VIDYASAGAR UNIVERSITY

Midnapore, West Bengal

PROPOSED CURRICULUM & SYLLABUS (DRAFT) OF

BACHELOR OF SCIENCE (HONOURS)

MAJOR IN CHEMISTRY

4-YEAR UNDERGRADUATE PROGRAMME

(w.e.f. Academic Year 2023-2024)

Based on

Curriculum & Credit Framework for Undergraduate Programmes

(CCFUP), 2023 & NEP, 2020

Downloaded from Vidyasagar University by 14.139.211.194 on 08 Nov 2026 21:32:20 PM; Copyright (c) : Vidyasagar University
http://download.vidyasagar.ac.in/OpenLink.aspx?LINKID=78

VIDYASAGAR UNIVERSITY
BACHELOR OF SCIENCE (HONOURS) MAJOR IN CHEMISTRY
(under CCFUP, 2023)

Level	YR.	SEM	Course Type	Course Code	Course Title	Credit	L-T-P	Marks		
								CA	ESE	TOTAL
B.Sc. (Hons.)	1st	I	**SEMESTER-I**							
			Major-1	**CEMHMJ101**	**T:Organic Chemistry-I** **P: Organic Chemistry Lab- I**	**4**	**3-0-1**	**15**	**60**	**75**
			SEC	**CEMSEC01**	**P: Chemistry of Cosmetics & Perfumes**	**3**	**0-0-3**	**10**	**40**	**50**
			AEC	**AEC01**	Communicative English -1 (***common for all programmes***)	**2**	**2-0-0**	**10**	**40**	**50**
			MDC	**MDC01**	Multidisciplinary Course -1 (***to be chosen from the list***)	**3**	**3-0-0**	**10**	**40**	**50**
			VAC	**VAC01**	ENVS (***common for all programmes***)	**4**	**2-0-2**	**50**	**50**	**100**
			Minor CEM (Disc.-I)	**CEMMI01**	**T:Atomic Structure, Acids And Bases, Redox Reactions, & States of Matter; P: Practical *(To be taken by students of other Disciplines)***	**4**	**3-0-1**	**15**	**60**	**75**
					Semester-I Total	**20**				**400**
		II	**SEMESTER-II**							
			Major-2	**CEMHMJ102**	**T:Inorganic Chemistry-I** **P: Inorganic ChemistryLab-I**	**4**	**3-0-1**	**15**	**60**	**75**
			SEC	**CEMSEC02**	**P: Medicinal & Pharmaceutical Chemistry**	**3**	**0-0-3**	**10**	**40**	**50**
			AEC	**AEC02**	MIL-1 (***common for all programmes***)	**2**	**2-0-0**	**10**	**40**	**50**
			MDC	**MDC02**	Multi Disciplinary Course-02 (***to be chosen from the list***)	**3**	**3-0-0**	**10**	**40**	**50**
			VAC	**VAC02**	Value Added Course-02 (***to be chosen from the list***)	**4**	**4-0-0**	**10**	**40**	**50**
			Minor (Disc.-II)	**CEMMI02**	**T: General Organic Chemistry, Aliphatic Hydrocarbons & Chemical Kinetics; P: Practical** **(*To be taken by students of other Disciplines)***	**4**	**3-0-1**	**15**	**60**	**75**
			Summer Intern.	**CS**	Community Service	**4**	**0-0-4**	**-**	**-**	**50**
					Semester-II Total	**24**				**400**
					TOTAL of YEAR-1	**44**				**800**

MJ = Major, MI = Minor Course, SEC = Skill Enhancement Course, AEC = Ability Enhancement Course, MDC = Multidisciplinary Course, VAC = Value Added Course; CA= Continuous Assessment, ESE= End Semester Examination, T = Theory, P= Practical, L-T-P = Lecture-Tutorial-Practical, MIL = Modern Indian Language, ENVS = Environmental Studies

Downloaded from Vidyasagar University by 14.139.211.194 on 08 Nov 2026 21:32:20 PM; Copyright (c) : Vidyasagar University
http://download.vidyasagar.ac.in/OpenLink.aspx?LINKID=78

