

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

UNIVERSITY OF JAMMU

SYLLABUS FOR FOUR YEAR UNDERGRADUATE PROGRAMME (FYUGP) IN CHEMISTRY W.E.F. ACADEMIC SESSION 2022 AS PER NATIONAL EDUCATION POLICY (NEP)

List of Major (MJ), Minor (MI), Skill (SEC) and Multi Disciplinary (MD) Courses for 1st and 2nd Semesters of Four Year Undergraduate Program (FYUGP) in Chemistry as per National Education Policy (NEP)

Sr. No.	Level (UG/Sem)	Course Code	Credits	Course Name	Nature of open Elective
1.	UG/Sem-1	UMJCHT101	4 (3 credit theory + 1 credit practical)	Foundation Course Chemistry-1	Major
2.	UG/Sem-1	UMICHT102	4 (3 credit theory + 1 credit practical)	Foundation Course Chemistry-1	Minor
3.	UG/Sem-1	UMDCHT103	3	Chemistry in Everyday Life	Multi – disciplinary
4.	UG/Sem-1	USECHT104	2 (1 credit theory + 1 credit practical)	Basic Analytical Techniques in Chemistry	Skill Enhancement Course
5.	UG/Sem-2	UMJCHT201	4 (3 credit theory + 1 credit practical)	Foundation Course Chemistry-2	Major
6.	UG/Sem-2	UMICHT202	4 (3 credit theory + 1 credit practical)	Foundation Course Chemistry-2	Minor
7.	UG/Sem-2	UMDCHT203	3	Hazardous Waste and its Treatment	Multi – disciplinary
8.	UG/Sem-2	USECHT204	2 (1 credit theory + 1 credit practical)	Chemistry of Soaps, Detergents and Surfactants	Skill Enhancement 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. 2022, 2023 & 2024)

Course No.: UMJCHT101 (Major course)

Title: FOUNDATION COURSE CHEMISTRY-1

Credits: 03 (Theory) + 01 (Practical)

Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits

Duration of Course: 45 hours

Duration of Examination: 3 hours

SEMESTER-I

Unit I: Atomic Structure

(15 Lectures)

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 hydrogenic wavefunctions (atomic orbitals) and their variations for $1s$, $2s$, $2p$, $3s$, $3p$ and $3d$ orbitals (Only graphical representation). Radial and angular nodes and their significance. Probability distribution curves and radial probability distribution curves, 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.

Unit II: Classifications of Elements and Periodic Properties

(10 Lectures)

Periodic Table- 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), Inert pair effect, Anomalous behaviour of first element in respective groups of representative elements, Diagonal relationship of Li and Mg ; Be and Al .

Unit III: General Organic Chemistry

(10 Lectures)

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.



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(For examinations to be held in the years Dec. 2022, 2023 & 2024)

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Title: FOUNDATION COURSE CHEMISTRY-1

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Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits

Duration of Course: 45 hours

Duration of Examination: 3 hours

Introduction to types of organic reactions: Addition, Elimination and Substitution reactions.

UNIT IV: States of Matter -I

(10 Lectures)

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, LPG and critical phenomenon, Critical constants and their calculations from van der Waals equation. Andrew's isotherm of CO_2 .

Practical: 01 Credit

Duration: 30 hours

Course Objectives:

- To prepare solutions of different concentrations.
- To detect and purify organic compounds by different methods.
- To determine extra elements present in the organic compound.

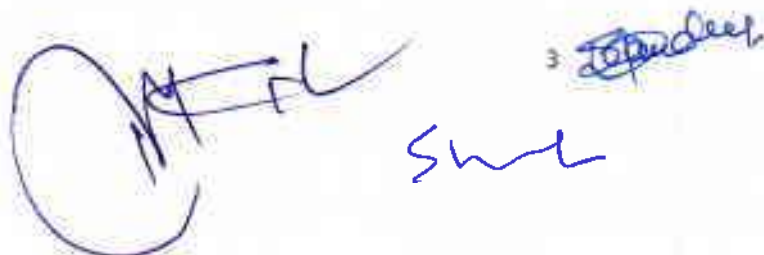
Learning outcomes:

On completion of the course, the student should be able to:

- Prepare and standardize different solutions.
- Learn techniques of purification.
- Learn the extra elements present in organic compounds

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.



