

Course Curriculum under National Education Policy

Curriculum and Credit Framework for Undergraduate Chemistry Programme

(to be effective from Academic Year: 2023-24)



**Bankura University
Bankura, West Bengal**

Draft Course Code Format for Chemistry

Draft Programme and Course Structure with Credit Distribution: UG Degree Programmes with Single Major

Category of Course (credit)	Major (4)		Minor Stream (4)	Multidisciplinary (3)	Skill Enhancement Courses (SEC) (3)	Ability Enhancement Courses (AEC) (2)	Value Added Courses common for all (4)	Internship (2)	TOTAL CREDIT / NUMBER OF COURSES
	DSC	DSE							
SEM									
I	1x 4=4 S/CHEM/101/MJC-1		1x4 = 4 S/CHEM/102/MIN-1	1x3 = 3 S/CHEM/103/MID-1	1x 3 = 3 S/CHEM/104/SEC-1	1x 2=2 ACS/105/AEC-1	1x 4 = 4 ACS/106/VAC-1		20 / 6
II	1x 4=4 S/CHEM/201/MJC-2		1x4 = 4 S/CHEM/202/MIN-2	1x3 = 3 S/CHEM/203/MID-2	1x 3 = 3 S/CHEM/204/SEC-2	1x 2=2 ACS/205/AEC-2	1x 4 = 4 ACS/206/VAC-2		20 / 6
CERTIFICATE (total credit)	8		8	6	4		6	4*(ADDITIONAL) ACS/207/INT-1	40

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Important Guidelines

- All graphs for physical courses must be done using standard spreadsheet software (Excel, Origin etc.)
- Each college should take necessary measures to ensure they should have the following facilities:
 1. UV-VIS Spectrophotometer with printer
 2. Internet facility
 3. Computers (~ 1 Computer for 5 students)
- For proper maintenance of above mentioned facilities, clean & dry AC rooms are mandatory.
- Each lecture is of 1 hr duration for both theory and practical classes.

1. Scheme for NEP Curriculum

1.1 Scheme and Credit Distribution for NEP Curriculum

Semester	Broad Category of Course	Course Title	Course Code	Credits
Semester I	Major	Fundamentals of Chemistry	S/CHEM/101/MJC-1	4
	Minor	Fundamentals of Chemistry	S/CHEM/102/MN-1	4
	Multidisciplinary	Basic Chemistry	S/CHEM/103/MD-1	3
	Skill Enhancement Course	Basic Analytical Chemistry	S/CHEM/104/SEC-1	3
	Ability Enhancement Courses (AEC)		ACS/105/AEC-1	2
	Value Added Courses common for all		ACS/106/VAC-1	4
Semester II	Major	Physicochemical Analysis	S/CHEM/101/MJC-2	4
	Minor	Physicochemical Analysis	S/CHEM/102/MN-2	4
	Multidisciplinary	Chemistry in daily life	S/CHEM/103/MD-2	3
	Skill Enhancement Course	Pharmaceuticals Chemistry	S/CHEM/104/SEC-2	3
	Ability Enhancement Courses (AEC)		ACS/105/AEC-2	2
	Value Added Courses common for all		ACS/106/VAC-2	4

2 DSC-1: Major (Core) Subjects Syllabus

2.1 Fundamentals of Chemistry

4 Credits

Extra nuclear Structure of atom

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.

Chemical periodicity

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.

Chemical Bonding I

Covalent bond: Polarizing power and polarizability, ionic potential, Fajan's rules. Lewis structures, formal charge. Valence Bond Theory. The hydrogen molecule (Heitler-London approach), directional character of covalent bonds, hybridizations, equivalent and nonequivalent hybrid orbitals, Bent's rule, Dipole moments, VSEPR theory, shapes of molecules and ions containing lone pairs and bond pairs (examples from main groups chemistry) and multiple bonding (σ and π bond approach).

Bonding and Physical Properties

1. 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)
2. Electronic displacements: inductive effect, field effect, mesomeric effect, resonance energy; bond polarization and bond polarizability; electromeric effect; steric effect, steric inhibition of resonance.
3. 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.

General Treatment of Reaction Mechanism I

1. Mechanistic classification: ionic, radical and pericyclic (definition and example); organic 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). Elementary idea of S_N1 and S_N2 , S_Ni , E_1 , E_2 and E_{1CB} reactions.

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

Stereochemistry -I

1. 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.

2. 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.

3. 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.

Gaseous state I

1. Kinetic Theory of gases: 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); Wall collision and rate of effusion.

2. Maxwell's distribution of speed and energy: Nature of distribution of velocities, Maxwell's distribution of speeds in one, two and three dimensions; calculations of average, root mean square and most probable values in each case; Kinetic energy distribution in one, two and three dimensions, Principle of equipartition of energy and its application to calculate the classical limit of molar heat capacity of gases.

