UNIVERSITY OF JAMMU

(NAAC ACCREDITED 'A ++' GRADE' UNIVERSITY)
Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

Academic Section
Email: academicsectionju14@gmail.com

NOTIFICATION
(26/June/Adp./28)

In partial modification of this office Notification No. F.Acd/II/25/4236-60 dated 23.07.2025, it is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, is pleased to authorize the modification in the syllabi and Courses of Study of the Subject of Chemistry of Semester-III Course no. MICHTC-303, Titled: "Foundation Course Chemistry-III" for **Four Year Under Graduate Programme as per NEP-2020 (as given in the annexure)** for the examinations to be held in the years as per the details given below:

Subject	Semester	For the examinations to be held in the year
Chemistry	Semester- III	December 2026, 2027 and 2028

The Syllabi of the courses are also available on the University website: www.jammuuniversity.in

Sd/-
DEAN ACADEMIC AFFAIRS

No. F.Acd/II/26/3063-80
Dated: 19/06/2026

Copy for information and necessary action to:

1. Dean, Faculty of **Science**
2. Convener, Board of Studies in **Chemistry**
3. All members of the Board of Studies
4. Sr. P.A.to the Controller of Examinations
5. C.A. to the Controller of Examinations
6. Director, Computer Centre, University of Jammu.
7. Joint Registrar/Deputy Registrar/Asst. Registrar (Confidential/Exam UG/Exam. Non Prof.)
8. Guard File

18/6/26

JOINT REGISTRAR (ACADEMIC)

18/6/26 & 18/6/26

UNIVERSITY OFJAMMU

SYLLABUS FOR FOUR YEAR UNDERGRADUATE PROGRAMME (FYUGP) IN CHEMISTRY W.E.F. ACADEMIC SESSION 2025 AS PER NATIONAL EDUCATION POLICY (NEP 2020)

Semester-wise Grid Plan[Semesters I–III]

S. No.	Course No.	Course Title	No. of Credits			Course Type	Marks		Research Project/ SummerInternship/Dissertation	Percentage of change/ Any other change
				Credits Level	Credit Point	Core/Elective/ MOOC/Open	Theory	Practical /Skills		
1.	UMJCHT101	Foundation Course Chemistry-I	4 (3 credit theory + 1 credit practical)	100	45 (Theory) + 30 (Practical) = 75 Hrs.	Major	75	25	-	<10%
2.	UMICHT102	Foundation Course Chemistry-I	4 (3 credit theory + 1 credit practical)	100	45 (Theory) + 30 (Practical) = 75 Hrs.	Minor	75	25	-	<10%
3.	UMDCHT103	Chemistry in Everyday Life	3	-	45 Hrs.	Multi–disciplinary	75	-	-	<20%
4.	USECHT111	Basic Analytical Techniques in Chemistry	3 (1 credit theory + 2 credits skills)	-	15(Theory) + 60 (Skills) = 75 Hrs.	Skill Enhancement Course	25	50	-	100%
5.	UMJCHT201	Foundation Course Chemistry-II	4 (3 credit theory + 1 credit practical)	100	45 (Theory) + 30 (Practical) = 75 Hrs.	Major	75	25	-	<10%
6.	UMICHT202	Foundation Course Chemistry-II	4 (3 credit theory + 1 credit practical)	100	45 (Theory) + 30 (Practical) = 75 Hrs.	Minor	75	25	-	<10%
7.	UMDCHT203	Chemistry in Everyday Life	3	-	45Hrs.	Multi–disciplinary	75	-	-	<20%
8.	USECHT211	Chemistry of Soaps, Detergents and Surfactants	3 (1 credit theory +2 credits skills)	-	15(Theory) + 60 (Skills) = 75 Hrs.	Skill Enhancement Course	25	50	-	100%
9.	UMJCHT301	Foundation Course Chemistry-III	4 (3 credit theory + 1 credit practical)	200	45 (Theory) + 30 (Practical) = 75 Hrs.	Major	75	25	-	<10%

S. No.	Course No.	Course Title	No. of Credits	Credits Level	Credit Point	Course Type Core/Elective/ MOOC/Open	Marks Theory	Marks Practical /Skills	Research Project/ SummerInternship/Dissertation	Percentage of change/ Any other change
10.	UMJCHT302	Analytical Chemistry	4 (3 credit theory + 1 credit practical)	200	45 (Theory) + 30 (Practical) = 75 Hrs.	Major	75	25	-	<10%
11.	UMICHT303	Foundation Course Chemistry-III	4 (3 credit theory + 1 credit practical)	200	45 (Theory) + 30 (Practical) = 75 Hrs.	Major	75	25	-	<10%
12.	UMDCHT304	Chemistry In Everyday Life	3	-	45 Hrs.	Multi–disciplinary	75	-	-	<20%
13.	USECHT311	Chemistry of Food And Cosmetics	3 (1 credit theory + 2 credits skills)	-	15(Theory) + 60 (Skills) = 75 Hrs.	Skill Enhancement Course	25	50	-	100%

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2025, 2026 & 2027)

Semester-I
Course No.: UMJCHT101 (Major course)
Title: FOUNDATION COURSE CHEMISTRY-I

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours (Theory) and 2½ Hours (Practical)

Theory: 03 Credits **Contact Hours: 45 hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Atomic Structure in terms of atomic orbitals and electronic configuration
- Periodic properties through periodic table
- Electronic displacement and bond cleavage in organic molecules
- Properties of Gaseous state

Unit-I: Atomic Structure I **(13 Hours)**
Introduction to Quantum mechanics, Time independent Schrodinger wave equation and its derivation. Significance of ψ and ψ^2, Application of Schrödinger equation to hydrogen atom(in terms of spherical polar coordinates),Radial and angular parts of the hydrogenicwavefunctions (atomic orbitals) and their variations for $1s$, $2s$, $2p$, $3s$, $3p$ and $3d$ orbitals (Only graphical representation). Radial and angular nodes and their significance.

Unit-II: Atomic Structure II and Periodic Properties **(12 Hours)**
Quantum numbers and their significance, Shapes of s, p and d atomic orbitals.Rules governing electronic configuration in various atomic orbitals: Aufbau principle, Pauli's Exclusion Principle and Hund's rule of maximum multiplicity, Concept of exchange energy-extra stability of half-filled and fully filled electronic configurations. Anomalous electronic configurations.
Periodic Laws (Mendeleev and Mosley), Classification of elements into s, p, d and f-blocks, Nuclear Charge, Effective Nuclear Charge, Shielding effect and their inter-relation i.e., Slater's Rule. Concept, Variations and factors affecting various periodic properties (atomic/ionic radii, ionisation energy, electron affinity and electronegativity)

Unit-III: General Organic Chemistry **(10 Hours)**
Electronic Displacements: Inductive Effect, Electromeric Effect, Mesomeric Effect/Resonance and Hyperconjugation, Polar and Non-Polar organic Molecules, Dipole moment and Hydrogen bonding.
Bond Cleavage: Homolytic and Heterolytic fission with suitable examples, formal charge, Concept of Electrophiles and Nucleophiles (with suitable examples).
Reactive Intermediates: Types, shape and relative stability of Carbocations, Carbanions, Free radicals and carbenes.
Introduction to types of organic reactions: Addition, Elimination and Substitution reactions.

Semester-I
Course No.: UMJCHT101 (Major course)
Title: FOUNDATION COURSE CHEMISTRY-I

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours (Theory) and 2½ Hours (Practical)

UNIT-IV: States of Matter -I **(10 Hours)**

Gaseous State: Postulates of Kinetic Theory of Gases, Concept of Ideal & Non-ideal Gases, Ideal Gas equation, Deviation of gases from ideal behaviour, compressibility factor, causes of deviation and van der Waal's equation.

Molecular velocities: Root mean square, average and most probable velocities, Collision Theory- Collision number, mean free path and collision diameter.

Liquefaction of gases, Critical phenomenon, Critical constants and their calculations from van der Waal's equation.Andrew's isotherm of CO_2.

BOOKS RECOMMENDED:

1. Concise Inorganic Chemistry; J.D. Lee; 5thEdn., OUP/Wiley India Pvt. Limited, 2008.
2. Principles of Inorganic Chemistry; B.R. Puri, L.R. Sharma and K.C. Kalia; 33rdEdn., Milestone Publishers & Distributors/ Vishal Publishing Co., 2017.
3. Advanced General Organic Chemistry: A Modern Approach; S.K. Ghosh; 3rd Revised Edn., New Central, 2010.
4. Organic Chemistry; R.T. Morrison, R.N. Boyd, S. K. Bhattacharjee; 7th Edn., Pearson India, 2011.
5. Organic Chemistry; J. Clayden, N. Greeves and S. Warren, 2nd Edn., Oxford University Press, 2012.
6. Advanced Organic Chemistry; Dr.Jagdamba Singh and LDS Yadav; Pragati edition, 2017.
7. Principles of Physical Chemistry; B.R. Puri, L.R. Sharma and L.S. Pathania; 47thEdn.,Vishal Pubs & Co, 2017.
8. Physical Chemistry; T. Engel, P. Reid;3rdEdn., Pearson India, 2013.
9. Atkins' Physical chemistry; P. Atkins, J. De Paula and J. Keeler, 11th Edn., Oxford University Press, 2017.

NOTE FOR PAPER SETTING:

Note for paper setter for End Semester Examination:

The question paper will be of **60 marks**. There shall be **2 Sections** in the question paper with pattern as follows:

Section-A shall comprise of **4** short answer type questions of (**3** marks each) with one question from each unit. The students have to attempt all the questions from Section-A.

Section-B shall comprise of a total of **8** questions with two questions selected from each unit. Each question shall be of **12 marks**. The students have to attempt **4** questions selecting only one question from each unit.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2025, 2026 & 2027)

Semester-I
Course No.: UMJCHT101 (Major course)
Title: FOUNDATION COURSE CHEMISTRY-I

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours (Theory) and 2½ Hours (Practical)

The numerical problems should not exceed more than 20% of the maximum marks.