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Course No.: UMJCHT101 (Major course)

Title: FOUNDATION COURSE CHEMISTRY-1

Credits: 03 (Theory) + 01 (Practical)

Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits

Duration of Course: 45 hours

Duration of Examination: 3 hours

5. Criteria of purity: Determination of melting point/boiling point.
6. Detection of N, S and halogens in organic compounds.

NOTE FOR PAPER SETTING:

Totalmarks = 75

The evaluation of course shall contain two parts:

Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of four questions of five marks each. The candidate has to attempt any three of them. **(Total Marks: 15; Time Duration: 1½ hour)**

End semester assessment: It consists of two sections:

Section A will consist of four short answer questions (one question from each unit) of 3 marks each covering the entire syllabi. **Section B** consists of eight long answer questions (two questions from each unit) of 12 marks each.

Section A is compulsory. From Section B, the candidate has to attempt four questions in total, selecting one from each unit. **(Total Marks: 60; Time Duration: 3 hours)**

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.		10 marks
Final examination	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks= viva-voce examination)

Books Recommended:

Theory

1. Concise Inorganic Chemistry; J.D. Lee; 5thEdn., OUP/Wiley India Pvt. Limited, 2008.

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(For examinations to be held in the years Dec. 2022, 2023 & 2024)

Course No.: UMJCHT101 (Major course)

Title: FOUNDATION COURSE CHEMISTRY-1

Credits: 03 (Theory) + 01 (Practical)

Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits

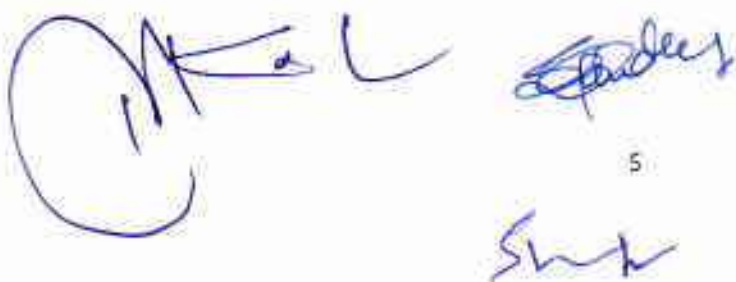
Duration of Course: 45 hours

Duration of Examination: 3 hours

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; 3rd Edn., Pearson India, 2013.
9. Atkins' Physical chemistry; P. Atkins, J. De Paula and J. Keeler, 11th Edn., Oxford University Press, 2017.

Practicals

1. Comprehensive Practical Organic Chemistry: Qualitative analysis V. K. Ahluwalia, & Sunita Dhingra; 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. Advanced Physical Chemistry Experiments; J. N. Gurtu, A. Gurtu, Pragati Prakashan, 2008.



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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. 2022, 2023&2024)

Course No.: UMICHT102 (Minor course)

Title: FOUNDATION COURSE CHEMISTRY-1

Credits: 03 (Theory) + 01 (Practical)

Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits

Duration of Course: 45 hours

Duration of Examination: 3 hours

Unit I: Structure of atom

(15 Lectures)

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. Radial and angular nodes, 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 Lectures)

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), Inert pair effect, Diagonal relationship of Lithium and Magnesium.

Unit III: General Organic Chemistry

(10 Lectures)

Electronic Displacement: 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 and Free radicals.

Introduction to types of organic reactions: Addition, Elimination and Substitution reactions (Elementary idea only).

UNIT IV: States of Matter -I

(10 Lectures)

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, LPG and critical phenomenon (Andrew's Experiment).

Practical: 01 Credit

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(For examinations to be held in the years Dec. 2022, 2023&2024)

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

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits
Duration of Course: 45 hours
Duration of Examination: 3 hours

Duration: 30 hours

Course Objectives:

- To prepare solutions of different concentrations.
- To detect and purify organic compounds by different methods.
- To determine extra elements present in the organic compound.