MAJOR (MJ)

Major-1: ORGANIC CHEMISTRY-I **Credits 04 (Theory-03, Practicals-01)**

MJ1T: ORGANIC CHEMISTRY-I **Credits 03 (Theory: 45 Lectures)**

Course contents:

A. Basics of Organic Chemistry

Bonding and Physical Properties **(20 Lectures)**

Valence Bond Theory: concept of hybridisation, shapes of molecules, resonance (including hyperconjugation); calculation of formal charges and double bond equivalent (DBE); orbital pictures of bonding (sp^3, sp^2, sp: C-C, C-N & C-O systems and *s-cis*and *s-trans* geometry for suitable cases).

Electronic displacements: inductive effect, field effect, mesomeric effect, resonance energy; bond polarization and bond polarizability; electromeric effect; steric effect, steric inhibition of resonance.

MO theory: qualitative idea about molecular orbitals, bonding and antibonding interactions, idea about σ, σ^*, π, π^*, n – MOs; basic idea about Frontier MOs (FMO); concept of HOMO, LUMO and SOMO; interpretation of chemical reactivity in terms of FMO interactions; sketch and energy levels of π MOs of i) acyclic p orbital system (C=C, conjugated diene, triene, allyl and pentadienyl systems) ii) cyclic p orbital system (neutral systems: [4], [6]-annulenes; charged systems: 3-,4-,5-membered ring systems); Hückel's rules for aromaticity up to [10]-annulene (including mononuclear heterocyclic compounds up to 6-membered ring); concept of antiaromaticity and homoaromaticity; non-aromatic molecules; Frost diagram; elementary idea about α and β; measurement of delocalization energies in terms of β for buta-1,3-diene, cyclobutadiene, hexa-1,3,5-triene and benzene.

Physical properties: influence of hybridization on bond properties: bond dissociation energy (BDE) and bond energy; bond distances, bond angles; concept of bond angle strain (Baeyer's strain theory); melting point/boiling point and solubility of common organic compounds in terms of covalent & non-covalent intermolecular forces; polarity of molecules and dipole moments; relative stabilities of isomeric hydrocarbons in terms of heat of hydrogenation, heat of combustion and heat of formation.

B. General Treatment of Reaction Mechanism I **(5 Lectures)**

Mechanistic classification: ionic, radical and pericyclic (definition and example);

Reaction type: addition, elimination and substitution reactions (definition and example); nature of bond cleavage and bond formation: homolytic and heterolytic bond fission, homogenic and

Heterogenic bond formation; curly arrow rules in representation of mechanistic steps; reagent type: electrophiles and nucleophiles (elementary idea); electrophilicity and nucleophilicity in terms of FMO approach.

Downloaded from Vidyasagar University by 14.139.211.194 on 08 Nov 2026 21:32:20 PM; Copyright (c) : Vidyasagar University
http://download.vidyasagar.ac.in/OpenLink.aspx?LINKID=78

Reactive intermediates: carbocations (carbenium and carbonium ions), carbanions, carbon radicals, carbenes: generation and stability, structure using orbital picture and electrophilic/nucleophilicbehavior of reactive intermediates (elementary idea).

C. **Stereochemistry I** **(20 Lectures)**

Bonding geometries of carbon compounds and representation of molecules: tetrahedral nature of carbon and concept of asymmetry; Fischer, sawhorse, flying-wedge and Newman projection formulae and their inter translations.

Concept of chirality and symmetry: symmetry elements and point groups ($C_{\alpha v}$, C_{nh}, C_{nv}, C_n, $D_{\alpha h}$, D_{nh}, D_{nd}, D_n, S_n (C_s, C_i); molecular chirality and centre of chirality; asymmetric and dissymmetric molecules; enantiomers and diastereomers; concept of epimers; concept of stereogenicity, chirotopicity and pseudoasymmetry; chiral centres and number of stereoisomerism: systems involving 1/2/3-chiral centre(s) (AA, AB, ABA and ABC types).