Note for paper setter for Mid Semester Examination:
The Mid Semester Examination shall be conducted by the course coordinator after completion of **50%** of the syllabus.
The question paper will be of **15** marks and duration of examination shall be 1 hour. There shall be **2** sections in the question paper with pattern as follows:
Section-A shall comprise of **3** questions (of **4** marks each) and the students are required to attempt any two questions.
Section-B shall comprise of **2** questions (of **7** marks each) and the students are required to attempt any one question.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2025, 2026 & 2027)

Semester-I
Course No.: UMJCHT101 (Major course)
Title: FOUNDATION COURSE CHEMISTRY-I

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours (Theory) and 2½ Hours (Practical)

Practical: 01 Credit **Contact Hours: 30 hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Preparation of standard solutions of different concentrations.
- Purification of organic compounds by different methods.
- Determination of extra elements present in the organic compound.

Suggested Experiments:

1. Preparation of solutions of different concentrations; Standardization of solutions (acids and bases).
2. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
3. Volumetric estimation of oxalic acid by titrating it with $KMnO_4$.
4. Purification of organic compounds by crystallization (from water and alcohol) and sublimation.
5. Criteria of purity: Determination of melting point/boiling point.
6. Detection of N, S and halogens in organic compounds.

BOOKS RECOMMENDED:

1. Comprehensive Practical Organic Chemistry: Qualitative analysis V. K. Ahluwalia&SunitaDhingra; Universities Press, India, 2004.
2. Advanced Practical Organic Chemistry; N. K. Vishnoi; 3rd Edn; Vikas Publishing, 2009.
3. Advanced Practical Physical Chemistry; J.B. Yadav; Krishna PrakashanMedia(P) Limited, 2015.
4. Advanced Physical Chemistry Experiments; J. N. Gurtu, A. Gurtu, PragatiPrakashan, 2008.

NOTE FOR PAPER SETTING:

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.	10 marks	
Final examination (to be conducted by the course coordinator internally)	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks= viva-voce examination)

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2025, 2026 & 2027)

Semester-I
Course No.: UMICHT102 (Minor course)
Title: FOUNDATION COURSE CHEMISTRY-I

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Theory: 03 Credits **Contact Hours: 45 hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Atomic Structure in terms of atomic orbitals and electronic configuration
- Periodic properties through periodic table
- Electronic displacement and bond cleavage in organic molecules
- Properties of Gaseous state

Unit-I: Structure of atom **(15 Hours)**
Recapitulation of Bohr's theory and its limitations. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance.
Schrödinger's wave equation (Elementary idea only), Significance of ψ and ψ^2.
Quantum numbers and their significance.Shapes of s, p and d orbitals. Rules governing electronic configuration in various atomic orbitals: Aufbau principle, Pauli's Exclusion Principle and Hund's rule of maximum multiplicity, Concept of exchange energy-extra stability of half-filled and fully filled electronic configurations.

Unit-II: Classifications of Elements and Periodic Properties **(10 Hours)**
Periodic Table- Classification of elements into s, p, d and f-blocks, Nuclear Charge, Effective Nuclear Charge, Shielding effect and their inter-relation i.e., Slater's Rule.
Concept, Variations and factors affecting various periodic properties (atomic/ionic radii, ionisation energy, electron affinity and electronegativity).

Unit-III: General Organic Chemistry **(10 Hours)**
Electronic Displacement: Inductive Effect, ElectromericEffect,Mesomeric Effect/Resonance andHyperconjugation, Polar and Non-Polar organic Molecules, Dipole moment and Hydrogen bonding.
Bond Cleavage: Homolytic and Heterolytic fission with suitable examples, formal charge,Concept of Electrophiles and Nucleophiles (with suitable examples).
Reactive Intermediates: Types, shape and relative stability of Carbocations, Carbanions and Free radicals.
Introduction to types of organic reactions: Addition, Elimination and Substitution reactions (Elementary idea only).

Semester-I
Course No.: UMICHT102 (Minor course)
Title: FOUNDATION COURSE CHEMISTRY-I

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Unit- IV: States of Matter -I **(10 Hours)**

Gaseous State: Kinetic Theory of Gases,Ideal& Non-ideal Gases, Ideal Gas equation, Deviation of gases from ideal behaviour, van der Waal's equation.

Molecular velocities: Root mean square, average and most probable velocities (basic concepts only). Collision Theory- Collision number, mean free path and collision diameter. Liquefaction of gases.

BOOKS RECOMMENDED:

1. Concise Inorganic Chemistry; J.D. Lee; 5th Edn., OUP/Wiley India Pvt. Limited, 2008.
2. Principles of Inorganic Chemistry; B.R. Puri, L.R. Sharma and K.C. Kalia; 33rd Edn., Milestone Publishers & Distributors/ Vishal Publishing Co., 2017.
3. Advanced General Organic Chemistry: A Modern Approach; S.K. Ghosh; 3rd Revised Edn., New Central, 2010.
4. Organic Chemistry; R.T. Morrison, R.N. Boyd, S. K. Bhattacharjee; 7th Edn., Pearson India, 2011.
5. Organic Chemistry; J. Clayden, N. Greeves and S. Warren, 2nd Edn., Oxford University Press, 2012.
6. Advanced Organic Chemistry; Dr.Jagdamba Singh and LDS Yadav; Pragati edition, 2017.
7. Principles of Physical Chemistry; B.R. Puri, L.R. Sharma and L.S. Pathania; 47th Edn.,Vishal Pubs & Co, 2017.
8. Physical Chemistry; T. Engel, P. Reid ;3rd Edn., Pearson India, 2013.
9. Atkins' Physical chemistry; P. Atkins, J. De Paula and J. Keeler, 11th Edn., Oxford University Press, 2017.

NOTE FOR PAPER SETTING:

Note for paper setter for End Semester Examination:

The question paper will be of **60 marks**. There shall be **2 Sections** in the question paper with pattern as follows:

Section-A shall comprise of **4** short answer type questions of (**3** marks each) with one question from each unit. The students have to attempt all the questions from Section-A.

Section-B shall comprise of a total of **8** questions with two questions selected from each unit. Each question shall be of **12 marks**. The students have to attempt **4** questions selecting only one question from each unit.

The numerical problems should not exceed more than 20% of the maximum marks.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2025, 2026 & 2027)

Semester-I
Course No.: UMICHT102 (Minor course)
Title: FOUNDATION COURSE CHEMISTRY-I

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Note for paper setter for Mid Semester Examination:
The Mid Semester Examination shall be conducted by the course coordinator after completion of **50%** of the syllabus.
The question paper will be of **15** marks and duration of examination shall be 1 hour. There shall be **2** sections in the question paper with pattern as follows:
Section-A shall comprise of **3** questions (of **4** marks each) and the students are required to attempt any two questions.
Section-B shall comprise of **2** questions (of **7** marks each) and the students are required to attempt any one question.

Semester-I
Course No.: UMICHT102 (Minor course)
Title: FOUNDATION COURSE CHEMISTRY-I

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Practical: 01 Credit **Contact Hours: 30 hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Preparation of standard solutions of different concentrations.
- Purification of organic compounds by different methods.
- Determination of extra elements present in the organic compound.

Suggested Experiments:

1. Preparation of solutions of different concentrations; Standardization of solutions (acids and bases).
2. Volumetric estimation of oxalic acid by titrating it with $KMnO_4$.
3. Purification of organic compounds by crystallization (from water and alcohol) and sublimation.
4. Criteria of purity: Determination of melting point/boiling point.
5. Detection of N, S and halogens in organic compounds.

BOOKS RECOMMENDED:

1. Comprehensive Practical Organic Chemistry: Qualitative analysis V. K. Ahluwalia, &SunitaDhingra; Universities Press, India, 2004.
2. Advanced Practical Organic Chemistry; N. K. Vishnoi; 3rd Edn; Vikas Publishing, 2009.
3. Advanced Practical Physical Chemistry; J.B. Yadav; Krishna PrakashanMedia(P) Limited, 2015.
4. Advanced Physical Chemistry Experiments; J. N. Gurtu, . A. Gurtu, PragatiPrakashan, 2008.

NOTE FOR PAPER SETTING:

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.	10 marks	
Final examination (to be conducted by the course coordinator internally)	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks= viva-voce examination)

Semester-I
Course No.: UMDCHT103 (Multi -Disciplinary Course)
Title: CHEMISTRY IN EVERYDAY LIFE

Credits: 03
Maximum Marks: 75
Contact Hours: 45 Hours
Duration of Examination: 3 Hours

Learning Objectives:

1. To understand the significance of chemistry in everyday life and its impact on health, food, and the environment.
2. To explore how various types of drugs function in the human body.
3. To understand the structure and importance of biomolecules.

Unit-I: Pharmaceuticals and Drug Classification (10 Hours)

Introduction:- Definition, Characteristics of a drug

Drug Classes and Examples:- Functions and examples (atleast two)each for Antacids, Antihistamines, and Neurological Active drugs (Tranquilizers & Analgesics-Non-narcotic and narcotics with special emphasis on Chitta a local name for Narcotic substance, NashaMuktAbhiyaan / Drug-Free Campaign), Antimicrobials (Antibiotics, Antifungal, Antiviral &Antiparasitic), anaesthetics (local and general).

Unit-II Cleansing Agents (10 Hours)

Soaps: Definition and types of soaps, saponification reaction, ineffectiveness of soap in hard water.

Synthetic detergents: Definition and classification of synthetic detergents (Anionic, Cationic and Non-ionic) with examples.

Unit-III: Biomolecules-I and Their Role in Health (10Hours)

Carbohydrates:- Definition, Classification:-Sugars and Non-Sugars; Monosaccharides, Oigosaccharides and Polysaccharides. Importance in energy and metabolism.

Proteins and Amino Acids:- Definition, Classification, importance in bodily functions, and denaturation.

Unit-IV: Biomolecules-II and Their Role in Health (15 Hours)

Vitamins:-Definition, Classification, sources and deficiency diseases (A, B-complex, C, D, E, and K).

Minerals:-Definition, Classification of minerals: Macro (major) and Micro (trace) minerals. Sources and deficiency diseases of Macro minerals (Calcium, Phosphorous, Magnesium, Potassium, chloride, Sulfur) sources and deficiency diseases of Micro minerals (Iron, Zinc, Copper, Iodine, Molybednum, selenium.Manganese).