Learning outcomes:

On completion of the course, the student should be able to:

- Prepare and standardize different solutions.
- Learn techniques of purification.
- Learn the extra elements present in organic compounds

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.

NOTE FOR PAPER SETTING:

Total marks = 75

The evaluation of course shall contain two parts:

Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of four questions of five marks each. The candidate has to attempt any three of them. **(Total Marks: 15; Time Duration: 1½ hour)**

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Course No.: UMICHT102 (Minor course)

Title: FOUNDATION COURSE CHEMISTRY-1

Credits: 03 (Theory) + 01 (Practical)

Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits

Duration of Course: 45 hours

Duration of Examination: 3 hours

End semester assessment: It consists of two sections:

Section A will consist of four short answer questions (one question from each unit) of 3 marks each covering the entire syllabi. **Section B** consists of eight long answer questions (two questions from each unit) of 12 marks each.

Section A is compulsory. From Section B, the candidate has to attempt four questions in total, selecting one from each unit. (**Total Marks: 60; Time Duration: 3 hours**)

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.		10 marks
Final examination	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks = viva-voce examination)

Books Recommended:

Theory

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.

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Course No.: UMICHT102 (Minor course)

Title: FOUNDATION COURSE CHEMISTRY-I

Credits: 03 (Theory) + 01 (Practical)

Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits

Duration of Course: 45 hours

Duration of Examination: 3 hours

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.

Practicals

1. Comprehensive Practical Organic Chemistry: Qualitative analysis V. K. Ahluwalia, & Sunita Dhingra; 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. Advanced Physical Chemistry Experiments; J. N. Gurtu, A. Gurtu, Pragati Prakashan, 2008.

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. 2022, 2023&2024)

Course No.: UMDCHT103 (Multi Disciplinary Course)

Title: CHEMISTRY IN EVERYDAY LIFE

Credits: 03

Maximum Marks: 75

Duration of course: 45 hours

Duration of Examination: 3 hours

Learning Objectives:

To learn about food additives and chemical composition of drugs.

Unit-I- Chemotherapy(13 Lectures)

Definition of chemotherapy- examples each for (i) Analgesics, (ii) antibacterial, (iii) anti-inflammatory, (iv) antipyretic, (v) antibiotic, (vi) antacid (vii) antiviral, (viii) antidepressant, (ix) antiallergic, (x) antidiabetics, (xi) antihypertensive, (xii) anaesthetics (local and general)

Structures not necessary.

Unit-II- Food Additives and Preservation(12 Lectures)

Artificial sweeteners - saccharin - cyclamate and aspartate, food flavours esters and aldehydes, Food colours - restricted use of spurious colors - emulsifying agents - leavening agents, baking powder, yeast - taste makers - MSG, vinegar, Food preservation – Methods – preservation by low temperature, high temperature - preservatives.

Structures not necessary.

Unit-III- Biomolecules-I(10 Lectures)

Carbohydrates: Definition, classification and their importance

Amino acids : Essential and non-essential. Definition, classification and their importance.

Oils and Fats: Definition, classification and importance. Saponification value

Structure not necessary.

Unit- IV Biomolecules-II(10 Lectures)

Vitamins: Nomenclature and Classification, Sources, deficiency diseases due to vitamins A, B,C, D, E and K. Structure not necessary.

Minerals: Macro and micro elements, importance and deficiency diseases.

Structure not necessary.

NOTE FOR PAPER SETTING:

Total marks = 75

The evaluation of course shall contain two parts:

Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of four questions of five

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(For examinations to be held in the years Dec. 2022, 2023&2024)

Course No.: UMDCHT103 (Multi Disciplinary Course)

Title: CHEMISTRY IN EVERYDAY LIFE

Credits: 03

Maximum Marks: 75

Duration of course: 45 hours

Duration of Examination: 3 hours

marks each. The candidate has to attempt any three of them. **(Total Marks: 15; Time Duration: 1½ hour)**

End semester assessment: It consists of two sections:

Section A will consist of four short answer questions (one question from each unit) of 3 marks each covering the entire syllabi. **Section B** consists of eight long answer questions (two questions from each unit) of 12 marks each.