Relative and absolute configuration: D/L and *R/S* descriptors; *erythro/threo*and *meso*nomenclature of compounds; *syn/anti* nomenclatures for aldols; *E*/*Z* descriptors for C=C, conjugated diene, triene, C=N and N=N systems; combination of *R/S*- and *E/ Z*-isomerisms.

Optical activity of chiral compounds: optical rotation, specific rotation and molar rotation; racemic compounds, racemisation (through cationic, anionic, radical intermediates and through reversible formation of stable achiral intermediates); resolution of acids, bases and alcohols via diastereomeric salt formation; optical purity and enantiomeric excess; invertomerism of chiral trialkylamines.

Reference Books

1. Clayden, J., Greeves, N. & Warren, S. *Organic Chemistry*, Second edition, Oxford University Press, 2012.
2. Keeler, J., Wothers, P. *Chemical Structure and Reactivity – An Integrated approach*, Oxford University Press.
3. Sykes, P. *A guidebook to Mechanism in Organic Chemistry*, Pearson Education, 2003.
4. Smith, J. G. *Organic Chemistry*, Tata McGraw-Hill Publishing Company Limited.
5. Carey, F. A., Guiliano, R. M. *Organic Chemistry*, Eighth edition, McGraw Hill Education, 2012. 6. Eliel, E. L. &Wilen, S. H. *Stereochemistry of Organic Compounds*, Wiley: London, 1994.
6. Nasipuri, D. *Stereochemistry of Organic Compounds*, Wiley Eastern Limited.
7. Morrison, R. N. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
8. Finar, I. L. *Organic Chemistry (Volume 1)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education)
9. Fleming, I. *Molecular Orbitals and Organic Chemical Reactions*, Reference/Student Edition, Wiley, 2009.
10. James, J., Peach, J. M. *Stereochemistry at a Glance*, Blackwell Publishing, 2003.
11. Robinson, M. J. T., *Stereochemistry*, Oxford Chemistry Primer, Oxford University Press, 2005.

Downloaded from Vidyasagar University by 14.139.211.194 on 08 Nov 2026 21:32:20 PM; Copyright (c) : Vidyasagar University
http://download.vidyasagar.ac.in/OpenLink.aspx?LINKID=78

MJ1P: ORGANIC CHEMISTRY LAB- I **Credits 01 (30 Lectures)**

1. Separation, based upon solubility, by using common laboratory reagents like water (cold, hot), dil. HCl, dil. NaOH, dil. $NaHCO_3$, *etc*., of components of a binary solid mixture; purification of **any one** of the separated components by crystallization and determination of its melting point. The composition of the mixture may be of the following types: Benzoic acid/*p*-Toluidine; *p*-Nitrobenzoic acid/*p*-Aminobenzoic acid; *p*-Nitrotolune/*p*-Anisidine; *etc*.

2.Determination of boiling point of common organic liquid compounds e.g., ethanol, cyclohexane, chloroform, ethyl methyl ketone, cyclohexanone, acetylacetone, anisole, crotonaldehyde, mesityl oxide, *etc*. [Boiling point of the chosen organic compounds should preferably be less than 160 °C]

3.Identification of a Pure Organic Compound

Solid compounds: oxalic acid, tartaric acid, citric acid, succinic acid, resorcinol, urea, glucose, cane sugar, benzoic acid and salicylic acid

Liquid Compounds: formic acid, acetic acid, methyl alcohol, ethyl alcohol, acetone, aniline, dimethylaniline, benzaldehyde, chloroform and nitrobenzene

Reference Books

1. Bhattacharyya, R. C, *A Manual of Practical Chemistry.*
2. Vogel, A. I. *Elementary Practical Organic Chemistry*, Part 2: *Qualitative Organic Analysis*, CBS Publishers and Distributors.
3. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009).
4. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. *Practical Organic Chemistry,5th Ed.*, Pearson (2012).
5. Dutta, S, *B. Sc. Honours Practical Chemistry*, Bharati Book Stall.