Liquid State

1. Viscosity: General features of fluid flow (streamline flow and turbulent flow); Newton's equation, viscosity coefficient; Poiseuille's equation; principle of determination of viscosity coefficient of liquids by Ostwald and falling sphere method; Temperature variation of viscosity of liquids and comparison with that of gases.

2. Surface tension and energy: Surface tension, surface energy, excess pressure, capillary rise and surface tension; Work of cohesion and adhesion, spreading of liquid over other surface; Vapour pressure over curved surface; Temperature dependence of surface tension.

Thermodynamics I

1. Zeroth and 1st law of Thermodynamics: Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics; Concept of heat, work, internal energy and statement of first law; enthalpy, H; relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions, Joule's experiment and its consequence.

2. Thermo-chemistry: Standard states; Heats of reaction; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; Laws of thermo-chemistry; bond energy, bond dissociation energy and resonance energy from thermo-chemical data, Kirchhoff's equations and effect of pressure on enthalpy of reactions; Adiabatic flame temperature; explosion temperature

Reference Books

- ▶ Lee, J. D. Concise Inorganic Chemistry ELBS, 1991.
- ▶ Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970.
- ▶ Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962.
- ▶ Atkins, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010).
- ▶ Cotton, F.A., Wilkinson, G. and Gaus, P.L., Basic Inorganic Chemistry 3rd Ed.; Wiley India.
- ▶ Sharpe, A.G., Inorganic Chemistry, 4th Indian Reprint (Pearson Education) 2005.
- ▶ Huheey, J. E.; Keiter, E.A. & Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson, 2006.
- ▶ Atkins, P.W. & Paula, J. Physical Chemistry, Oxford Press, 2006.
- ▶ Mingos, D.M.P., Essential trends in inorganic chemistry. Oxford University Press (1998).
- ▶ Winter, M. J., The Orbitron, [http://winter.group.shef.ac.uk/orbitron/\(2002\)](http://winter.group.shef.ac.uk/orbitron/(2002)). An illustrated gallery of atomic and molecular orbitals.
- ▶ Burgess, J., Ions in solution: basic principles of chemical interactions. Ellis Horwood (1999).
- ▶ Nasipuri, D. Stereochemistry of Organic Compounds, Wiley Eastern Limited.
- ▶ Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- ▶ Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd., (Pearson Education).
- ▶ Graham Solomons, T.W & Fryhle, C. B. Organic Chemistry, John Wiley & Sons, Inc.
- ▶ Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson Education.
- ▶ James, J., Peach, J. M. Stereochemistry at a Glance, Blackwell Publishing, 2003.
- ▶ Robinson, M. J. T., Stereochemistry, Oxford Chemistry Primer, Oxford University Press, 2005.
- ▶ Pal, S.C. Principles of Stereochemistry and their Application in Organic Reactions.
- ▶ Sen Gupta, S. Basic Stereochemistry of Organic molecules,

Qualitative semimicro analysis of Inorganic compounds

Qualitative semimicro analysis of mixtures containing four radicals. Emphasis should be given to the understanding of the chemistry of different reactions and to assign the most probable composition. Cation Radicals: Na^+ , K^+ , Ca^{2+} , Sr^{2+} , Ba^{2+} , Al^{3+} , Cr^{3+} , $\text{Mn}^{2+}/\text{Mn}^{4+}$, Fe^{3+} , $\text{Co}^{2+}/\text{Co}^{3+}$, Ni^{2+} , Cu^{2+} , Zn^{2+} , Cd^{2+} , Bi^{3+} , $\text{Sn}^{2+}/\text{Sn}^{4+}$, $\text{Sb}^{3+}/^{5+}$, NH_4^+ , Mg^+ .

Anion Radicals: F^- , Cl^- , Br^- , I^- , SCN^- , S^{2-} , SO_4^{2-} , NO_3^- , NO_2^- , PO_4^{3-} , BO_3^{3-} , CrO_4^{2-} / $\text{Cr}_2\text{O}_7^{2-}$, $[\text{Fe}(\text{CN})_6]^{4-}$, $[\text{Fe}(\text{CN})_6]^{3-}$.

Qualitative Analysis of Single Solid Organic Compounds

1. Detection of special elements (N, S, Cl, Br) by Lassaigne's test
2. Solubility and classification (solvents: H_2O , 5% HCl , 5% NaOH and 5% NaHCO_3)
3. Detection of the following functional groups by systematic chemical tests:
Aromatic amino ($-\text{NH}_2$), aromatic nitro ($-\text{NO}_2$), amido ($-\text{CONH}_2$), phenolic $-\text{OH}$, carboxylic acid ($-\text{COOH}$), carbonyl ($-\text{CHO}$ and $>\text{C}=\text{O}$); only one test for each functional group is to be reported.
4. Melting point (M.P.) of the given compound.
5. Preparation, purification and melting point determination of a crystalline derivative of the given compound.