Section A is compulsory. From Section B, the candidate has to attempt four questions in total, selecting one from each unit. **(Total Marks: 60; Time Duration: 3 hours)**

Recommended Books:

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.

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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. 2022, 2023&2024)

Course No.: USECHT104 (Skill Enhancement Course)

Title: BASIC ANALYTICAL TECHNIQUES IN CHEMISTRY

Credits: 01 (Theory) + 01 (Practical)

Maximum Marks: 50 [25 (Theory) + 25 (Practical)]

Theory: 01 Credit

Duration of Course: 15 hours

Duration of examination: 2.5 hours

Learning Objectives:

- To know the principles of the volumetry.
- To have a knowledge on various types of titrations.
- To have Knowledge about normality, equivalent weight of compounds.
- To learn about the hardness and analysis of water.
- To Learn about the purification and separation techniques in Organic Chemistry.

UNIT-I

(5 Lectures)

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 Lectures)

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 Lectures)

Distillation and Chromatographic Techniques: Introduction, Basic Distillation apparatus, Simple, Fractional and Steam Distillation, Separation of Liquid mixture, Azeotropes. Chromatographic techniques and types-Paper chromatography, Thin Layer chromatography and Column Chromatography. Separation of Mixtures and R_f value.

Practical: 01 Credit

Duration: 30 hours

Learning Objectives:

- To know the Preparation of standard solutions.
- To learn the practical application of volumetric analysis.

Course Outcome:

- After successful completion of the course, students will be able to prepare standard solutions.
- Students will have knowledge of different water quality parameters.

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Course No.: USECHT104 (Skill Enhancement Course)

Title: BASIC ANALYTICAL TECHNIQUES IN CHEMISTRY

Credits: 01 (Theory) + 01 (Practical)

Maximum Marks: 50 [25 (Theory) + 25 (Practical)]

Theory: 01 Credit

Duration of Course: 15 hours

Duration of examination: 2.5 hours

- Students will learn to use paper chromatography as a separation technique for separation of mixtures.

Experiments:

1. Preparation of solutions of different concentrations; Standardization of Solutions, acid base and redox titrations.
2. Estimation of sodium carbonate and Sodium Hydrogen Carbonate present in a mixture.
3. Preparation of Battery water.
4. Purification of Organic compounds by Distillation.
5. Identification and separation of components of a given mixture (amino acids and sugars) by paper chromatography.
6. Determination of chloride, available chloride and chlorine demand.
7. Determination of Suspended solid (SS), Total Dissolved solid (TDS), Total suspended solid (TSS) and Total volatile solids (TVS).

NOTE FOR PAPER SETTING:

Total marks = 25

The evaluation of course shall contain two parts:

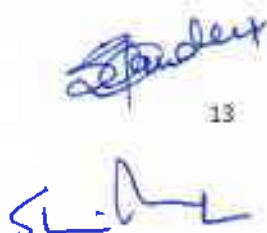
Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of three questions of 2.5 marks each. The candidate has to attempt any two of them. (**Total Marks: 5; Time Duration: 01 hour**)

End semester assessment: It consists of two sections:

Section A will consist of four short answer questions (at least one question from each unit) of 01 mark each covering the entire syllabi. **Section B** consists of six long answer questions (two questions from each unit) of 04 marks each.

Section A is compulsory. From Section B, the candidate has to attempt any four questions in total. (**Total Marks: 20; Time Duration: 2 $\frac{1}{2}$ hours**)

EVALUATION OF PRACTICALS:



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Course No.: USECHT104 (Skill Enhancement Course)

Title: BASIC ANALYTICAL TECHNIQUES IN CHEMISTRY

Credits: 01 (Theory) + 01 (Practical)

Maximum Marks: 50 [25 (Theory) + 25 (Practical)]

Theory: 01 Credit

Duration of Course: 15 hours

Duration of examination: 2.5 hours

Daily evaluation of practical records/viva-voce etc.	10 marks	
Final examination	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks = viva-voce examination)

Recommended Books:

(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. Shashi Chawla, "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.