Major-2: INORGANIC CHEMISTRY-I **Credits 04 (Theory-03, Practicals-01)**

MJ2T: INORGANIC CHEMISTRY-I **Credits 03(Theory: 45 Lectures)**

Course contents:

Extra nuclear Structure of atom **(14 Lectures)**

Bohr's theory, its limitations and atomic spectrum of hydrogen atom; Sommerfeld's Theory. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2. Quantum numbers and their significance. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of *s*, *p*, *d* and *f* orbitals. Pauli's Exclusion Principle, Hund's rules and multiplicity, Exchange energy, Aufbau principle and its limitations, Ground state Term symbols of atoms and ions for atomic number up to 30.

Downloaded from Vidyasagar University by 14.139.211.194 on 08 Nov 2026 21:32:20 PM; Copyright (c) : Vidyasagar University
http://download.vidyasagar.ac.in/OpenLink.aspx?LINKID=78

Chemical periodicity **(5 Lectures)**

Modern IUPAC Periodic table, Effective nuclear charge, screening effects and penetration, Slater's rules, atomic radii, ionic radii (Pauling's univalent), covalent radii, lanthanide contraction. Ionization potential, electron affinity and electronegativity (Pauling's, Mulliken's and Allred-Rochow's scales) and factors influencing these properties, group electronegativities. Group trends and periodic trends in these properties in respect of s-, p- and d-block elements. Secondary periodicity, Relativistic Effect, Inert pair effect.

Acid-Base reactions **(12 Lectures)**

Acid-Base concept: Arrhenius concept, theory of solvent system (in H_2O, NH_3, $SO_2$and HF), Bronsted-Lowry's concept, relative strength of acids, Pauling's rules. Lux-Flood concept, Lewis concept, group characteristics of Lewis acids, solvent levelling and differentiating effects. Thermodynamic acidity parameters, Drago-Wayland equation. Superacids, Gas phase acidity and proton affinity; HSAB principle. Acid-baseequilibria in aqueous solution (Proton transfer equilibria in water), pH, buffer. Acid-base neutralisation curves; indicator, choice of indicators.

Redox Reactions and precipitation reactions **(14 Lectures)**

Ion-electron method of balancing equation of redox reaction. Elementary idea on standard redox potentials with sign conventions, Nernst equation (without derivation). Influence of complex formation, precipitation and change of pH on redox potentials; formal potential. Feasibility of a redox titration, redox potential at the equivalence point, redox indicators. Redox potential diagram (Latimer and Frost diagrams) of common elements and their applications. Disproportionation and comproportionation reactions (typical examples)

Solubility product principle, common ion effect and their applications to the precipitation and separation of common metallic ions as hydroxides, sulfides, phosphates, carbonates, sulfates and halides.

Reference Books

1. Lee, J. D. *Concise Inorganic Chemistry*,5th Ed., Wiley India Pvt. Ltd., 2008.
2. Douglas, B.E. and McDaniel, D.H. *Concepts & Models of Inorganic Chemistry* Oxford, 1970.
3. Day, M.C. and Selbin, J. *Theoretical Inorganic Chemistry*, ACS Publications, 1962.
4. Atkin, P. *Shriver & Atkins' Inorganic Chemistry,* 5th Ed., Oxford University Press (2010).
5. Cotton, F.A., Wilkinson, G. and Gaus, P.L., *Basic Inorganic Chemistry 3rd Ed.;* Wiley India.
6. Sharpe, A.G., *Inorganic Chemistry*, 4th Indian Reprint (Pearson Education) 2005.
7. Huheey, J. E.; Keiter, E.A. &Keiter, R.L. *Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed.*, Harper Collins 1993, Pearson,2006.
8. Atkins, P.W. & Paula, J. *Physical Chemistry*, Oxford Press, 2006.
9. Mingos, D.M.P., *Essential trends in inorganic chemistry*. Oxford University Press (1998).

Downloaded from Vidyasagar University by 14.139.211.194 on 08 Nov 2026 21:32:20 PM; Copyright (c) : Vidyasagar University
http://download.vidyasagar.ac.in/OpenLink.aspx?LINKID=78

10. Winter, M. J., The Orbitron, http://winter.group.shef.ac.uk/orbitron/ (2002). An illustrated gallery of atomic and molecular orbitals.
11. Burgess, J., *Ions in solution: basic principles of chemical interactions.* Ellis Horwood (1999).