Note: *In-depth structure discussion not required. Focus on their roles in health and well-being.*

Semester-I
Course No.: UMDCHT103 (Multi -Disciplinary Course)
Title: CHEMISTRY IN EVERYDAY LIFE

Credits: 03
Maximum Marks: 75
Contact Hours: 45 Hours
Duration of Examination: 3 Hours

BOOKS RECOMMENDED:

1. Thangamma Jacob, Textbook of Applied chemistry for home science and Allied Science, New Delhi, Macmillan Co., (1979).
2. Macmillan, 1st Ed., 1990. M. Swaminathan, Text Book on Food chemistry, Printing and Publishing Co., Ltd., Bangalore, 1993.
3. Alex Ramani, V., Food Chemistry, MJP Publishers, Triplicane, Chennai, 2009. 9. Sivasankar, B., Food Processing and Preservation, PHI Learning Private Limited, Delhi, 2013.
4. B. S. Bahl, A. Bhal, Textbook of Organic Chemistry, S. Chand and Company Ltd., New Delhi, 22nd Ed., 2016.
5. Organic Chemistry of Natural Products-Volume I and II by Gurdeep R Chatwal, Himalaya Publishing House.

NOTE FOR PAPER SETTING:

Note for paper setter for End Semester Examination:

The question paper will be of **60 marks**. There shall be **2 Sections** in the question paper with pattern as follows:

Section-A shall comprise of **4** short answer type questions of (3 marks each) with one question from each unit. The students have to attempt all the questions from Section-A.

Section-B shall comprise of a total of **8** questions with two questions selected from each unit. Each question shall be of **12 marks**. The students have to attempt **4** questions selecting only one question from each unit.

Note for paper setter for Mid Semester Examination:

The Mid Semester Examination shall be conducted by the course coordinator after completion of **50%** of the syllabus.

The question paper will be of **15** marks and duration of examination shall be 1½ hour. There shall be **2** sections in the question paper with pattern as follows:

Section-A shall comprise of **3** questions (of **4** marks each) and the students are required to attempt any two questions.

Section-B shall comprise of **2** questions (of **7** marks each) and the students are required to attempt any one question.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2025, 2026 & 2027)

Semester-I
Course No.: USECHT111 (Skill Enhancement Course)
Title: BASIC ANALYTICAL TECHNIQUES IN CHEMISTRY

Credits: 01 (Theory) + 02 (Skills)
Maximum Marks: 75 [25 (Theory) + 50 (Skills)]
Duration of Examination: 1½ Hours (Theory) and 3 Hours (Skills)

Part 1- Theory: 01 Credit **Contact Hours: 15 Hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Principles of the volumetry
- Various types of titrations.
- Normality, equivalent weight of compounds.
- Hardness and analysis of water.
- Purification and separation techniques in Organic Chemistry

Unit-I **(5 Hours)**
Titrimetric Analysis: definitions - standard solutions, equivalence point, end point, molarity, molality, normality, mole fraction, primary and secondary standards - types of titrimetric reactions - acid-base, redox, acid-base and redox indicators (External and Internal Indicators) Oxidation-reduction: oxidation number and oxidation states - equivalent weights of oxidizing and reducing agents.

Unit-II **(5 Hours)**
Water quality parameters: Introduction, Hard water and Softwater, Measurement of Hardness of Water, Water softening, Chemical Analysis (Dissolved Oxygen,Total Dissolved, suspended and volatile Solids, Chlorides contents, Free and available chlorine and chlorine demand), Battery water and its preparation.

Unit-III **(5 Hours)**
Distillation and Chromatographic Techniques: Introduction, Basic Distillation apparatus and Simple, Fractional and Steam Distillation.
Chromatographic techniques and types-Paper chromatography, Thin Layer chromatography and Column Chromatography. Separation of Mixtures and R_f value.

Semester-I
Course No.: USECHT111 (Skill Enhancement Course)
Title: BASIC ANALYTICAL TECHNIQUES IN CHEMISTRY

Credits: 01 (Theory) + 02 (Skills)
Maximum Marks: 75 [25 (Theory) + 50 (Skills)]
Duration of Examination: 1½ Hours (Theory) and 3 Hours (Skills)

Part 2- Skills: 02 Credit **Contact Hours: 60 Hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Preparation of standard solutions
- Practical applications of volumetric analysis

Suggested Experiments:

1. To prepare the primary and secondary standard solutions of different concentrations and standardize them.
2. To determine the strength of given solution of oxalic acid volumetrically given N/20 $KMnO_4$ solution.
3. To estimate the molecules of water of crystallization in given sample of Mohr's Salt provided N/20 $KMnO_4$ solution.
4. Preparation of Battery water.
5. Determination of chloride, available chloride and chlorine demand.
6. Determination of Suspended solid (SS),Total Dissolved solid (TDS), Total suspended solid (TSS) and Total volatile solids (TVS).
7. Identification and separation of components of a given mixture (amino acids and sugars) by paper chromatography.
8. To separate the mixture of two liquids of different boiling points (water and acetone) by simple distillation.
9. To determine the hardness of water using titration method with EDTA.
10. To separate volatile compounds (essential oil) from non volatile impurities usiong steam distillation.
11. Compare the hardness of water of different sources using EDTA titrartion method.
12. To separate the mixture of choloroform and aniline using distillation method.
13. Separation of mixture of sugars by thin layer chromatography.
14. Investigation of the effect of boiling on water hardness.
15. To study the effect of different soap solutions on the water hardness.

Semester-I
Course No.: USECHT111 (Skill Enhancement Course)
Title: BASIC ANALYTICAL TECHNIQUES IN CHEMISTRY

Credits: 01 (Theory) + 02 (Skills)
Maximum Marks: 75 [25 (Theory) + 50 (Skills)]
Duration of Examination: 1½ Hours (Theory) and 3 Hours (Skills)

BOOKS RECOMMENDED:
(Theory and Practicals)

1. P. L. Soni, Mohan Katyal, "Text book of Inorganic Chemistry", 20th Revised Ed., (2007), Sultan Chand & Sons, New Delhi. (UNIT I & II)
2. ShashiChawla, "A textbook of Engineering Chemistry,'' S.Chand.
3. Vogel's textbook of quantitative chemical analysis Mendham, John. Denney, Ronald C. Barnes, John D. Thomas, M., 7th Ed., Prentice Hall, New York, 6th Ed., 2000.
4. A K De,Environmental Chemistry, VIII Edition, New Age International Publishers.
5. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education,2012.
6. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson,2009.
7. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
8. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.

NOTE FOR PAPER SETTING:

Note for paper setter for Mid Term Examination:Part-1

The question paper will be of **25 marks**. There shall be **2 Sections** in the question paper with pattern as follows:

Section-A shall comprise of **4** short answer type questions of (2½marks each) covering all three units with atleast one question from each unit. The students have to attempt all the **4**questions from Section-A.

Section-B shall comprise of a total of **6** questions with two questions selected from each unit. Each question shall be of **5 marks**. The students have to attempt **3** questions selecting only one question from each unit.

EVALUATION OF SKILLS:*Final ExaminationPart-2*

The Evaluation of Skills will be internal. The Examination of Skills shall be of **50** marks. The evaluation of skills will be done internally through the Board of three Members (including the trainer of the Course).

Semester-II
Course No.: UMJCHT201 (Major course)
Title: FOUNDATION COURSE CHEMISTRY-II

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Theory: 03 Credits **Contact Hours: 45 hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Properties of liquid state
- Properties of solid state
- Ionic and covalent bonding
- Basics of organic stereochemistry

Unit-I: States of Matter–II **(10 Hours)**
Liquids: Intermolecular forces, vapour pressure and boiling point of liquids, viscosity and its determination by Ostwald's Viscometer, surface tension and its determination by stalagmometer, factors affecting viscosity and surface tension.
Liquid Crystals – Introduction and types (nematic, smectic and cholesteric) with examples.

Unit-II: States of Matter–III **(12 Hours)**
Solids: Characteristics of solids, Amorphous and crystalline solids, space lattice and unit cell, Primitive and centred unit cells, radius ratio rule, Structure of NaCl and CsCl, Closed Packed Structures (1D, 2D and 3D).
Symmetry Elements, Crystal Systems, Bravais lattice types and identification of Lattice planes. Laws of Crystallography- Law of constancy of interfacial angles, law of rational indices, miller indices, Bragg's Law.
Imperfections in solids-Types of point defects (Stoichiometric, non-stoichiometric and Impurity defects)

Unit-III: Chemical Bonding and Molecular Structure **(11 Hours)**
Ionic Bonding: General characteristics of ionic bond, Born-Haber cycle and its applications, lattice energy and solvation energy, polarizing power and polarizability- Fajan's rules and its applications. Dipole moment and percentage ionic character.
Covalent bonding: Postulates ofValence Bond theory and concept of Hybridization (sp, sp^2, sp^3, dsp^2, sp^3dand sp^3d^2). VSEPR Theory: Shapes of CH_4, NH_3,H_2O, SF_4andClF_3)
Molecular orbital theory (MOT)- rules for the LCAO method, Molecular orbital diagrams of homodiatomic molecules (N_2 and O_2) and heterodiatomic molecules (CO and NO). Comparison of VB and MO approaches.

Semester-II
Course No.: UMJCHT201 (Major course)
Title: FOUNDATION COURSE CHEMISTRY-II

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Unit-IV: Stereochemistry **(12 Hours)**

Conformational Isomerism: Conformations with respect to ethane, butane and cyclohexane. Representation of Flying-Wedge, Newmann, Sawhorse and Fischer projections and their interconversion. Concept of Chirality (upto two carbon atoms)

Configuration Isomerism: Relative(D/L) and Absolute (R/S) configurations upto two chiral carbon atoms, CIP rules, Geometrical isomerism (cis&trans; E/Z nomenclatures) and Optical isomerism, Enantiomerism, Diastereomerism and Meso compounds. Threo and erythro nomenclature.

