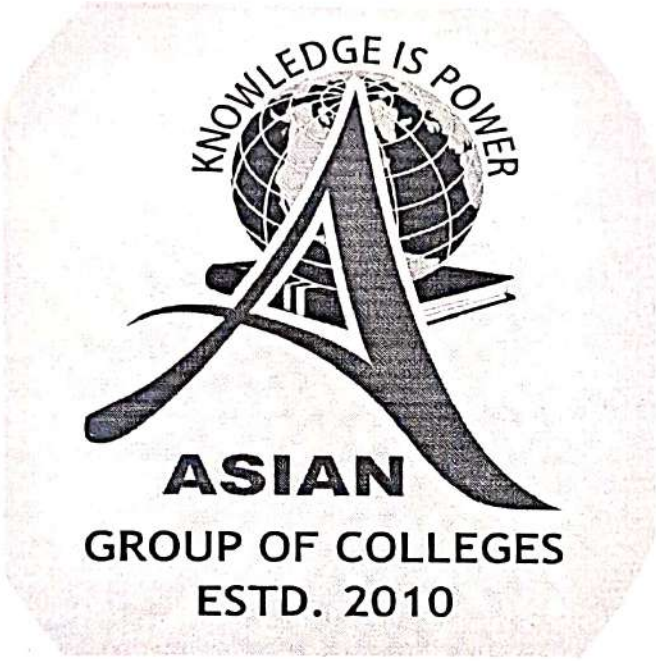
Asian Educational Institute, Patiala

(An Autonomous College)

School of Science and Mathematics



SYLLABUS

B.Sc./B.Sc.(Honours)

Physical Sciences/Life Sciences/ Multidisciplinary

CHEMISTRY (Major, Minor, IDC/MDC, SEC)

(Semester - III & IV)

Session: 2025-26

ASIAN EDUCATIONAL INSTITUTE, PATIALA (PB)

UG PROGRAMME (Bachelor of Science)

PHYSICAL SCIENCES/LIFE SCIENCES/MULTIDISCIPLIANARY

B.Sc. / B.Sc. (HONOURS)

SESSION: 2025-2026

Code	Title of Paper	Hours (Per Week)	Max. Marks			Credits	Examination Time(Hours)
SEMESTR-III			Total	Ext.	Int.		
BCHEM201T	**MAJ:** PHYSICAL CHEMISTRY-I	03	100	70	30	03	03
BCHEM201L	**MAJ:** : CHEMISTRY PRACTICAL	02	50	35	15	01	03
BCHEM201T(M)	**MIN:** PHYSICAL CHEMISTRY-I	03	100	70	30	03	03
BCHEM201L	**MIN:** : CHEMISTRY PRACTICAL	02	50	35	15	01	03
BSEC201	**SEC:** CHEMISTRY OF FERTILIZERS AND PESTICIDES	03	100	70	30	03	03
SEMESTR-IV							
BCHEM202T	**MAJ:** ORGANIC CHEMISTRY-II	03	100	70	30	03	03
BCHEM202L	**MAJ:** CHEMISTRY PRACTICAL	02	50	35	15	01	03
BCHEM202T(M)	**MIN:** ORGANIC CHEMISTRY-II	03	100	70	30	03	03
BCHEM202L	**MIN:** : CHEMISTRY PRACTICAL	02	50	35	15	01	03
BIDC202	**IDC/MDC:** FUNDAMENTALS OF GREEN CHEMISTRY	03	100	70	30	03	03

- **MAJ:** Discipline Specific Core Course: **MIN**: Minor Core Course; **IDC/MDC:** Inter Disciplinary Course/Multi-Disciplinary Course, **AEC:** Ability Enhancement Course, **VAC:** Value Added Course, **SEC:** Skill Enhancement Course.

Semester-III

Paper Code	Title of paper	Teaching hour/week	Max. Marks			Credits	Examination Time (Hours)
			Total Marks	External Exam (marks)	Internal Assessment (Marks)		
BCHEM201T	MAJOR THEORY PHYSICAL CHEMISTRY-I	03	100	70	30	03	03
BCHEM201L	MAJOR PRACTICAL CHEMISTRY LAB	02	50	35	15	01	03

Semester-IV

Paper Code	Title of paper	Hours/ Week	Max. Marks			Credits	Examination Time (Hours)
			Total Marks	External Exam (marks)	Internal Assessment (Marks)		
BCHEM202T	MAJOR THEORY ORGANIC CHEMISTRY-II	03	100	70	30	03	03
BCHEM202L	MAJOR PRACTICAL CHEMISTRY LAB	02	50	35	15	01	03

(Semester III)
(Major Theory)
PHYSICAL CHEMISTRY-I
Paper Code: BCHEM201T

Max. Marks: 100
External Exam: 70 marks
Internal Assessment: 30 marks
Passing Marks: 35%

Credits: 03
Exam Time Duration: 03 hrs.
Total Teaching hours: 45 hrs.