MJ2PINORGANIC CHEMISTRY LAB-I Credits 01(30 hr. Class)

Acid and Base Titrations:

1. Estimation of carbonate and hydroxide present together in mixture
2. Estimation of carbonate and bicarbonate present together in a mixture.
3. Estimation of free alkali present in different soaps/detergents.

Oxidation-Reduction Titrimetric

1. Estimation of Fe(II) using standardized $KMnO_4$ solution
2. Estimation of oxalic acid and sodium oxalate in a given mixture
3. Estimation of Fe(II) and Fe(III) in a given mixture using $K_2Cr_2O_7$ solution.
4. Estimation of Fe(III) and Mn(II) in a mixture using standardized $KMnO_4$ solution.
5. Estimation of Fe(III) and Cu(II) in a mixture using $K_2Cr_2O_7$.
6. Estimation of Fe(III) and Cr(III) in a mixture using $K_2Cr_2O_7$.

Reference Books

1. Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis* 6th Ed., Pearson, 2009.
2. Ghosal, Mahapatra&Nad, *An Advanced course in practical Chemistry*, New Central Book Agency.

Downloaded from Vidyasagar University by 14.139.211.194 on 08 Nov 2026 21:32:20 PM; Copyright (c) : Vidyasagar University
http://download.vidyasagar.ac.in/OpenLink.aspx?LINKID=78

MINOR (MI)

Minor-1:ATOMIC STRUCTURE, ACIDS AND BASES, REDOX REACTIONS, &STATES OF MATTER. (Credits 04)

MI-1T:ATOMIC STRUCTURE, ACIDS AND BASES, REDOX REACTIONS, &STATES OF MATTER. Credits 03(45 Lectures)

Course contents:

Section A: Inorganic Chemistry-I (20 Lectures)

Atomic Structure (7 Lectures)

Bohr's theory for hydrogen atom (simple mathematical treatment), atomic spectra of hydrogen and Bohr's model, Sommerfeld's model, quantum numbers and their significance, Pauli's exclusion principle, Hund's rule, electronic configuration of many-electron atoms, *Aufbau*principle and its limitations.

Acids and bases (7 Lectures)

Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept and solvent system concept. Hard and soft acids and bases (HSAB concept), applications of HSAB process.

Redox reactions (6 Lectures)

Balancing of equation of redox reactions: oxidation number and ion-electron methods. Elementary idea on standard redox potentials with sign conventions, Nernst equation (without derivation), formal potential, oxidimetry and reductimetry.

Section

B: Physical Chemistry-I (25 Lectures)

Kinetic Theory of Gases and Real gases (10 Lectures)

Concept of pressure and temperature; Collision of gas molecules; Collision diameter; Collision number and mean free path; Frequency of binary collisions (similar and different molecules); Rate of effusion

Nature of distribution of velocities, Maxwell’s distribution of speed and kinetic energy; Average velocity, root mean square velocity and most probable velocity; Principle of equipartition of energy and its application to calculate the classical limit of molar heat capacity of gases

Deviation of gases from ideal behavior; compressibility factor; Boyle temperature; Andrew’s and Amagat’s plots; van der Waals equation and its features; its derivation and application in explaining real gas behaviour; Existence of critical state, Critical constants in terms of van der Waals constants; Law of corresponding states

Downloaded from Vidyasagar University by 14.139.211.194 on 08 Nov 2026 21:32:20 PM; Copyright (c) : Vidyasagar University
http://download.vidyasagar.ac.in/OpenLink.aspx?LINKID=78

Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only)

Liquids **(08 Lectures)**

Definition of Surface tension, its dimension and principle of its determination using stalagmometer; Viscosity of a liquid and principle of determination of coefficient of viscosity using Ostwald viscometer; Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only)

Solids **(07 Lectures)**

Forms of solids, crystal systems, unit cells, Bravais lattice types, Symmetry elements; Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices; Miller indices of different planes and interplanar distance, Bragg's law; Structures of NaCl, KCl and CsCl (qualitative treatment only); Defects in crystals; Glasses and liquid crystals.

