitative description.	7

V	Practicals: 1. To determine the pH and electrical conductivity of water. 2. To determine the pH of given soil sample. 3. To determine the Biochemical Oxygen Demand (BOD) of given water sample. 4. To determine the Chemical Oxygen Demand (COD) of given water sample. 5. To determine the Dissolved oxygen (DO) of given water sample. 6. To analyze the soil nutrients (N, P, K) content in given soil sample. 7. To determine the residual chlorine in a given water sample. 8. Determination of hardness of water by complexometric titration. 9. To analyze the turbidity and color of a given water sample.	30
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COURSE EVALUATION METHODS

Theory Exams:

Total Marks: 50 (External: 35 + Internal: 15)

Internal Assessment: 15 Marks	• Class Participation: 05 Marks • Seminar/ Presentation/ Assignment: 05 Marks • Mid Term Exam: 05 Marks
External Assessment: 35 Marks (03 Hours)	• End Term Exam: 35 Marks

Practical Exam:

Total Marks: 25 (External: 20 + Internal: 5)

Internal Assessment: 05 Marks	• Class Participation: 2.5 Marks • Seminar/Lab record/Demonstration: 2.5 Marks
External Assessment: 20 Marks (03 Hours)	• End Term Practical Exam: 10 Marks • Lab record: 05 Marks • Viva Voce: 05 Marks

Instruction for End Term Theory Exam:

The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-I will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks.

RECOMMENDED BOOKS

1. Jain, P. C., & Jain, M. (2022). *Engineering chemistry* (17th ed.). Dhanpat Rai Publishing Co.
2. Baird, C., & Cann, M. (2022). *Environmental chemistry* (6th ed.). W.H. Freeman and Company.
3. Essington, M. E. (2015). *Soil and water chemistry: An integrative approach* (2nd ed.). CRC Press.
4. Das, D. K. (2020). *Soil science* (4th ed.). Kalyani Publishers.
5. American Water Works Association. (2021). *Water quality and treatment: A handbook on drinking water* (7th ed.). McGraw Hill.
6. Goel, P. K. (2019). *Water and wastewater analysis* (1st ed.). Kalyani Publishers.
7. Baruah, T. C., & Barthakur, H. P. (2017). *A textbook of soil analysis* (1st ed.). Vikas Publishing House.
8. Sparks, D. L. (Ed.). (2020). *Methods of soil analysis, part 3: Chemical methods* (2nd ed.). Soil Science Society of America.



SKILL COURSES- CHEMISTRY

COURSE DETAILS:

Course Title	Chemistry and its impact on daily life	
Semester	Semester-II	
Course Code	SEC-2	
Course ID	260/CHE/SE/203	
Total Credits	03 (Lecture: 02, Tutorial: 0, Practical: 01)	
Total Marks	75	
Marks Distribution	Theory External: 35 Practical External: 20	Theory Internal: 15 Practical Internal: 05

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 4		
Lectures (L) Hours per Week: 2	Practical (P) Hours per Week: 2	

COURSE OBJECTIVES:

- To understand the chemical composition, function, and regulatory aspects of cosmetics and analyze hazards associated with cosmetic ingredients.
- To understand the chemistry of soaps, detergents, bleaching agents and dry cleaning, including surfactant action and environmental impact.
- To describe nutritional aspects of food and the role of food additives, preservatives and processing techniques in food chemistry.
- To analyze the chemistry of swimming pool sanitation, including chlorination, pH control, stabilizers and safe handling of chlorine.

COURSE OUTCOMES:

- After completing this course, students will be able to identify major and minor constituents of cosmetics and assess their safety.
- Students will be able to differentiate between soaps and synthetic detergents, and explain the mechanism of bleaching agents and enzymatic cleaners.
- Students will be able to classify food additives by function and detect common preservatives, colors, and adulterants using chemical tests.
- Students will be able to maintain swimming pool water quality by testing free chlorine, pH and apply chlorine handling guidelines safely.