BOOKS RECOMMENDED:

1. Concise Inorganic Chemistry; J.D. Lee; 5thEdn., OUP/Wiley India Pvt. Limited, 2008.
2. Principles of Inorganic Chemistry; B.R. Puri, L.R. Sharma and K.C. Kalia; 33rdEdn., Milestone Publishers & Distributors/ Vishal Publishing Co., 2017.
3. Principles of Physical Chemistry; B.R. Puri, L.R. Sharma and L.S. Pathania; 47thEdn., Vishal Pubs & Co, 2017.
4. Physical Chemistry; T. Engel, P. Reid,; 3rdEdn., Pearson India, 2013.
5. Atkins' Physical chemistry; P. Atkins, J. De Paula and J. Keeler, 11th Edn., Oxford University Press, 2017.
6. Organic Chemistry; J. Clayden, N. Greeves and S. Warren, 2ndEdn., Oxford University Press, 2012.
7. Stereochemistry of Organic Compounds: Principles and Applications; D. Nasipuri, 4thEdn. Kent, England: New Academic science Limited, 2013.
8. Advanced Organic Chemistry; Dr.Jagdamba Singh and LDS Yadav; Pragati edition, 2017.

NOTE FOR PAPER SETTING:

Note for paper setter for End Semester Examination:

The question paper will be of **60 marks**. There shall be **2 Sections** in the question paper with pattern as follows:

Section-A shall comprise of **4** short answer type questions of (**3** marks each) with one question from each unit. The students have to attempt all the questions from Section-A.

Section-B shall comprise of a total of **8** questions with two questions selected from each unit. Each question shall be of **12 marks**. The students have to attempt **4** questions selecting only one question from each unit.

The numerical problems should not exceed more than 20% of the maximum marks.

Semester-II
Course No.: UMJCHT201 (Major course)
Title: FOUNDATION COURSE CHEMISTRY-II

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Note for paper setter for Mid Semester Examination:
The Mid Semester Examination shall be conducted by the course coordinator after completion of **50%** of the syllabus.
The question paper will be of **15** marks and duration of examination shall be 1 hour. There shall be **2** sections in the question paper with pattern as follows:
Section-A shall comprise of **3** questions (of **4** marks each) and the students are required to attempt any two questions.
Section-B shall comprise of **2** questions (of **7** marks each) and the students are required to attempt any one question.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years May 2026, 2027 & 2028)

Semester-II
Course No.: UMJCHT201 (Major course)
Title: FOUNDATION COURSE CHEMISTRY-II

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Practical: 01 Credit **Contact Hours: 30 hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Measurement of density, surface tension and viscosity of different liquids.
- Synthesize and identify functional groups in different organic compounds.

Suggested Experiments:

1. Measurement of density and relative density of various liquids using pyknometer/density bottle.
2. Measurement of viscosity of given liquids using Ostwald Viscometer.
3. Measurement of Surface tension of a given liquid using stalagmometer.
4. Functional Group Identification: Aromatic hydrocarbons, carboxylic acids, carbonyl compounds, phenols, amides and nitro compounds.

BOOKS RECOMMENDED:

1. Comprehensive Practical Organic Chemistry: Qualitative analysis Ahluwalia, V.K. &SunitaDhingra; Universities Press, India, 2004.
2. Advanced Practical Organic Chemistry; N. K. Vishnoi; 3rdEdn; Vikas Publishing, 2009.
3. Advanced Practical Physical Chemistry; J.B. Yadav; Krishna Prakashan Media (P) Limited, 2015.
4. Selected Experiments in Physical Chemistry; Mukherjee N.G.&Ghosh, J.N.; S. Chand & Sons.
5. Advanced Physical Chemistry Experiments; J.N. Gurtu, A.Gurtu, PragatiPrakashan, 2008.
6. Experiments in Physical Chemistry; Das, R. C, and Behra, B.; Tata McGraw Hill.

NOTE FOR PAPER SETTING:

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.	10 marks	
Final examination (to be conducted by the course coordinator internally)	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks= viva-voce examination)

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years May 2026, 2027 & 2028)

Semester-II
Course No.: UMICHT202 (Minor course)
Title: FOUNDATION COURSE CHEMISTRY-II

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Theory: 03 Credits **Contact Hours: 45 hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Properties of liquid state
- Properties of solid state
- Ionic and covalent bonding
- Basics of organic stereochemistry

Unit-I: State of Matter –II **(10 Hours)**
Liquids: Properties of liquids- vapour pressure, boiling point, viscosity, surface tension, determination of viscosity by Ostwald's Viscometer, determination of surface tension by stalagmometer, factors affecting viscosity and surface tension.
Liquid Crystals – Introduction and types (nematic, smectic and cholesteric) with examples.

Unit-II: State of Matter –III **(12 Hours)**
Solids: Characteristics of solids, Amorphous and crystalline solids, space lattice and unit cell, Primitive and centred unit cells, radius ratio rule, Structure of NaCl and CsCl, Closed Packed Structures.
Imperfections in solids-Types of point defects (Stoichiometric, non-stoichiometric and Impurity defects)

Unit-III: Chemical Bonding and Molecular Structure **(11 Hours)**
Ionic Bonding: General characteristics of ionic bond, Born-Haber cycle and its applications, lattice energy and solvation energy, polarizing power and polarizability- Fajan's rules and its applications. Dipole moment and percentage ionic character.
Covalent bonding: Postulates of Valence Bond theory and concept of Hybridization (sp, sp^2, sp^3, dsp^2, sp^3dand sp^3d^2). VSEPR Theory: Shapes of CH_4, $NH_3$and H_2O).

Unit-IV: Stereochemistry **(12 Hours)**
Conformational Isomerism: Conformations of ethane, butane and cyclohexane. Representation of Flying-Wedge, Newmann, Sawhorse and Fischer projections.Concept of chirality.
Configuration Isomerism: Relative(D/L) and Absolute (R/S) configurations for one chiral carbon atom, CIP rules, Geometrical isomerism (cis& trans; E/Z nomenclatures) and Optical isomerism, Enantiomerism, Diastereomerism and Meso compounds.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years May 2026, 2027 & 2028)

Semester-II
Course No.: UMICHT202 (Minor course)
Title: FOUNDATION COURSE CHEMISTRY-II

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

BOOKS RECOMMENDED:

1. Concise Inorganic Chemistry; J.D. Lee; 5thEdn., OUP/Wiley India Pvt. Limited, 2008.
2. Principles of Inorganic Chemistry; B.R. Puri, L.R. Sharma and K.C. Kalia; 33rdEdn., Milestone Publishers & Distributors/ Vishal Publishing Co., 2017.
3. Principles of Physical Chemistry; B.R. Puri, L.R. Sharma and L.S. Pathania; 47th Edn., Vishal Pubs & Co, 2017.
4. Physical Chemistry; T. Engel, P. Reid,;3rdEdn., Pearson India, 2013.
5. Atkins' Physical chemistry; P. Atkins, J. De Paula and J. Keeler, 11th Edn., Oxford University Press, 2017.
6. Organic Chemistry; J. Clayden, N. Greeves and S. Warren, 2nd Edn., Oxford University Press, 2012.
7. Stereochemistry of Organic Compounds: Principles and Applications; D. Nasipuri, 4thEdn. Kent, England: New Academic science Limited, 2013.
8. Advanced Organic Chemistry; Dr.Jagdamba Singh and LDS Yadav; Pragati edition, 2017.

NOTE FOR PAPER SETTING:

Note for paper setter for End Semester Examination:

The question paper will be of **60 marks**. There shall be **2 Sections** in the question paper with pattern as follows:

Section-A shall comprise of **4** short answer type questions of (**3** marks each) with one question from each unit. The students have to attempt all the questions from Section-A.

Section-B shall comprise of a total of **8** questions with two questions selected from each unit. Each question shall be of **12 marks**. The students have to attempt **4** questions selecting only one question from each unit.

The numerical problems should not exceed more than 20% of the maximum marks.

Note for paper setter for Mid Semester Examination:

The Mid Semester Examination shall be conducted by the course coordinator after completion of **50%** of the syllabus.

The question paper will be of **15** marks and duration of examination shall be 1 hour. There shall be **2** sections in the question paper with pattern as follows:

Section-A shall comprise of **3** questions (of **4** marks each) and the students are required to attempt any two questions.

Section-B shall comprise of **2** questions (of **7** marks each) and the students are required to attempt any one question.

Semester-II
Course No.: UMICHT202 (Minor course)
Title: FOUNDATION COURSE CHEMISTRY-II

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Practical: 01 Credit **Contact Hours: 30 hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Measurement of density, surface tension and viscosity of different liquids.
- Synthesize and identify functional groups in different organic compounds.

Suggested Experiments:

1. Measurement of density and relative density of various liquids using pyknometer/density bottle.
2. Measurement of viscosity of given liquids using Ostwald Viscometer.
3. Measurement of Surface tension of a given liquid using stalagmometer.
4. Functional Group Identification: Aromatic hydrocarbons, carboxylic acids, carbonyl compounds, phenols and amides.

BOOKS RECOMMENDED:

1. Comprehensive Practical Organic Chemistry: Qualitative analysis Ahluwalia, V.K. &SunitaDhingra; Universities Press, India, 2004.
2. Advanced Practical Organic Chemistry; N. K. Vishnoi; 3rd Edn; Vikas Publishing, 2009.
3. Advanced Practical Physical Chemistry; J.B. Yadav; Krishna Prakashan Media (P) Limited, 2015.
4. Selected Experiments in Physical Chemistry; Mukherjee N.G.&Ghosh, J.N.; S. Chand & Sons.
5. Advanced Physical Chemistry Experiments; J.N. Gurtu, A.Gurtu, PragatiPrakashan, 2008.
6. Experiments in Physical Chemistry; Das, R. C, and Behra, B.; Tata McGraw Hill.

NOTE FOR PAPER SETTING:

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.	10 marks	
Final examination (to be conducted by the course coordinator internally)	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks= viva-voce examination)

Semester-II
Course No.: UMDCHT203 (Multi-Disciplinary Course)
Title: CHEMISTRY IN EVERYDAY LIFE

Credits: 03
Maximum Marks: 75
Contact Hours: 45 Hours
Duration of Examination: 3 Hours

Learning Objectives:

1. To understand the significance of chemistry in everyday life and its impact on health, food, and the environment.
2. To explore how various types of drugs function in the human body.
3. To understand the structure and importance of biomolecules.