Reference Books:

1. Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. &Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. *Concepts and Models in Inorganic Chemistry*, John Wiley & Sons.
4. Huheey, J.E., Keiter, E.A., Keiter, R.L. &Medhi, O.K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006
5. Barrow, G.M. *Physical Chemistry* Tata McGraw-Hill (2007).
6. Castellan, G.W. *Physical Chemistry* 4th Ed. Narosa (2004).
7. Kotz, J.C., Treichel, P.M. & Townsend, J.R. *General Chemistry* Cengage Learning India Pvt. Ltd., New Delhi (2009).
8. Mahan, B.H. *University Chemistry* 3rd Ed. Narosa (1998).
9. Petrucci, R.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York (1985).
10. Chugh, K.L., Agnish, S.L. *A Text Book of Physical Chemistry* Kalyani Publishers
11. Bahl, B.S., Bahl, A., Tuli, G.D., *Essentials of Physical Chemistry* S. Chand &Co.ltd.
12. Palit, S. R., *Elementary Physical Chemistry* Book Syndicate Pvt. Ltd.
13. Mandal, A. K. *Degree Physical and General Chemistry* Sarat Book House
14. Pahari, S., *Physical Chemistry* New Central Book Agency
15. Pahari, S., Pahari, D., *Problems in Physical Chemistry* New Central Book Agency
16. Mukherjee, R.C., *Modern Approach to Physical Chemistry I & II*BharatiBhawan

MI-1P: Practical **Credits 01**

Course Outline:

Section A: Inorganic Chemistry –LAB **(15 Lectures)**

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with $KMnO_4$.
3. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$.
4. Estimation of Fe(II) ions by titrating it with $K_2Cr_2O_7$using redox indicator.
5. Estimation of Cu(II) ions iodometrically using $Na_2S_2O_3$.

Downloaded from Vidyasagar University by 14.139.211.194 on 08 Nov 2026 21:32:20 PM; Copyright (c) : Vidyasagar University
http://download.vidyasagar.ac.in/OpenLink.aspx?LINKID=78

Reference Books:

1. *University Hand Book of Undergraduate Chemistry Experiments*, edited by Mukherjee, G. N., University of Calcutta, 2003.
2. Das, S. C., Chakraborty, S. B., *Practical Chemistry*.
3. Mukherjee, K. S. *Text book on Practical Chemistry*, New Oriental Book Agency.
4. Ghosal, Mahapatra&Nad, *An Advanced course in practical Chemistry*, New Central Book Agency.

Section B: Physical Chemistry-LAB **(15 Lectures)**

(I) Surface tension measurement (use of organic solvents excluded)
- a) Determination of the surface tension of a liquid or a dilute solution using a Stalagmometer
- b) Study of the variation of surface tension of a detergent solution with concentration

(II) Viscosity measurement (use of organic solvents excluded)
- a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer
- b) Study of the variation of viscosity of an aqueous solution with concentration of solute

Reference Books:

1. *University Hand Book of Undergraduate Chemistry Experiments*, edited by Mukherjee, G. N., University of Calcutta, 2003.
2. Palit, S.R., *Practical Physical Chemistry* Science Book Agency
3. Mukherjee, N.G., *Selected Experiments in Physical Chemistry* J. N. Ghose& Sons
4. Dutta, S.K., *Physical Chemistry Experiments* Bharati Book Stall

Minor-2: GENERAL ORGANIC CHEMISTRY, ALIPHATIC HYDROCARBONS & CHEMICAL KINETICS **Credits 04**

MI-2T: GENERAL ORGANIC CHEMISTRY, ALIPHATIC HYDROCARBONS & CHEMICAL KINETICS **Credits 03**

(45 Lectures)

Course contents:

Section A: Organic Chemistry-I **(30 Lectures)**

Fundamentals of Organic Chemistry **(5 Lectures)**

Electronic displacements: inductive effect, resonance and hyperconjugation; cleavage of bonds: homolytic and heterolytic; structure of organic molecules on the basis of VBT; nucleophiles electrophiles; reactive intermediates: carbocations, carbanions and free radicals.