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 2023, 2024 & 2025)

Course No.: UMJCHT201 (Major course)

Title: FOUNDATION COURSE CHEMISTRY-2

Credits: 03 (Theory) + 01 (Practical)

Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits

Duration of Course: 45 hours

Duration of Examination: 3 hours

SEMESTER-II

Unit-I State of Matter –II

(10 Lectures)

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 State of Matter –III

(12 Lectures)

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 Lectures)

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^3d and sp^3d^2). VSEPR Theory; Shapes of CH_4 , NH_3 , H_2O , SF_4 and ClF_3

Molecular orbital theory (MOT)- rules for the LCAO method, Molecular orbital diagrams of homonuclear diatomic molecules (N_2 and O_2) and heteronuclear diatomic molecules (CO and NO). Comparison of VB and MO approaches.

Unit-IV: Stereochemistry

(12 Lectures)

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, CIP rules, Geometrical isomerism (cis & trans; E/Z nomenclatures) and Optical isomerism, Enantiomerism, Diastereomerism and Meso compounds. Threo and erythro nomenclature.



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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 2023, 2024 & 2025)

Course No.: UMJCHT201 (Major course)

Title: FOUNDATION COURSE CHEMISTRY-2

Credits: 03 (Theory) + 01 (Practical)

Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits

Duration of Course: 45 hours

Duration of Examination: 3 hours

Practical: 01 Credit

Duration: 30 hours

Course Objectives:

- To estimate density, viscosity and surface tension of different liquids.
- To prepare some important organic compounds and detect their functional groups

Learning outcomes:

On completion of the course, the student should be able to:

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

Proposed Experiments

1. Measurement of density and relative density of various liquids using pycnometer/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, unsaturation, carboxylic acids, carbonyl compounds, phenols, alcohols, amines, amides, nitro compounds.

NOTE FOR PAPER SETTING:

Total marks = 75

The evaluation of course shall contain two parts:

Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of four questions of five marks each.

The candidate has to attempt any three of them. **(Total Marks: 15; Time Duration: 1½ hour)**

End semester assessment: It consists of two sections:

Section A will consist of four short answer questions (one question from each unit) of 3 marks each covering the entire syllabi. **Section B** consists of eight long answer questions (two questions from each unit) of 12 marks each.

Section A is compulsory. From Section B, the candidate has to attempt four questions in total, selecting one from each unit. **(Total Marks: 60; Time Duration: 3 hours)**

EVALUATION OF PRACTICALS:

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 2023, 2024 & 2025)

Course No.: UMJCHT201 (Major course)

Title: FOUNDATION COURSE CHEMISTRY-2

Credits: 03 (Theory) + 01 (Practical)

Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits

Duration of Course: 45 hours

Duration of Examination: 3 hours

Daily evaluation of practical records/viva-voce etc.		10 marks
Final examination	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks = viva-voce examination)

Books Recommended:

Theory

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. 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, 3rd Edn., 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, 4th Edn. Kent, England: New Academic science Limited, 2013.
8. Advanced Organic Chemistry; Dr Jagdamba Singh and LDS Yadav; Pragati edition, 2017.

Practicals

1. Comprehensive Practical Organic Chemistry: Qualitative analysis Ahluwalia, V.K. & Sunita Dhingra; 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, Pragati Prakashan, 2008.
6. Experiments in Physical Chemistry; Das, R. C. and Behra, B.; Tata McGraw Hill.

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 2023, 2024 & 2025)

Course No.: UMICHT202 (Minor course)

Title: FOUNDATION COURSE CHEMISTRY-2

Credits: 03 (Theory) + 01 (Practical)

Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits

Duration of Course: 45 hours

Duration of Examination: 3 hours

Unit-I State of Matter –II (10 Lectures)

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, smatic and cholesteric) with examples.

Unit-II State of Matter –III (12 Lectures)

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).