Physical chemistry Practical

1. Study of viscosity of unknown liquid (glycerol, sugar) with respect to water
2. Determination of surface tension of a liquid using Stalagmometer

Reference Books

- ▶ Svehla, G., Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
- ▶ Vogel, A. I. Elementary Practical Organic Chemistry, Part 2: Qualitative Organic Analysis, CBS Publishers and Distributors.
- ▶ University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N. University of Calcutta, 2003.
- ▶ Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009).
- ▶ Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012).
- ▶ Clarke, H. T., A Handbook of Organic Analysis (Qualitative and Quantitative), Fourth Edition, CBS Publishers and Distributors (2007).
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- ▶ Dutta, S.K., Physical Chemistry Experiments Bharati Book Stall
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- ▶ Manna, A.K. Practical Organic Chemistry, Books and Allied (P) Ltd.
- ▶ Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R.Chand & Co.: New Delhi (2011).

3. Minor Stream Subjects Syllabus

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Extra nuclear Structure of atom

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, 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.

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- ▶ Mandal, A. K. Degree Physical and General Chemistry Sarat Book House
- ▶ Pahari, S., Physical Chemistry New Central Book Agency
- ▶ Pahari, S., Pahari, D., Problems in Physical Chemistry New Central Book Agency
- ▶ Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.
- ▶ Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.
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Anion Radicals: F^- , Cl^- , Br^- , I^- , SCN^- , S^{2-} , SO_4^{2-} , NO_3^- , NO_2^- , PO_4^{3-} , BO_3^{3-} , CrO_4^{2-} / $\text{Cr}_2\text{O}_7^{2-}$, $[\text{Fe}(\text{CN})_6]^{4-}$, $[\text{Fe}(\text{CN})_6]^{3-}$.

Qualitative Analysis of Single Solid Organic Compounds

1. Detection of special elements (N, S, Cl) by Lassaigne's test
2. Solubility and classification (solvents: H_2O , dil. HCl , dil. NaOH)
3. Detection of the following functional groups by systematic chemical tests: aromatic amino ($-\text{NH}_2$), aromatic nitro ($-\text{NO}_2$), amido ($-\text{CONH}_2$), phenolic $-\text{OH}$, carboxylic acid ($-\text{COOH}$), carbonyl ($-\text{CHO}$ and $>\text{C}=\text{O}$); only one test for each functional group is to be reported.
4. Melting point (M.P.) of the given compound.

Physical chemistry Practical

3. Study of viscosity of unknown liquid (glycerol, sugar) with respect to water
4. Determination of surface tension of a liquid using Stalagmometer

Reference Books

- ▶ Svehla, G., Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
- ▶ Vogel, A. I. Elementary Practical Organic Chemistry, Part 2: Qualitative Organic Analysis, CBS Publishers and Distributors.
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- ▶ Manna, A.K. Practical Organic Chemistry, Books and Allied (P) Ltd.

4 Multidisciplinary

4.1 Basic Chemistry

3 credits

1. Chemistry of carbon compounds: Hybridization of carbon, σ and π bonds, Functional group approach for the following (preparations & reactions) to be studied in context to their structures: aliphatic hydrocarbons (alkanes, alkenes, alkynes, alcohols, ethers, carbonyls carboxylic acids, esters, amines and amide) and aromatic hydrocarbons.
2. Methods of purification of organic compound – filtration, crystallization, sublimation, distillation and chromatography.
3. Structure of atom – discovery of sub-atomic particles; atomic models; Bohr's model for hydrogen atom.
4. Classification of element and periodicity in properties – why we need to classify elements? Genesis of periodic classification, Modern periodic Law and the present form of periodic table, periodic trends in properties of elements.
5. Acids and Bases – Different concept of acids and bases – Arrhenius, Lowry –Bronsted, Lewis, and Salt; Ionization of acids and Bases, Ostwald dilution law, Buffer solution; indicators.
6. Gaseous state, gas laws, ideal gas equation and real gas equation.
7. Thermodynamics – concept of heat and work, state and path function, reversible process, isothermal and adiabatic processes, internal energy, enthalpy, reaction enthalpy.

Reference Book:

1. Inorganic Chemistry by R. L. Dutta & G.S. De (Vol I); The New Book Stall.
2. Palit, S. R., Elementary Physical Chemistry Book Syndicate Pvt. Ltd.
3. Pahari, S., Physical Chemistry New Central Book Agency
4. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd., (Pearson Education).
5. Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand.
6. Sen Gupta, S. Organic Chemistry: General Course, Book Syndicate (P) Ltd.