Stereochemistry **(8 Lectures)**

Different types of isomerism; geometrical and optical isomerism; concept of chirality and optical activity (up to two carbon atoms); asymmetric carbon atom; elements of symmetry (plane and centre); interconversion of Fischer and Newman representations; enantiomerism and diastereomerism, meso

Downloaded from Vidyasagar University by 14.139.211.194 on 08 Nov 2026 21:32:20 PM; Copyright (c) : Vidyasagar University
http://download.vidyasagar.ac.in/OpenLink.aspx?LINKID=78

compounds; threo and erythro, D and L, cis and trans nomenclature; CIP Rules: R/S (upto 2 chiral carbon atoms) and E/Z nomenclature.

Nucleophilic Substitution and Elimination Reactions (5 Lectures)

Nucleophilic substitutions: SN1 and SN2 reactions; eliminations: E1 and E2 reactions (elementary mechanistic aspects); Saytzeff and Hofmann eliminations; elimination vs substitution.

Aliphatic Hydrocarbons (12 Lectures)

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structures.

Alkanes: (up to 5 Carbons). Preparation: catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: mechanism for free radical substitution: halogenation.

Alkenes: (up to 5 Carbons). Preparation: elimination reactions: dehydration of alcohols and dehydrohalogenation of alkyl halides; cis alkenes (partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alkaline $KMnO_4$) and trans-addition (bromine) with mechanism, addition of HX [Markownikoff's (with mechanism) and anti-Markownikoff's addition], hydration, ozonolysis, oxymercuration-demercuration and hydroboration-oxidation reaction.

Alkynes: (up to 5 Carbons). Preparation: acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal dihalides.

Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO4, ozonolysis and oxidation with hot alkaline $KMnO_4$.

Section B: Physical Chemistry (15 Lectures)

Chemical Kinetics

Introduction of rate law, Order and molecularity; Extent of reaction; rate constants; Rates of First, second and nth order reactions and their Differential and integrated forms (with derivation); Pseudo first order reactions; Determination of order of a reaction by half-life and differential method; Opposing reactions, consecutive reactions and parallel reactions Temperature dependence of rate constant; Arrhenius equation, energy of activation; Collisiontheory; Lindemann theory of unimolecular reaction; outline of Transition State theory (classical treatment)

Reference Books:

1. Sethi, A. Conceptual Organic Chemistry; New Age International Publisher.
2. Parmar, V. S. A Text Book of Organic Chemistry, S. Chand & Sons.
3. Madan, R. L. Organic Chemistry, S. Chand & Sons.
4. Wade, L. G., Singh, M. S., Organic Chemistry.
5. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
6. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
7. Eliel, E. L. &Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994.
8. Sen Gupta, Subrata. Basic Stereochemistry of Organic molecules.
9. Kalsi, P. S. Stereochemistry Conformation and Mechanism, Eighth edition, New Age International, 2014.
10. Bahl, A. &Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
11. Chugh, K.L., Agnish, S.L. *A Text Book of Physical Chemistry* Kalyani Publishers

Downloaded from Vidyasagar University by 14.139.211.194 on 08 Nov 2026 21:32:20 PM; Copyright (c) : Vidyasagar University
http://download.vidyasagar.ac.in/OpenLink.aspx?LINKID=78

12. Bahl, B.S., Bahl, A., Tuli, G.D., *Essentials of Physical Chemistry* S. Chand &Co.ltd.
13. Palit, S. R., *Elementary Physical Chemistry* Book Syndicate Pvt. Ltd.
14. Mandal, A. K. *Degree Physical and General Chemistry* Sarat Book House
15. Pahari, S., *Physical Chemistry* New Central Book Agency
16. Pahari, S., Pahari, D., *Problems in Physical Chemistry* New Central Book Agency

MI-2P: Practical **Credits 01 (30 Lectures)**

MI2P: Organic Chemistry- LAB

Qualitative Analysis of Single Solid Organic Compound(s) **(20 Lectures)**

Experiment A: Detection of special elements (N, Cl, and S) in organic compounds.
Experiment B: Solubility and Classification (solvents: H_2O, dil. HCl, dil. NaOH)

Experiment C: Detection of functional groups: Aromatic-NO_2, Aromatic -NH_2, - COOH, carbonyl (no distinction of –CHO and >C=O needed), -OH (phenolic) in solid organic compounds.