Imperfections in solids-Types of point defects (Stoichiometric, non-stoichiometric and Impurity defects)

Unit-III Chemical Bonding and Molecular Structure (11 Lectures)

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^3d and sp^3d^2). **VSEPR Theory:** Shapes of CH_4 , NH_3 , H_2O , SF_4 and ClF_3

Unit-IV: Stereochemistry (12 Lectures)

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, CIP rules, Geometrical isomerism (cis & trans; E/Z nomenclatures) and Optical isomerism, Enantiomerism, Diastereomerism and Meso compounds.

Practical: 01 Credit

Duration: 30 hours

Course Objectives:

- To estimate density, viscosity and surface tension of different liquids.
- To prepare some important organic compounds and detect their functional groups

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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 2023, 2024 & 2025)

Course No.: UMICHT202 (Minor course)

Title: FOUNDATION COURSE CHEMISTRY-2

Credits: 03 (Theory) + 01 (Practical)

Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits

Duration of Course: 45 hours

Duration of Examination: 3 hours

Learning outcomes:

On completion of the course, the student should be able to:

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

Proposed Experiments

1. Measurement of density and relative density of various liquids using pycnometer/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, unsaturation, carboxylic acids, carbonyl compounds, phenols, alcohols, amines, amides, nitro compounds.

NOTE FOR PAPER SETTING:

Total marks = 75

The evaluation of course shall contain two parts:

Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of four questions of five marks each.

The candidate has to attempt any three of them. **(Total Marks: 15; Time Duration: 1½ hour)**

End semester assessment: It consists of two sections:

Section A will consist of four short answer questions (one question from each unit) of 3 marks each covering the entire syllabi. **Section B** consists of eight long answer questions (two questions from each unit) of 12 marks each.

Section A is compulsory. From Section B, the candidate has to attempt four questions in total, selecting one from each unit. **(Total Marks: 60; Time Duration: 3 hours)**

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.	10 marks	
Final examination	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks = viva-voce examination)

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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 2023, 2024 & 2025)

Course No.: UMICHT202 (Minor course)

Title: FOUNDATION COURSE CHEMISTRY-2

Credits: 03 (Theory) + 01 (Practical)

Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits

Duration of Course: 45 hours

Duration of Examination: 3 hours

Books Recommended:

Theory

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. 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.; 3rd Edn.. 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, 4th Edn. Kent, England: New Academic science Limited, 2013.
8. Advanced Organic Chemistry; Dr. Jagdamba Singh and LDS Yadav; Pragati edition, 2017.

Practicals

1. Comprehensive Practical Organic Chemistry: Qualitative analysis Ahluwalia, V.K. & Sunita Dhingra; 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, Pragati Prakashan, 2008.
6. Experiments in Physical Chemistry; Das, R. C, and Behra, B.; Tata McGraw Hill.

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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 2023, 2024 & 2025)

Course No.: UMDCHT203 (Multi Disciplinary Course)

Title: HAZARDOUS WASTE AND ITS TREATMENT

Credits: 03 (Theory)

Maximum Marks: 75

Duration of Course: 45 hours

Duration of Examination: 3 hours

Unit-I Hazardous waste(11 Lectures)

Definition, Classification based on ignitability, Corrosivity, Reactivity and Toxicity. Types of listed Hazardous Wastes: F-type, K-type and U-type and their origin sources. Household hazardous materials and their health and Environmental impact.

Unit-II Environmental Chemistry of Hazardous Wastes(11 Lectures)

Origins, Transport, Reactions, Effects and Fates. Physical and Chemical Properties of Hazardous Wastes. Management of hazardous wastes: generation, storage, collection and transportation. Waste minimization, utilization and recycling.

Unit-III Treatment(12 Lectures)

Chemical treatment: Acid/base neutralization, Chemical precipitation, Chemical extraction and leaching, Oxidation, Ion exchange and Reduction, Thermal treatment.

Microbial Treatments: Aerobic, Anaerobic and Reductive dehalogenations (by anaerobic bacteria).

Unit-IV Disposal of Hazardous wastes(11 Lectures)

Disposal Above ground, Land Treatment, Open Dumping & Disadvantages, Composting and Landfill Sanitary landfills, Secure landfills and Monofills.