INSTRUCTIONS FOR THE PAPER SETTER
The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 12 marks each. Section C will consist of 11 short answer questions that will cover the entire syllabus and will be of 2 marks each.

INSTRUCTIONS FOR THE CANDIDATES
Students have to attempt four questions in all from Section A and B by selecting two questions from each section. Section C will be compulsory.

COURSE OBJECTIVES:
The course is well designed to learn about the various states of matter-liquids and gases states, and thermodynamics. The main aim of the course is to give the theoretical background as well as the application perspective of the physical parameters.

COURSE OUTCOMES:

S. No.	On completing the course
CO1	Students will learn to implicate the concepts of gaseous state, kinetic theory, and vander Waals equations to real systems.
CO2	Learn about applications of Liquid crystals in LCDs and Digital Electronics
CO3	Students will earn about the various thermodynamic terms and processes.
CO4	They will understand the first law of thermodynamics and will learn to calculate the various thermodynamic properties for reversible isothermal and adiabatic expansion of ideal gases. They will also solve various numerical problems related to these topics.
CO5	Students will learn about the second and third law of thermodynamics. Carnot cycle, concept of entropy and free energy and numerical problems associated with these concepts.

Section-A

Mathematical Concepts

Logarithmic relations curve sketching, linear graphs and calculation of slopes, differentiation of functions like kx, e^x, x^n, sin x, log x, maxima and minima, partial differentiation and reciprocity relations. Integration of some useful/relevant functions permutations and combinations, Factorials.

Gaseous State

Postulates of kinetic theory of gases, deviation from ideal behaviour, Van der Waals equation of state, the isotherms of van der Waals equation, relationship between critical constants and Van der Waals constants, the law of corresponding states, reduced equation of state.

Molecular Velocities: Root mean square, average and most probable velocities. Qualitative discussion of the maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, Liquefaction of gases.

Liquid State

Intermolecular forces, structure of liquids (a qualitative description) Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquid crystal, solid and liquid, Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.

Physical properties and molecular structure

Optical activity, polarization (Claussius -Mossotti Equation), Orientation of dipoles in an electric field, dipole moment, induced dipole moment, dipole moment and structure of molecules, magnetic properties- paramagnetism, diamagnetism, and ferromagnetism.

Section-B

Thermodynamics-I

Definition of thermodynamics terms: system, surroundings. Types of systems, intensive and extensive properties.State and path functions and their differentials, Thermodynamic processes, Concept of heat and work, elementary idea of thermochemistry.

First Law of Thermodynamics: statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law. Joule Thomson coefficient and inversion temperature, Calculation of w, q, dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermodynamics-II

Second law of thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.

Concept of Entropy: Entropy as a state function, entropy as a function of V &T, entropy as a function of P &T, entropy change in physical change, Clausius inequality, entropy as a criterion of spontaneity and equilibrium. Entropy change in ideal gases mixing of gases.

Thermodynamics-III

Third law of thermodynamics, Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data, Gibbs and Helmholtz functions; Gibbs function (G) and Helmhotz function (A) as thermodynamic quantities. A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T

BOOKS PRESCRIBED:

1. Physical Chemistry, P.W. Atkins, 8thEd., Oxford University Press, 2006 (IndianPrint).
2. Physical Chemistry, T. Engel &P. Reid, 1st Ed., Pearson Education, 2006.
3. Physical Chemistry, Castellan, 3rdEd., Addison Wisley/Narosa,1985 (IndianPrint)
4. Physical Chemistry, G. M. Barrow, 6thEd., NewYork, McGrawHill, 1996.
5. Physical Chemistry, R. J. Silbey, R. A. Albert & Moungi G. Bawendi, 4thEd., New York, John Wiley, 2005
6. The Elements of Physical Chemistry, P.W. Atkins, OUP Oxford; 6th Edition , December 2012.
7. Physical Chemistry through Problems. S. K. Dogra and S. Dogra. Wiley Eastern Ltd.

(Semester III)
(Minor Theory)
PHYSICAL CHEMISTRY-I
Paper Code: BCHEM201T(M)

Max. Marks: 100
External Exam: 70 marks
Internal Assessment: 30 marks
Passing Marks: 35%

Credits: 03
Exam Time Duration - 3 hrs.
Total Teaching hours: 40hrs.

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 12 marks each. Section C will consist of 11 short answer questions that will cover the entire syllabus and will be of 2 marks each.

INSTRUCTIONS FOR THE CANDIDATES

Students have to attempt four questions in all from Section A and B by selecting two questions from each section. Section C will be compulsory.