Experiments A - C with unknown (at least 6) solid samples containing not more than two of the above type of functional groups should be done.

Physical Chemistry-LAB **(10 Lectures)**

(I) Study the kinetics of the following reactions
a) Initial rate method: Iodide-persulphate reaction
b) Integrated rate method:
(i) Acid hydrolysis of methyl acetate with hydrochloric acid
(ii) Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate
(iii) Decomposition of H_2O_2

Reference Books:

1. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N., University of Calcutta, 2003.
2. Das, S. C., Chakraborty, S. B., Practical Chemistry.
3. Mukherjee, K. S. Text book on Practical Chemistry, New Oriental Book Agency.
4. Ghosal, Mahapatra&Nad, An Advanced course in practical Chemistry, New Central Book Agency.
5. Vogel, A. I. Elementary Practical Organic Chemistry, Part 2: Qualitative Organic Analysis, CBS Publishers and Distributors.
6. 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.
7. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
8. *University Hand Book of Undergraduate Chemistry Experiments*, edited by Mukherjee, G. N., University of Calcutta, 2003.
9. Palit, S.R., *Practical Physical Chemistry* Science Book Agency
10. Mukherjee, N.G., *Selected Experiments in Physical Chemistry* J. N. Ghose&Sons
11. Dutta, S.K., *Physical Chemistry Experiments* Bharati Book Stall

Downloaded from Vidyasagar University by 14.139.211.194 on 08 Nov 2026 21:32:20 PM; Copyright (c) : Vidyasagar University
http://download.vidyasagar.ac.in/OpenLink.aspx?LINKID=78

SKILL ENHANCEMENT COURSE (SEC)

SEC 1: Chemistry of Cosmetics & Perfumes **Credits 03**

SEC1P: Chemistry of Cosmetics & Perfumes **Full Marks: 50**

Course Outline:

Part-A:

i) Preparation of talcum powder.
ii) Preparation of shampoo.
iii) Preparation of enamels.
iv) Preparation of hair remover.
v) Preparation of face cream.
vi) Preparation of nail polish and nail polish remover.
vii) Preparation of Lipstick.

Any other preparation as per the instruction of respective College

Part-B: Field visit and submission of the Report

Suggested Readings:

1. Stocchi, E. Industrial Chemistry, Vol, Ellis Horwood Ltd. UK (1990). Jain,
2. P.C. & Jain, M. Engineering Chemistry DhanpatRai& Sons, Delhi.Sharma,
3. B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).

SEC 2: Medicinal & Pharmaceutical Chemistry **Credits 03**

SEC 2P: Medicinal & Pharmaceutical Chemistry **Full Marks: 50**

Part-A: Extraction

i) Extraction of eucalyptus leaf ingredient
ii) Extraction of eugenol from clove
iii) Extraction of nicotine from tobacco.
iv) Curumine from turmeric
v) Extraction of caffeine from tea/coffee

Part-B: A project: Collection and brief introduction of at least 10 herbal plants

Suggested Readings:

1. Patrick, G. L. Introduction to Medicinal Chemistry, Oxford University Press, UK, 2013.
2. Singh, H. & Kapoor, V.K. Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Pitampura, New Delhi, 2012.
3. Foye, W.O., Lemke, T.L. & William, D.A.: Principles of Medicinal Chemistry, 4th ed., B.I. Waverly Pvt. Ltd. New Delhi.

Downloaded from Vidyasagar University by 14.139.211.194 on 08 Nov 2026 21:32:20 PM; Copyright (c) : Vidyasagar University
http://download.vidyasagar.ac.in/OpenLink.aspx?LINKID=78