4.2 Chemistry in daily life

3 Credits

1. Hydrocarbons in daily use: Coal based chemicals, petro-chemicals-kerosene, liquefied petroleum gas (LPG)
2. Agrochemicals: Manufacture of ammonia and ammonium salts, sulfur-phosphate, fungicides, herbicides, pesticides
3. Glass and ceramics: Manufactures of glasses, optical glass and colour glass, porcelain, enamel and cement.
4. Food chemistry: Classification of foods- carbohydrates, proteins and fats; nutritional and medicinal values, food additives-food flavour, food colour, food preservatives, artificial sweeteners, Food adulteration in some common foods like turmeric, coriander, peppers etc
5. Drugs and Pharmaceuticals: Aspirin, paracetamol, ibuprofen, vitamin C, vitamin B12 etc.
6. Surface Chemistry: surface tension of liquids and related phenomenon, colloids and surface active agents (detergents), micelle's and applications

References

1. Pharmaceutical Chemistry and Production: An Introductory Textbook by S. K. Mandal, R. Ghanta; Bentham Science Publishers 2022, ISBN: 978-1-68108-890-7
2. Application Oriented Chemistry by S. Sengupta, Books Syndicate Pvt. Ltd., 2000
3. Application Oriented Chemistry by P.K. Gangopadhyay, Books Syndicate Pvt. Ltd.

5.Skill Enhancement Subjects Syllabus

5.1SEC-1 – Basic Analytical Chemistry

3 Credits

Introduction

Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

Analysis of soil

Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators

1. Determination of pH of soil samples.
2. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

Analysis of water

Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.

1. Determination of pH, acidity and alkalinity of a water sample.
2. Determination of dissolved oxygen (DO) of a water sample.

Analysis of food products

Nutritional value of foods, idea about food processing and food preservations and adulteration.

1. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.
2. Analysis of preservatives and colouring matter.

Chromatography

Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.

1. Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}).
2. To compare paint samples by TLC method.

Ion-exchange

1. Column, ion-exchange chromatography etc.
2. Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).

Analysis of cosmetics

Major and minor constituents and their function

1. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.
2. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration

Suggested Applications

1. To study the use of phenolphthalein in trap cases.

2. To analyse arson accelerants.
3. To carry out analysis of gasoline.

Suggested Instrumental demonstrations

1. Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry.
2. Spectrophotometric determination of Iron in Vitamin / Dietary Tablets.
3. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in Soft Drinks

Reference Books

- ▶ Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods of Analysis, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
- ▶ Skoog, D.A., Holler, F.J. & Crouch, S. Principles of Instrumental Analysis, Cengage Learning India Edition, 2007.
- ▶ Skoog, D.A.; West, D.M. & Holler, F.J. Analytical Chemistry: An Introduction 6th Ed., Saunders College Publishing, Fort Worth, Philadelphia (1994).
- ▶ Harris, D. C. Quantitative Chemical Analysis, 9th ed. Macmillan Education, 2016.
- ▶ Dean, J. A. Analytical Chemistry Handbook, McGraw Hill, 2004.
- ▶ Day, R. A. & Underwood, A. L. Quantitative Analysis, Prentice Hall of India, 1992.
- ▶ Freifelder, D.M. Physical Biochemistry 2nd Ed., W.H. Freeman & Co., N.Y. USA (1982).
- ▶ Cooper, T.G. The Tools of Biochemistry, John Wiley & Sons, N.Y. USA. 16 (1977).
- ▶ Vogel, A. I. Vogel's Qualitative Inorganic Analysis 7th Ed., Prentice Hall, 1996.
- ▶ Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.
- ▶ Robinson, J.W. Undergraduate Instrumental Analysis 5th Ed., Marcel Dekker, Inc., New York (1995).
- ▶ Christian, G.D. Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.

5.2SEC-2 – Pharmaceuticals Chemistry

3 Credits

Drugs & Pharmaceuticals

Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, Ibuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine).

Fermentation

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

Hands on Practical

1. Preparation of Aspirin and its analysis.
2. Preparation of magnesium bisilicate (Antacid).

Reference Books

- ▶ Patrick, G. L. Introduction to Medicinal Chemistry, Oxford University Press, UK, 2013.
- ▶ Singh, H. & Kapoor, V.K. Medicinal and Pharmaceutical Chemistry, VallabhPrakashan, Pitampura, New Delhi, 2012.
- ▶ Foye, W.O., Lemke, T.L. & William, D.A.: Principles of Medicinal Chemistry, 4th ed., B.I. Waverly Pvt. Ltd. New Delhi.
- ▶ Pharmaceutical Chemistry and Production: An Introductory Textbook by Samir Kumar Mandal, Rebeca Ghanta; Bentham Science Publishers 2022, ISBN: 978-1-68108-890-7