COURSE OBJECTIVES:

The course is well designed to learn about the various states of matter-liquids and gases states, and thermodynamics. The main aim of the course is to give the theoretical background as well as the application perspective of the physical parameters.

COURSE OUTCOMES:

S. No.	On completing the course
CO1	Students will learn to implicate the concepts of gaseous state, kinetic theory, and vander Waals equations to real systems.
CO2	Learn about applications of Liquid crystals in LCDs and Digital Electronics
CO3	Students will earn about the various thermodynamic terms and processes.
CO4	They will understand the first law of thermodynamics and will learn to calculate the various thermodynamic properties for reversible isothermal and adiabatic expansion of ideal gases. They will also solve various numerical problems related to these topics.
CO5	Students will learn about the second and third law of thermodynamics. Carnot cycle, concept of entropy and free energy and numerical problems associated with these concepts.

Section-A

Mathematical Concepts

Logarithmic relations curve sketching, linear graphs and calculation of slopes, differentiation of functions like kx, e^x, x^n, sin x, log x, maxima and minima, partial differentiation and reciprocity relations. Integration of some useful/relevant functions permutations and combinations, Factorials.

Gaseous State

Postulates of kinetic theory of gases, deviation from ideal behaviour, Van der Waals equation of state, the isotherms of van der Waals equation, relationship between critical constants and Van der Waals constants, the law of corresponding states, reduced equation of state.

Molecular Velocities: Root mean square, average and most probable velocities. Qualitative discussion of the maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, Liquefaction of gases.

Liquid State

Intermolecular forces, structure of liquids (a qualitative description) Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquid crystal, solid and liquid, Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.

Section-B

Thermodynamics-I

Definition of thermodynamics terms: system, surroundings. Types of systems, intensive and extensive properties. State and path functions and their differentials, Thermodynamic processes, Concept of heat and work, elementary idea of thermochemistry.

First Law of Thermodynamics: statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship.Joule's law. Joule Thomson coefficient and inversion temperature, Calculation of w, q, dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermodynamics-II

Second law of thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.

Concept of Entropy: Entropy as a state function, entropy as a function of V &T, entropy as a function of P &T, entropy change in physical change, Clausius inequality, entropy as a criterion of spontaneity and equilibrium. Entropy change in ideal gases mixing of gases.

Thermodynamics-III

Third law of thermodynamics, Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data, Gibbs and Helmholtz functions; Gibbs function (G) and Helmhotz function (A) as thermodynamic quantities. A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.

BOOKS PRESCRIBED:

1. Physical Chemistry, P.W. Atkins, 8th Ed., Oxford University Press, 2006 (IndianPrint).
2. Physical Chemistry, T. Engel &P. Reid, 1st Ed., Pearson Education, 2006.
3. Physical Chemistry, Castellan, 3rd Ed., Addison Wisley/Narosa,1985 (IndianPrint)
4. Physical Chemistry, G. M. Barrow, 6th Ed., NewYork, McGrawHill, 1996.
5. Physical Chemistry, R. J. Silbey, R. A. Albert & Moungi G. Bawendi, 4th Ed., New York, John Wiley, 2005
6. The Elements of Physical Chemistry, P.W. Atkins, Oxford
7. Physical Chemistry through Problems. S. K. Dogra and S. Dogra. Wiley Eastern Ltd.

CHEMISTRY PRACTICAL
SEMESTER III
PAPER CODE: BCHEM201L

Max Marks: 50
External Exam: 35 marks
Internal Assessment: 15 marks
Passing Marks: 35%

Credits: 01
Time allowed: 3hrs

INSTRUCTIONS FOR THE

PAPER SETTERS EXAMINERS/CANDIDATES

In this session students will perform Physical chemistry practicals. Examiner will conduct viva-voce of students.

1) The examiner will provide a list of four physical chemistry experiments. The examiner will allot one experiment randomly to each candidate.
2) The candidate will write theory, brief procedure and general calculations of the experiment in the first 10 minutes and thereafter perform the actual experiment.

DETAILS OF DISTRIBUTION OF MARKS

Physical Chemistry Experiment	**15 marks** (Initial write up & Perfomance)
Initial Write up 5 marks	(Theory/principle:1, Procedure: 2 General Calculations: 2)
Performance and result:	**10 marks**(Full credit up to 10% error)}
Viva-voce	**05 marks**
Practical Record	**05 marks**

Experiments

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. Viscosity & Surface Tension of pure liquids.
4. To determine the viscosity and surface tension of C_2H_5OH and glycerin solution in water
5. Molecular weight determined by Rast method.
6. To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
7. To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
8. To determine the enthalpy of solution of solid calcium chloride.