Unit-I: Pharmaceuticals and Drug Classification (10 Hours)

Introduction:- Definition, Characteristics of a drug

Drug Classes and Examples:- Functions and examples (atleast two) each for Antacids, Antihistamines, and Neurological Active drugs (Tranquilizers & Analgesics-Non-narcotic and narcotics with special emphasis on Chitta a local name for Narcotic substance, NashaMuktAbhiyaan / Drug-Free Campaign), Antimicrobials (Antibiotics, Antifungal, Antiviral &Antiparasitic), anaesthetics (local and general).

Unit-II Cleansing Agents (10 Hours)

Soaps: Definition and types of soaps, saponification reaction, ineffectiveness of soap in hard water.

Synthetic detergents: Definition and classification of synthetic detergents (Anionic, Cationic and Non-ionic) with examples.

Unit-III: Biomolecules-I and Their Role in Health (10Hours)

Carbohydrates:- Definition, Classification:-Sugars and Non-Sugars; Monosaccharides, Oigosaccharides and Polysaccharides. Importance in energy and metabolism.

Proteins and Amino Acids:- Definition, Classification, importance in bodily functions, and denaturation.

Unit-IV: Biomolecules-II and Their Role in Health (15 Hours)

Vitamins:-Definition, Classification, sources and deficiency diseases (A, B-complex, C, D, E, and K).

Minerals:-Definition, Classification of minerals: Macro (major) and Micro (trace) minerals. Sources and deficiency diseases of Macro minerals (Calcium, Phosphorous, Magnesium, Potassium, chloride, Sulfur) sources and deficiency diseases of Micro minerals (Iron, Zinc, Copper, Iodine, Molybednum, selenium.Manganese).

Note: *In-depth structure discussion not required. Focus on their roles in health and well-being.*

Semester-II
Course No.: UMDCHT203 (Multi-Disciplinary Course)
Title: CHEMISTRY IN EVERYDAY LIFE

Credits: 03
Maximum Marks: 75
Contact Hours: 45 Hours
Duration of Examination: 3 Hours

BOOKS RECOMMENDED:

1. Thangamma Jacob, Textbook of Applied chemistry for home science and Allied Science, New Delhi, Macmillan Co., (1979).
2. Macmillan, 1st Ed., 1990. M. Swaminathan, Text Book on Food chemistry, Printing and Publishing Co., Ltd., Bangalore, 1993.
3. Alex Ramani, V., Food Chemistry, MJP Publishers, Triplicane, Chennai, 2009. 9. Sivasankar, B., Food Processing and Preservation, PHI Learning Private Limited, Delhi, 2013.
4. B. S. Bahl, A. Bhal, Textbook of Organic Chemistry, S. Chand and Company Ltd., New Delhi, 22nd Ed., 2016.
5. Organic Chemistry of Natural Products-Volume I and II by Gurdeep R Chatwal, Himalaya Publishing House.

NOTE FOR PAPER SETTING:

Note for paper setter for End Semester Examination:

The question paper will be of **60 marks**. There shall be **2 Sections** in the question paper with pattern as follows:

Section-A shall comprise of **4** short answer type questions of (3 marks each) with one question from each unit. The students have to attempt all the questions from Section-A.

Section-B shall comprise of a total of **8** questions with two questions selected from each unit. Each question shall be of **12 marks**. The students have to attempt **4** questions selecting only one question from each unit.

Note for paper setter for Mid Semester Examination:

The Mid Semester Examination shall be conducted by the course coordinator after completion of **50%** of the syllabus.

The question paper will be of **15** marks and duration of examination shall be 1½ hour. There shall be **2** sections in the question paper with pattern as follows:

Section-A shall comprise of **3** questions (of **4** marks each) and the students are required to attempt any two questions.

Section-B shall comprise of **2** questions (of **7** marks each) and the students are required toattempt any one question.

Semester-II
Course No.: USECHT211 (Skill Enhancement Course)
Title: CHEMISTRY OF SOAPS, DETERGENTS AND SURFACTANTS

Credits: 01 (Theory) + 02 (Skills)
Maximum Marks: 75 (25 (Theory) + 50 Hours (Skills))
Duration of Examination: 1½ Hours (Theory) and 3 Hours (Skills)

Part 1-Theory: 01 Credit **Contact Hours: 15Hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Cleaning agents and technology of soap
- Detergents and surfactants

Unit-1: Cleansing agents **(05 Hours)**
Introduction, Definition and purpose of cleansing agents,Types of cleansing agents applications of Natural cleaning agents, cleansing action, Floor cleaner, Toilet Cleaner, Bathroom Cleaner, Kitchen Cleaner. Environmental impact of cleansing agents

Unit-II: Soaps **(05 Hours)**
Introduction to soaps. Types of soaps-bathing, toilet soaps, antibacterial soaps, transparent soaps, liquid soaps.Chemistry and structure of soap, General principles of soap making, saponification reaction, Liquid hand wash and liquid dish wash.

Unit-III: Detergents and surfactants **(05 Hours)**
Introduction of surfactants; Types of surfactants.
Introduction; Different terms used in detergents, Types of detergents, Classification of detergents (anionic, cationic, nonionic, amphoterics), biodegradability.
Raw materials for detergents; Washing action of detergents.

Semester-II
Course No.: USECHT211 (Skill Enhancement Course)
Title: CHEMISTRY OF SOAPS, DETERGENTS AND SURFACTANTS

Credits: 01 (Theory) + 02 (Skills)
Maximum Marks: 75 (25 (Theory) + 50 Hours (Skills))
Duration of Examination: 1½ Hours (Theory) and 3 Hours (Skills)

Part 2-Skills: 02 Credit **Contact Hours: 60 Hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Preparation of soaps and detergents.
- Impact of soaps and detergents on surface tension of water.

Suggested Experiments:

1. Preparation of different types of soaps and Detergents.
2. Study the effect of the surfactants (soaps and detergents) on the surface tension of waters by using stalagmometer.
3. Determination of critical micelle concentration of different surfactants.
4. Determination of the Cleansing Action of Soap on Different Types of Water (Hard and Soft).
5. Comparative Study of the Foaming Capacity of Soaps and Synthetic Detergents.
6. Analysis of pH and Alkalinity of Soaps and Detergents.
7. Effect of Temperature on the Solubility and Foaming of Surfactants.
8. Preparation and Study of Emulsifying Properties of Soaps and Detergents.
9. Effect of Water Hardness on the Efficiency of Soaps and Detergents.
10. Qualitative Analysis of Surfactants Present in Commercial Detergents.
11. Biodegradability Test of Soaps and Detergents Using BOD (Biochemical Oxygen Demand) Method (Demonstration).

BOOKS RECOMMENDED:
(Theory and Practicals)

1. Handbook on Soaps, Detergents & Acid Slurry by NIIR Board, Asia Pacific Business Press.
2. Small scale industries and house hold industries in developing economy by Shetty M.C.
3. Surface Active Agents & Detergents by Anthony M. Schwartz, James W. Perry & Julian Berch, Interscience Publishers
4. The Complete Technology Book on Soaps by NIIR Board, Asia Pacific Business Press.
5. The Complete Technology Book on Detergents by NIIR Board, Asia Pacific Business Press.
6. Shreve's Chemical Process Industries by George T. Austin Vol. V, McGraw-Hill.

Semester-II
Course No.: USECHT211 (Skill Enhancement Course)
Title: CHEMISTRY OF SOAPS, DETERGENTS AND SURFACTANTS

Credits: 01 (Theory) + 02 (Skills)
Maximum Marks: 75 (25 (Theory) + 50 Hours (Skills))
Duration of Examination: 1½ Hours (Theory) and 3 Hours (Skills)

NOTE FOR PAPER SETTING:

Note for paper setter for Mid Term Examination:Part-1

The question paper will be of **25 marks**. There shall be **2 Sections** in the question paper with pattern as follows:

Section-A shall comprise of **4** short answer type questions of (2½marks each) covering all three units with atleast one question from each unit. The students have to attempt all the **4**questions from Section-A.

Section-B shall comprise of a total of **6** questions with two questions selected from each unit. Each question shall be of **5 marks**. The students have to attempt **3** questions selecting only one question from each unit.

EVALUATION OF SKILLS:*Final ExaminationPart-2*

The Evaluation of Skills will be internal. The Examination of Skills shall be of **50** marks. The evaluation of skills will be done internally through the Board of three Members (including the trainer of the Course).

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2026, 2027 & 2028)

Semester-III
Course No.: UMJCHT-301 (Major course)
Title: FOUNDATION COURSE CHEMISTRY-III

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Theory: 03 Credits **Contact Hours: 45 hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Chemistry of saturated, unsaturated Aliphatic and aromatic Hydrocarbons
- Concept of thermodynamics
- Chemistry of s and p Block Elements

Unit-I: Chemistry of saturated and unsaturated Aliphatic Hydrocarbons **(13 Hours)**

a)Chemistry of Alkanes :Nomenclature upto 5 carbon atoms. Formation of alkanes by Wurtz Reaction, Wurtz Fitting Reaction, Free Radical Substitution in alkanes, Halogenation : Relative reactivity and selectivity.

b)Chemistry of Alkenes and Alkynes:

Formation of Alkenes:Nomenclatureupto 5 carbon atoms.E1, E2, E1cB reactions, Hoffmann Elimination and Saytzeff rule.

Addition of Halogen to alkenes: Carbocation and Halonium ion Mechanism. Ozonolysis of Propene with Mechanism. Addition of Hydrogen halides to alkenes with mechanism, Markownikoff'srule Addition of HBr to Propene (Peroxide Effect/Anti-Markownikoff addition), Syn and Anti Addition Hydrogenation.