Deep Well Injection Technique : Categories of injection wells.

NOTE FOR PAPER SETTING:

Total marks = 75

The evaluation of course shall contain two parts:

Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of four questions of five marks each. The candidate has to attempt any three of them. **(Total Marks: 15; Time Duration: 1½ hour)**

End semester assessment: It consists of two sections:

Section A will consist of four short answer questions (one question from each unit) of 3 marks each covering the entire syllabi. **Section B** consists of eight long answer questions (two questions from each unit) of 12 marks each.

Section A is compulsory. From Section B, the candidate has to attempt four questions in total, selecting one from each unit. **(Total Marks: 60; Time Duration: 3 hours)**

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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 2023, 2024 & 2025)

Course No.: UMDCHT203 (Multi Disciplinary Course)

Title: HAZARDOUS WASTE AND ITS TREATMENT

Credits: 03 (Theory)

Maximum Marks: 75

Duration of Course: 45 hours

Duration of Examination: 3 hours

Books Recommended:

1. Environmental Chemistry, Stanley E Manahan, 6th Edition, Lewis Publishers.
2. Principles of Environmental Chemistry, James E. Girard, 3rd Edition., Jones and Bartlett Learning, 2015.

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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 2023, 2024 & 2025)

Course No.: USECHT204 (Skill Enhancement Course)

Title: CHEMISTRY OF SOAPS, DETERGENTS AND SURFACTANTS

Credits: 01 (Theory) + 01 (Practical)

Maximum Marks: 50 (25 (Theory) + 25 (Practical))

Theory: 01 Credit

Duration: 15 hours

Unit 1- Cleansing agents (05 Lectures)

Introduction, synthesis and applications of Natural cleaning agents, cleansing action, Floor cleaner, Toilet Cleaner, Bathroom Cleaner, Kitchen Cleaner. Introduction to soaps and detergents. Types of soaps-bathing, toilet soaps, antibacterial soaps, transparent soaps, liquid soaps.

Unit II- Technology of Soap(05 Lectures)

Chemistry of soap, Raw material for soap industry and their selection, hard fats yielding and oil yielding soaps, Chemical reactions of soaps, Hard and Soft soaps, General principles of soap making, chemistry of soap boiling and saponification reaction, Liquid hand wash and liquid dish wash.

Unit III -Detergents and surfactants(05 Lectures)

Introduction; Different terms used in detergents, Types of detergents, Classification of detergents (anionic, cationic, nonionic, amphoteric), biodegradability.

Raw materials for detergents; Washing action of detergents; Introduction of surfactants; Types of surfactants.

Practical: 01 Credit

Duration: 30 hours

Learning Objectives:

- To know the Preparation of soaps and detergents.
- To learn about the effect of soaps and detergents on surface tension of water.

Experiments:

1. Preparation of different types of soaps and Detergents.
2. Study the effect of the surfactants on the surface tension of waters.
3. Determination of critical micelle concentration of different surfactants.

NOTE FOR PAPER SETTING:

Total marks = 25

The evaluation of course shall contain two parts:



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 2023, 2024 & 2025)

Course No.: USECHT204 (Skill Enhancement Course)

Title: CHEMISTRY OF SOAPS, DETERGENTS AND SURFACTANTS

Credits: 01 (Theory) + 01 (Practical)

Maximum Marks: 50 (25 (Theory) + 25 (Practical))

Theory: 01 Credit

Duration: 15 hours

Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of three questions of 2.5 marks each. The candidate has to attempt any two of them. **(Total Marks: 5; Time Duration: 01 hour)**

End semester assessment: It consists of two sections:

Section A will consist of four short answer questions (at least one question from each unit) of 01 mark each covering the entire syllabi. **Section B** consists of six long answer questions (two questions from each unit) of 04 marks each.

Section A is compulsory. From Section B, the candidate has to attempt any four questions in total. **(Total Marks: 20; Time Duration: 2 $\frac{1}{2}$ hours)**

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.		10 marks
Final examination	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks = viva-voce examination)

Recommended Books:

(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.