DETAILED CONTENT OF COURSE:

Theory Syllabus: Total Contact Hours: 30

Unit	Topics	Contact Hours
I	Chemistry in Cosmetics: Analysis of cosmetics- Major and minor constituents and their functions. Composition of skin creams, hand lotions, nail paints, lip balm, conditioners, sunscreen. Different kinds of Shampoos- antidandruff, anti-lice, herbal and baby shampoos. Hazards of cosmetics (skin allergies, banned ingredients, BIS standards) Perfumes- Requirement of a good perfume, composition, classification of perfumery materials. Regulatory aspects- FSSAI CDSCO guidelines for cosmetics in India.	8
II	Chemistry in Laundry: Soaps (bathing and washing) - Formulation, Ingredient, saponification process, synthetic surfactants and their mode of action. Bleaching agents - chlorin, sodium perborate, hydrogen peroxide- composition and their mode of action. Detergents- Anionic, Cationic and Non-ionic classification, surfactants action. Dry cleaning- solvent used, environment impact, green alternative. Stain remover-Enzymatic cleaner and their action on protein/oil stain.	8
III	Chemistry in Kitchen: Nutritional value of food (carbohydrate, protein, fat, vitamin, mineral). Food processing (canning, freezing, dehydration, pasteurization) and food preservations (physical method). Food additives –Define sweeteners (saccharin, aspartame, sucralose, stevia), preservatives (Sodium carbonate, Sodium benzoate, Sorbic acid), Flavoring agents, Emulsifiers, Acidulants (citric acid, tartaric acid), Coloring matter (Natural vs synthetic -brilliant blue FCF, fast green FCF).	7
IV	Chemistry in Swimming pool: Purpose and importance of chlorination, effect of pH, chlorine stabilizers, super chlorination, effect of sunlight on chlorine, side effects of chlorine on skin and preventive measures, water quality testing and monitoring, alternative of chlorine, guideline of chlorine handling.	7

V	Practical: 1. Preparation of Cold cream. 2. Prepare cosmetic formulations: for Talcum powder. 3. Prepare cosmetic formulations: for Lip balm. 4. Prepare cosmetic formulations: for Nail polish remover. 5. Prepare cosmetic formulations: for Shampoo. 6. Preparation of Hand Wash and soap by Saponification process. 7. Quality testing of soap: assess pH, alkalinity. 8. Determine chlorine content in swimming pool water via titration. 9. To study the effect of sunlight on pH of chlorinated water of swimming pool 10. pH testing of common kitchen items (lemon juice, baking soda solution, vinegar, milk etc.) 11. Identification of synthetic food colors by Paper chromatography. 12. Qualitative analysis of Food preservatives – Test for benzoic acid in soft drinks, sulphites in dried fruits	30
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COURSE EVALUATION METHODS

Theory Exams:

Total Marks: 50 (External: 35 + Internal: 15)

Internal Assessment: 15 Marks	• Class Participation: 05 Marks • Seminar/Presentation/ Assignment: 05 Marks • Mid Term Exam: 05 Marks
External Assessment: 35 Marks (03 Hours)	• End Term Exam: 35 Marks

Practical Exam:

Total Marks: 25 (External: 20 + Internal: 5)

Internal Assessment: 05 Marks	• Class Participation: 2.5 Marks • Seminar/Lab record/Demonstration: 2.5 Marks
External Assessment: 20 Marks (03 Hours)	• End Term Practical Exam: 10 Marks • Lab record: 05 Marks • Viva Voce: 05 Marks

Instruction for End Term Theory Exam:

The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-I will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks.

RECOMMENDED BOOKS

1. Jain, P. C., & Jain, M. (2022). *Engineering chemistry* (17th ed.). Dhanpat Rai Publishing Co.
2. Rao, C. V. (2021). *Applied chemistry* (2nd ed.). New Age International Publishers.
3. Srilakshmi, B. (2023). *Food science* (8th ed.). New Age International Publishers.
4. Panda, H. (2020). *Textbook of cosmetic formulations* (3rd ed.). Asia Pacific Business Press Inc.
5. Brown, T. L., LeMay, H. E., & Bursten, B. E. (2023). *Chemistry: The central science* (15th ed.). Pearson Education.
6. Rosen, M. R. (2021). *Harry's cosmeticology* (9th ed.). Chemical Publishing Company.
7. Fennema, O. R., Damodaran, S., & Parkin, K. L. (2017). *Food chemistry* (5th ed.). CRC Press.
8. Lowry, R. W. (2022). *Pool & spa operator handbook* (3rd ed.). Lowry Consulting Group.
9. Sharma, B. K. (2020). *Industrial chemistry* (19th ed.). Krishna Prakashan Media Pvt. Ltd.
10. Goyal, R. K. (2019). *Food chemistry and nutrition* (1st ed.). S. Chand Publishing.