Alkynes: Acidity of Alkynes, Alkylation of terminal Alkynes, hydrogenation and hydration of Alkynes

Relative Reactivity of Alkenes and Alkynes

c) Butadiene: 1,2 and 1,4 addition reaction of butadiene

d) Cycloalkanes (upto Cyclohexane) : Nomenclature, Methods of Preparation. Stability of Cycloalkanes: Bayer Strain Theory

Unit-II: Aromatic hydrocarbons **(10 Hours)**

Concept of Aromaticity: Benzenoids and Hückel's rule, **Structure of Benzene**: Kekulestructures, Resonance and Molecular Orbital Theory.

Preparation (Case Benzene): from Phenol, from Acetylene, from Benzene sulphonic acid, by decarboxylation.

Reactions: (Case Benzene): General mechanism of Electrophilic Substitution reactions, σ and π complexes, Nitration, Halogenation and Sulphonation.

Friedel-Craft's reaction : alkylation (upto 3 carbons on benzene)and **acylation**

Side chain oxidation of alkyl benzenes (upto 3 carbons on benzene).

Activating and Deactivating groups, Orientation effect, Ortho-para ratio

Aromatic nucleophilic Substitution (S_NAr) with mechanism.

Semester-III
Course No.: UMJCHT-301 (Major course)
Title: FOUNDATION COURSE CHEMISTRY-III

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Unit-III: Thermodynamics-I **(11 Hours)**

Definition of thermodynamics terms: system, surroundings, boundary. Types of system, Thermodynamic variables, intensive and extensive properties.State and path functions.Thermodynamic equilibrium.Thermodynamic process.Concept of heat and work.
First Law of Thermodynamics: Statement and our daily life examples, internal energy and its physical significance. Heat change at constant volume, heat change at constant pressure: Enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship.Variation of internal energy with temperature and volume, Joules law.Variation of enthalpy with temperature and pressure, Joule-Thomson coefficient and inversion temperature.

Unit-IV: Chemistry of s and p Block Elements-I **(11 Hours)**

Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation.Complex formation tendency of s and p block elements.Hydrides and their classification (ionic, covalent and interstitial).Preparation, structure and bonding of borohydrides (diborane).

BOOKS RECOMMENDED:

1. Morrison, R.N., Boyd, R.N.' Bhattacharjee, S.k. (2010) Organic Chemistry.
2. Finar, I.L. (2002) Organic Chemistry Volume I, II, 6th Edition Pearson Education.
3. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
4. Sykes, P.A. Guidebook to Mechanism in Organic Chemistry, Orient Longman, Longman, New Delhi (1988).
5. Bahl, A. &Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
6. R.P. Rastogi, R.R. Misra. Sixth Revised Edition. Vikas Publishing House Pvt. Ltd.
7. Bell, R. P., Proton in Chemistry, 2nd Ed., Chapmaon Hall, (1973).
8. Drago, R. S., Modern Approach to Acid base Chemistry, J. C.Chem. Educ., 51, 300 (1974).
9. Gillespie, R. R., Proton acids, Lewis acids, hard acids, soft acids and super acids. Chapman and Hall (1975).
10. Jensen, W.B., The Lewis Acid-Base Concepts, Wiley, New York (1980).
11. Nicholls, D. Inorganic Chemistry in Liquid Ammonia, Elsevier (1979).
12. Pearson, R. G., Ed., Hard and Soft Acids and Bases, Dowden, Hutchinson (1973).

Semester-III
Course No.: UMJCHT-301 (Major course)
Title: FOUNDATION COURSE CHEMISTRY-III

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

NOTE FOR PAPER SETTING:

Note for paper setter for End Semester Examination:

The question paper will be of **60 marks**. There shall be **2 Sections** in the question paper with pattern as follows:

Section-A shall comprise of **4** short answer type questions of (**3** marks each) with one question from each unit. The students have to attempt all the questions from Section-A.

Section-B shall comprise of a total of **8** questions with two questions selected from each unit. Each question shall be of **12 marks**. The students have to attempt **4** questions selecting only one question from each unit.

The numerical problems should not exceed more than 20% of the maximum marks.

Note for paper setter for Mid Semester Examination:

The Mid Semester Examination shall be conducted by the course coordinator after completion of **50%** of the syllabus.

The question paper will be of **15** marks and duration of examination shall be 1 hour. There shall be **2** sections in the question paper with pattern as follows:

Section-A shall comprise of **3** questions (of **4** marks each) and the students are required to attempt any two questions.

Section-B shall comprise of **2** questions (of **7** marks each) and the students are required to attempt any one question.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2026, 2027 & 2028)

Semester-III
Course No.: UMJCHT-301 (Major course)
Title: FOUNDATION COURSE CHEMISTRY-III

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Practical: 01 Credit **Contact Hours: 30 Hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Qualitative analysis of common organic compounds
- Determination of heat capacity and heat of neutralization
- Semi-micro qualitative analysis of cations and anions

Suggested Experiments:

Section A: Organic Chemistry:
Qualitative analysis of following Organic Compounds:
1. Naphthalene
2. Anthracene
3. Benzoic Acid
4. Salicylic Acid
5. Glucose
6. Sucrose
7. Catechol
8. Resorcinol
9. Salicylaldehyde
10. Acetophenone
11. Benzophenone
12. P-aminobenzoic
13. Urea
14. Thiourea
14. Acetamide
15. Benzamide

(Note: Any 05 to 07compounds to be analysed in a semester)

Section B: Physical Chemistry:
1. Determination of heat capacity of calorimeter.
2. Determination of heat of neutralization hydrochloric acid with sodium hydroxide.

Section C: Inorganic Chemistry:
Semi-micro qualitative analysis using H_2S of mixtures of salts (not more than four ionic species, two anions and two cations and excluding insoluble salts) out of the following:
Cations : NH_4^+, Pb^{2+}, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Cr^{3+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, K^+.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2026, 2027 & 2028)

Semester-III
Course No.: UMJCHT-301 (Major course)
Title: FOUNDATION COURSE CHEMISTRY-III

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Anions : CO_3^{2-}, $S_2O_3^{2-}$, NO_3^-, $CH3COO^-$, Cl^-, NO_3^-,SO_4^{2-}, $C_2O_4^{2-}$ (Students should be encouraged to perform Spot tests wherever feasible)

BOOKS RECOMMENDED:

1. Vogel's Textbook of Practical Organic Chemistry, Brian S. Furniss, Antony J. Hannaford, Peter W. G. Smith, Austin R. Tatchell. Pearson, 5th Edition, 2012.
2. Man,F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson education (2009).
3. Practical Physical Chemistry; Khosla, B. D.; Garg, V. C. &Gulati, A.; R. Chand & Co.; 2011.
4. Experiments in Physical Chemistry; Das, R. C, and Behra, B.; Tata McGraw Hill.
5. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
6. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.

NOTE FOR PAPER SETTING:

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.	10 marks	
Final examination (to be conducted by the course coordinator internally)	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks= viva-voce examination)

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2026, 2027 & 2028)

Semester-III
Course No.: UMJCHT-302 (Major course)
Title: ANALYTICAL CHEMISTRY

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Theory: 03 Credits **Contact Hours: 45 hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Basics of analytical Chemistry
- Acid-base, complexometric, precipitation and redox titrations
- Chromatographic methods

Unit-I: Basics of Analytical chemistry **(12 Hours)**

Classification of analytical techniques. Choice of analytical method chosen: accuracy, precision, sensitivity, selectivity and method validation. Limit of detection (LOD), Limit of quantification (LOQ), Limitations of analytical methods – Errors: Determinate and indeterminate errors, absolute error, relative error, minimization of errors.
Rules of fire prevention and accidents, First aid, Precautions to be taken while handling toxic chemicals, concentrated/fuming acids and organic solvents.

Unit-II: Acid-base and complexometricTitrimetry **(11 Hours)**

Basic principle and Classification of titrimetric analysis.
Acid-base titrimetry: Titration curves for strong acid vs strong base, weak acid vs strong base and weak base vs strong acid titrations. Titration curves, Quantitative applications – selecting and standardizing a titrant.
Complexometrictitrimetry: Indicators for EDTA titrations- theory of metal ion indicators, Application-determination of hardness of water.

Unit-III: Redox and Precipitation Titrimetry and Gravimetric Analysis **(11 Hours)**

Redox titrimetry: Derivation of the equilibrium constant of redox reactions, titration curves, Theory of redox indicators, calculation of standard potentials using Nernst equation and its applications.
Precipitation titrimetry: Titration curves, titrants and standards, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences.
Gravimetric Analysis: Principle and mechanism of precipitation, Factors influencing precipitation, Co-precipitation, post-precipitation, Advantages of organic reagents over inorganic reagents, Importance of reagents used in gravimetry [8-hydroxyquinoline (oxine) and dimethyl glyoxime (DMG)].

Unit-IV: Chromatographic Methods **(11 Hours)**

Classification of chromatographic methods: Principles of differential migration, description of

Semester-III
Course No.: UMJCHT-302 (Major course)
Title: ANALYTICAL CHEMISTRY

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Chromatographic process, distribution coefficients, capacity factor, column efficiency and resolution, Techniques of sample preparation in chromatography.
Brief overview of paper chromatography (detections of spots, retardation factors, factors that affect reproducibility of R_f values) and Thin Layer Chromatography (Stationary phase, adsorbents, liquid phase support, plate preparation, mobile phase, sample application, development, detection of spot, R_f values).

NOTE FOR PAPER SETTING:

Note for paper setter for End Semester Examination:
The question paper will be of **60 marks**. There shall be **2 Sections** in the question paper with pattern as follows:
Section-A shall comprise of **4** short answer type questions of (**3** marks each) with one question from each unit. The students have to attempt all the questions from Section-A.
Section-B shall comprise of a total of **8** questions with two questions selected from each unit. Each question shall be of **12 marks**. The students have to attempt **4** questions selecting only one question from each unit.
The numerical problems should not exceed more than 20% of the maximum marks.

Note for paper setter for Mid Semester Examination:
The Mid Semester Examination shall be conducted by the course coordinator after completion of **50%** of the syllabus.
The question paper will be of **15** marks and duration of examination shall be 1 hour. There shall be **2** sections in the question paper with pattern as follows:
Section-A shall comprise of **3** questions (of **4** marks each) and the students are required to attempt any two questions.
Section-B shall comprise of **2** questions (of **7** marks each) and the students are required to attempt any one question.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2026, 2027 & 2028)

Semester-III
Course No.: UMJCHT-302 (Major course)
Title: ANALYTICAL CHEMISTRY

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Practical: 01 Credit **Contact Hours: 30 Hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Separation of organic compounds and transition metal ions by chromatographic methods
- Use of complexometric, redox and acid-base titrations in practical applications

Suggested Experiments:

1. Basic laboratory practices: calibration of glassware (pipette, burette and volumetric flask), sampling (solids and liquids), weighing, drying, dissolving, acid treatment, safety in chemical.
2. Separation of ortho- & para-nitrophenol and o- and p-aminophenol by thin layer chromatography (TLC) and calculation of their R_f values.
3. Preparation of EDTA solution and estimation of hardness ($CaCO_3$) of two different samples of water.
4. Preparation of standard Na_2CO_3 solution, standardization of given HCl solution and estimation of alkali present in given antacid.
5. Estimation of Cu(II) using sodium thiosulphate solution (Iodometrically).
6. Estimation of $K_2Cr_2O_7$ using sodium thiosulphate solution (Iodometrically).

BOOKS RECOMMENDED:

1. Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons, 1989.
2. Willard, H. H., Merritt, L.L., Dean, J. & Settle, F.A. Instrumental Methods of Analysis, Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
3. Christian, G.D; Analytical Chemistry, VI Ed. John Wiley & Sons, New York, 2004.
4. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
5. Skoog, D. A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed, 2017.
6. Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand, 1974.
7. Fifield, F.W.; Kealey, D. (2000), Principles and Practice of Analytical Chemistry, Wiley.
8. Harris, D. C. (2007), Exploring Chemical Analysis, W.H. Freeman and Co.
9. Harris, D. C. (2007), Quantitative Chemical Analysis, 6th Edition, Freeman.
10. Mikes, O. (2000), Laboratory Handbook of Chromatographic methods, D. Van Nostrand Company Inc.

Semester-III
Course No.: UMJCHT-302 (Major course)
Title: ANALYTICAL CHEMISTRY

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

NOTE FOR PAPER SETTING:

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.	10 marks	
Final examination (to be conducted by the course coordinator internally)	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks= viva-voce examination)

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2026, 2027 & 2028)

Semester-III
Course No.: UMICHT-303 (Minor course)
Title: FOUNDATION COURSE CHEMISTRY-III

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Theory: 03 Credits **Contact Hours: 45 hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Chemistry of saturated, unsaturated Aliphatic and aromatic Hydrocarbons
- Concept of thermodynamics
- Chemistry of s and p Block Elements

Unit-I : Chemistry of saturated and unsaturated Aliphatic Hydrocarbons (13 Hours)
a)Chemistry of Alkanes: Nomenclature upto 5 C-atoms. Formation of alkanes by Wurtz Reaction , Wurtz Fitting Reaction, Free Radical Substitution in alkanes, Halogenation : Relative reactivity and selectivity.
b)Chemistry of Alkenes and Alkynes: Nomenclature upto 5 C-atoms.
Formation of Alkenes by E1, E2, E1cB reactions , Hoffmann Elimination and Saytzeff rule. Addition of Halogen to alkenes.Ozonolysis of Propene with Mechanism. Addition of Hydrogen halides to alkenes with mechanism, Markownikoff's rule, Addition of HBr to Propene (Peroxide Effect/Anti-Markownikoff addition), Syn and Anti Addition Hydrogenation.
Alkynes : Acidity of Alkynes, Alkylation of terminal Alkynes, hydrogenation and hydration of Alkynes, Relative Reactivity of Alkenes and Alkynes.

Unit-II : Aromatic hydrocarbons (10 Hours)
Concept of Aromaticity: Benzenoids and Hückel's rule, **Structure of Benzene**: Kekule Structures, Structure of Benzene on the basis of Resonance and Molecular Orbital Theory. Concept of resonance energy.
Preparation (Benzene): from Phenol, from Acetylene, from Benzene sulphonic acid, by decarboxylation.
Reactions: (Benzene): General mechanism of Electrophilic Substitution reactions, Nitration, Halogenation and Sulphonation (Mechanism not required).
Friedel-Craft's reaction : alkylation (upto 3 carbons on benzene) and acylation.

Unit-III: Thermodynamics-I (11 Hours)
Definition of thermodynamics terms: system, surroundings, boundary. Types of system, Thermodynamic variables, intensive and extensive properties.State and path functions.Thermodynamicequilibrium.Thermodynamicprocess.Concept of heat and work.
First Law of Thermodynamics: Statement and our daily life examples, internal energy and its physical significance. Heat change at constant volume, heat change at constant pressure: Enthalpy. Heat capacity, heat capacities at constant volume and pressure and their

Semester-III
Course No.: UMICHT-303 (Minor course)
Title: FOUNDATION COURSE CHEMISTRY-III

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

relationship.Variation of internal energy with temperature and volume.Variation of enthalpy with temperature and pressure.Entropy and its significance.2nd Law of thermodynamics.

Unit-IV Chemistry of s and p Block Elements – I (11 Hours)
Electronic configuration of s & p block elements, Relative stability of different oxidation states,Inert pair effect, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation.Complex formation tendency of s and p block elements.Hydrides and their classification (ionic, covalent and interstitial).Preparation, structure and bonding of borohydrides (diborane).

BOOKS RECOMMENDED:

1. Morrison, R.N., Boyd, R.N.' Bhattacharjee, S.K. (2010) Organic Chemistry.
2. Finar, I.L. (2002) Organic Chemistry Volume I, II , 6th Edition, Pearson Education.
3. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed., Cengage Learning India Edition, 2013.
4. Sykes, P.A. Guidebook to Mechanism in Organic Chemistry, Orient Longman, Longman, New Delhi (1988).
5. Bahl, A. &Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
6. R.P. Rastogi, R.R. Misra. Sixth Revised Edition. Vikas Publishing House Pvt. Ltd.
7. Bell, R. P. , Proton in Chemistry , 2nd Ed., Chapmaon Hall, (1973).
8. Drago, R. S., Modern Approach to Acid base Chemistry, J. C.Chem. Educ., 51, 300 (1974).
9. Gillespie, R. R., Proton acids, Lewis acids, hard acids, soft acids and super acids. Chapman and Hall (1975).
10. Jensen, W.B., The Lewis Acid-Base Concepts, Wiley, New York (1980).
11. Nicholls, D. Inorganic Chemistry in Liquid Ammonia, Elsevier (1979).
12. Pearson, R. G., Ed., Hard and Soft Acids and Bases, Dowden, Hutchinson (1973).

NOTE FOR PAPER SETTING:

Note for paper setter for End Semester Examination:
The question paper will be of **60 marks**. There shall be **2 Sections** in the question paper with pattern as follows:
Section-A shall comprise of **4** short answer type questions of (**3** marks each) with one question from each unit. The students have to attempt all the questions from Section-A.
Section-B shall comprise of a total of **8** questions with two questions selected from each unit. Each question shall be of **12 marks**. The students have to attempt **4** questions selecting only one question from each unit.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2026, 2027 & 2028)

Semester-III
Course No.: UMICHT-303 (Minor course)
Title: FOUNDATION COURSE CHEMISTRY-III

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

The numerical problems should not exceed more than 20% of the maximum marks.

Note for paper setter for Mid Semester Examination:
The Mid Semester Examination shall be conducted by the course coordinator after completion of **50%** of the syllabus.
The question paper will be of **15** marks and duration of examination shall be 1 hour. There shall be **2** sections in the question paper with pattern as follows:
Section-A shall comprise of **3** questions (of **4** marks each) and the students are required to attempt any two questions.
Section-B shall comprise of **2** questions (of **7** marks each) and the students are required to attempt any one question.

Semester-III
Course No.: UMICHT-303 (Minor course)
Title: FOUNDATION COURSE CHEMISTRY-III

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Practical: 01 Credit **Contact Hours: 30 Hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Qualitative analysis of common organic compounds
- Determination of heat capacity and heat of neutralization
- Semi-micro qualitative analysis of cations and anions

Suggested Experiments:

Section A: Organic Chemistry :
Qualitative analysis of following Organic Compounds :
1. Naphthalene
2. Anthracene
3. Benzoic Acid
4. Oxalic Acid
5. Salicylic Acid
6. Sucrose
7. Catechol
8. Resorcinol
9. Salicylaldehyde
10. Acetophenone
11. Benzophenone
12. P-aminobenzoic acid
13. p-chlorobenzoic acid
14. Thiourea
15. Acetamide
16. Benzamide

(Note : Any 05compounds to be analysed in a semester)

Section B: Physical Chemistry :
1. Determination of heat capacity of calorimeter.
2. Determination of heat of neutralization hydrochloric acid with sodium hydroxide.
3. Determination of heat of neutralization acetic acid with sodium hydroxide.

Section C: Inorganic Chemistry :
Semi-micro qualitative analysis using H_2S of mixtures of salts (not more than four ionic species, two anions and two cations and excluding insoluble salts) out of the following:

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2026, 2027 & 2028)

Semester-III
Course No.: UMICHT-303 (Minor course)
Title: FOUNDATION COURSE CHEMISTRY-III

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 Hours (Theory) and 2½ Hours (Practical)

Cations : NH_4^+, Pb^{2+}, Cu^{2+}, Cd^{2+},Fe^{3+}, Al^{3+}, Co^{2+} , Cr^{3+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}.
Anions : CO_3^{2-}, NO_3^-, CH_3COO^-, Cl^-, NO_3^-,SO_4^{2-} (Students should be encouraged to perform Spot tests wherever feasible)

BOOKS RECOMMENDED:

1. Vogel's Textbook of Practical Organic Chemistry, Brian S. Furniss, Antony J. Hannaford, Peter W. G. Smith, Austin R. Tatchell. Pearson 5th Edition, 2012.
2. Man,F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson education (2009).
3. Practical Physical Chemistry; Khosla, B. D.; Garg, V. C. &Gulati, A.; R. Chand & Co.; 2011.
4. Experiments in Physical Chemistry; Das, R. C, and Behra, B.; Tata McGraw Hill.
5. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
6. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.

NOTE FOR PAPER SETTING:

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.	10 marks	
Final examination (to be conducted by the course coordinator internally)	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks= viva-voce examination)

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2026, 2027 & 2028)

Semester-III
Course No.: UMDCHT-304 (Multi-Disciplinary Course)
Title: CHEMISTRY IN EVERYDAY LIFE

Credits: 03
Maximum Marks: 75
Contact Hours: 45 Hours
Duration of Examination: 3 Hours

Learning Objectives:

1. To understand the significance of chemistry in everyday life and its impact on health, food, and the environment.
2. To explore how various types of drugs function in the human body.
3. To understand the structure and importance of biomolecules.

Unit-I: Pharmaceuticals and Drug Classification (10 Hours)
Introduction:- Definition, Characteristics of a drug
Drug Classes and Examples:- Functions and examples (atleast two) each for Antacids, Antihistamines, and Neurological Active drugs (Tranquilizers & Analgesics-Non-narcotic and narcotics with special emphasis on Chitta a local name for Narcotic substance, NashaMuktAbhiyaan / Drug-Free Campaign), Antimicrobials (Antibiotics, Antifungal, Antiviral &Antiparasitic), anaesthetics (local and general).

Unit-II Cleansing Agents (10 Hours)
Soaps: Definition and types of soaps, saponification reaction, ineffectiveness of soap in hard water.
Synthetic detergents: Definition and classification of synthetic detergents (Anionic, Cationic and Non-ionic) with examples.

Unit-III: Biomolecules-I and Their Role in Health (10Hours)
Carbohydrates:- Definition, Classification:-Sugars and Non-Sugars; Monosaccharides, Oigosaccharides and Polysaccharides. Importance in energy and metabolism.
Proteins and Amino Acids:- Definition, Classification, importance in bodily functions, and denaturation.

Unit-IV: Biomolecules-II and Their Role in Health (15 Hours)
Vitamins:-Definition, Classification, sources and deficiency diseases (A, B-complex, C, D, E, and K).
Minerals:-Definition, Classification of minerals: Macro (major) and Micro (trace) minerals. Sources and deficiency diseases of Macro minerals (Calcium, Phosphorous, Magnesium, Potassium, chloride, Sulfur) sources and deficiency diseases of Micro minerals (Iron, Zinc, Copper, Iodine, Molybednum, selenium.Manganese).
Note: *In-depth structure discussion not required. Focus on their roles in health and well-being.*

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2026, 2027 & 2028)

Semester-III
Course No.: UMDCHT-304 (Multi-Disciplinary Course)
Title: CHEMISTRY IN EVERYDAY LIFE

Credits: 03
Maximum Marks: 75
Contact Hours: 45 Hours
Duration of Examination: 3 Hours

BOOKS RECOMMENDED:

1. Thangamma Jacob, Textbook of Applied chemistry for home science and Allied Science, New Delhi, Macmillan Co., (1979).
2. Macmillan, 1st Ed., 1990. M. Swaminathan, Text Book on Food chemistry, Printing and Publishing Co., Ltd., Bangalore, 1993.
3. Alex Ramani, V., Food Chemistry, MJP Publishers, Triplicane, Chennai, 2009. 9. Sivasankar, B., Food Processing and Preservation, PHI Learning Private Limited, Delhi, 2013.
4. B. S. Bahl, A. Bhal, Textbook of Organic Chemistry, S. Chand and Company Ltd., New Delhi, 22nd Ed., 2016.
5. Organic Chemistry of Natural Products-Volume I and II by Gurdeep R Chatwal, Himalaya Publishing House.

NOTE FOR PAPER SETTING:

Note for paper setter for End Semester Examination:

The question paper will be of **60 marks**. There shall be **2 Sections** in the question paper with pattern as follows:

Section-A shall comprise of **4** short answer type questions of (3 marks each) with one question from each unit. The students have to attempt all the questions from Section-A.

Section-B shall comprise of a total of **8** questions with two questions selected from each unit. Each question shall be of **12 marks**. The students have to attempt **4** questions selecting only one question from each unit.

Note for paper setter for Mid Semester Examination:

The Mid Semester Examination shall be conducted by the course coordinator after completion of **50%** of the syllabus.

The question paper will be of **15** marks and duration of examination shall be 1½ hour. There shall be **2** sections in the question paper with pattern as follows:

Section-A shall comprise of **3** questions (of **4** marks each) and the students are required to attempt any two questions.

Section-B shall comprise of **2** questions (of **7** marks each) and the students are required toattempt any one question.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2026, 2027 & 2028)

Semester-III
Course No.: USECHT-311 (Skill Enhancement Course)
Title: CHEMISTRY OF FOOD AND COSMETICS

Credits: 01 (Theory) + 02 (Skills)
Maximum Marks: 75 [25 (Theory) + 50 (Skills)]
Duration of examination: 1½ Hours (Theory) and 3 Hours (Skills)

Part 1-Theory: 01 Credit **Contact Hours: 15 Hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Food Preservation and Food Adulteration
- ChemistryofCosmetics

Unit-I: Food Preservation andFood Adulteration **(05 Hours)**
Principles of Food Preservation: Meaning, mode of action and changes in foods.
Traditional methods of Food Preservation: Smoking, Sun Drying, Pickling and Fermentation.
Food Adulteration: Common adulterants in different foods- milk and milk products, vegetable oils, and fats, spices and condiments, cereals, pulses.
Sweetening agents and beverages.
Contamination with toxic chemicals- pesticides and insecticides. Methods involved in the detection and prevention of food adulteration.

Unit-II: Chemistry of Cosmetics **(05 Hours)**
Types of cosmetics, Role of chemistry in cosmetics formulation, Historyofcosmetics and their development. Key ingredients and their functions in cosmetics, Safety and Regulatory aspects in cosmetics formulation.

Unit-III: Cosmetic Products **(05 Hours)**
Classificationofcosmetics, a general study including preparation and uses of the following: Hair dye, hair spray, shampoo, suntan lotions, sun screen, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), moisturizers, cleansers, acneand anti aging creams.

Semester-III
Course No.: USECHT-311 (Skill Enhancement Course)
Title: CHEMISTRY OF FOOD AND COSMETICS

Credits: 01 (Theory) + 02 (Skills)
Maximum Marks: 75 [25 (Theory) + 50 (Skills)]
Duration of examination: 1½ Hours (Theory) and 3 Hours (Skills)

Part 2- Skills: 02 Credit **Contact Hours: 60 Hours**

Course learning outcomes:
After completing this course contents, students will be able to understand

- Methods of preparation of shampoo, face cream, soap and lip balm
- Testing of adulterants in food samples

Suggested Experiments:

1. Preparation of shampooand study its foaming and cleansing action.
2. Preparation of face cream.
3. Preparation of Soap.
4. Preparation of Lip Balmusing natural waxes and oils.
5. Practice any two traditional methods of food Preservation (from theory component).
6. Study of the Effect of Salt and Sugar as Preservatives on Microbial Growth in Food Samples.
7. Preparation of Pickles and Jam to Understand the Role of pH and Preservatives.
8. Estimation of Shelf Life of Preserved Food Using Visual and Chemical Indicators.
9. Detection of Starch in Milk and Cream (Iodine Test).
10. Detection of Metanil Yellow in Turmeric Powder.
11. Detection of Adulterants like Chalk Powder in Flour and Washing Soda in Baking Soda.
12. Detection of Vanaspati in Ghee Using the Baudouin Test.
13. Preparation of Herbal Cold Cream or Moisturizer and Study of Emulsification.

BOOKS RECOMMENDED:

1. Rick Parker (2003) Introduction to Food Science, New York: Delmar Thomson Learning.
2. Scottsmith and Hui Y.H (Editors) (2004) Food Processing – Principles and Applications, London Blackwell Publishing.
3. Subbulakshmi, G and Udipi, S. A. (2001).Foods Processing and Preservation, New Delhi, New Age International (P) Ltd. Publishing.
4. Swaminathan, M. (1995).Food Science Chemistry and Experimental Food, The Bangalore Printing and Publishing Co. Ltd.
5. Vacklavick, V. and Christian, E. (2003).Essentials of Food Science.New York, Kluwer Academic/ Plenum Publisher.
   ** All new journals related to Food Preservation**
6. Perry Romanowski, Beginning Cosmetic Chemistry, Allured Pub Corp.2009.

Semester-III
Course No.: USECHT-311 (Skill Enhancement Course)
Title: CHEMISTRY OF FOOD AND COSMETICS

Credits: 01 (Theory) + 02 (Skills)
Maximum Marks: 75 [25 (Theory) + 50 (Skills)]
Duration of examination: 1½ Hours (Theory) and 3 Hours (Skills)

7. Dr. Ramesh Kumari, Chemistry of Cosmetics, Prestige Publishers.
8. Srilakshmi B., Food Science, New Age International Pvt. Ltd. Publishers, III ed. 2003.
9. ShakuntalaManay N. and Shadaksharaswamy M. FOODS: Facts and Principles. New Age International Pvt. Ltd. Publishers, II ed. 2002.
10. Norman N. Potter, Food Science, CBS Publishers and Distributors, New Delhi. 1994.
11. Swaminathan M. Advanced Text Book on Food and Nutrition, Volume I and II Printingand Publishing Co., Ltd., Bangalore. 1993.

NOTE FOR PAPER SETTING:

Note for paper setter for Mid Term Examination:Part-1

The question paper will be of **25 marks**. There shall be **2 Sections** in the question paper with pattern as follows:

Section-A shall comprise of **4** short answer type questions of (2½marks each) covering all three units with atleast one question from each unit. The students have to attempt all the **4** questions from Section-A.

Section-B shall comprise of a total of **6** questions with two questions selected from each unit. Each question shall be of **5 marks**. The students have to attempt **3** questions selecting only one question from each unit.

EVALUATION OF SKILLS:*Final ExaminationPart-2*

The Evaluation of Skills will be internal. The Examination of Skills shall be of **50** marks. The evaluation of skills will be done internally through the Board of three Members (including the trainer of the Course).