BOOKS PRESCRIBED:

1. Experiments in Physical Chemistry. R.C. Dass and B. Behra, Tata McGraw Hill.1993.
2. Advanced Practical Physical Chemistry, J. B. Yadav, Goel Publishing House. 2006.
3. Advanced Experimental Chemistry. Vol. I Physical, J.N. Gurtu and Amit Gurtu, Pragati Prakashan .2012.
4. Experiments in Physical Chemistry. J.E. Ghosh, Bharati Bhavan, Bharati Bhawan Publishers & Distributors. 2007.

Sem

(Semester IV)
(Major Theory)
ORGANIC CHEMISTRY-II
Paper Code: BCHEM202T

Max Marks: 100
External Exam: 70 marks
Internal Assessment: 30 marks
Passing Marks: 35%

Credits: 03
Exam Time Duration - 3 hrs.
Total teaching hours: 45 hrs.

INSTRUCTIONS FOR THE PAPER SETTER
The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 12 marks each. Section C will consist of 11 short answer questions that will cover the entire syllabus and will be of 2 marks each.

INSTRUCTIONS FOR THE CANDIDATES
Students have to attempt four questions in all from Section A and B by selecting two questions from each section. Section C will be compulsory.

COURSE OBJECTIVES:
The aim of the course is to enhance the basic knowledge of students on the topic aromaticity, arenes, halides, Mechanism of organic reactions, chemistry of alcholos, aldehydes and ketones.

COURSE OUTCOMES:

Sr. No.	On completing the course
CO1	Students will have a thorough knowledge about the chemistry of some selected functional groups of organic compounds and their reactions.
CO2	To enable the students to understand and study Organic reaction mechanisms.
CO3	Enable the students to study the structure, preparation and reactivity of arenes, halides, and Phenols.
CO4	Students will be able to study about alcohols, aldehyde and ketones containing compounds in detail.

Section-A

Arenes and Aromaticity

Nomenclature of benzene derivatives.The aryl group.Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO picture.

Aromaticity: The Huckel rule, aromatic ions. Aromatic electrophilic substitution-general pattern of the mechanism, role of σ and π complexes.Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Methods of formation and chemical reaction of alkyl benzene alkynyl benzene.

Alkyl and Aryl Halides

Nomenclature and classes of alkyl halides, methods of formation chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, S_N2 and S_N1 reactions with energy profile diagrams. Methods of formation of aryl halides, nuclear and side chain reactions. The addition elimination and the elimination-additional mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides allyl, vinyl and aryl halides.

Alcohols

Classification and nomenclature.Monohydric Alcohols-nomenclature, methods of formation by reduction of aldehydes, ketone, carboxylic acids and esters. Hydrogen bonding, Acidic nature, Reactions of alcohols. Dihydric alcohols-nomenclature, methods of formation, chemical reactions of vicinal glycols-nomenclature, methods of formation chemical reaction of vicinal glycols, oxidative cleavage with [$Pb(OAc)_4$ and HIO_4] and Pinacol-Pinacolone rearrangement. Trihydric alcohol-nomenclature, methods of formation and chemical reactions of glycerol.

Section-B

Phenols

Nomenclature, structure and bonding. Preparation of Phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonanace stabilization of phenoxide ion.Reactions of phenols-electrophilic aromatic subsititution, acylation and carboxylation Mechanisms of Fries rearrangement. Gatterman synthesis, Hauben. Hostch reaction. Lederer-Mianasse reaction and Reimer-Tiemann reaction.

Aldehydes and Ketones

Nomenclature and structure of the carbonyl group, Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehyes and ketones using 1,3 dithianes, synthesis of ketones from nitrites and from carboxylic acids. Physical properties and Mechanism of nucleophillic addition to carbonyl group with particular emphasis of Benzoin, Aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives, Wittig reaction, and Mannich reaction.

Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV (MeerweinPondoroffVorley) reaction, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions. Halogenation of enolizable ketones.

An Introduction to α, β unsaturated aldehydes and ketones, Michael addition.

BOOKS PRESCRIBED:

1. Organic Chemistry. Morrison and Boyd, Prentice Hall.
2. Organic Chemistry. L.G. Wade Ir.Prentice Hall.
3. Fundamentals of Organic Chemistry. Solomons, John Wiley.
4. Organic Chemistry. Vol. I, II & III. S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International)
5. Organic Chemistry. F.A. Aarey, McGraw Hill India.
6. Introduction to Organic Chemistry. Stretwieser, Heathcock and Kosover, Machmilan.

(Semester IV)
(Minor Theory)
ORGANIC CHEMISTRY-II
Paper Code: BCHEM202T(M)

Max. Marks: 100
External Exam: 70 Marks
Internal Assessment: 30 Marks
Passing Marks: 35%

Credits: 03
Exam Time Duration - 3 hrs.
Total teaching hours: 45 hrs.

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 12 marks each. Section C will consist of 11 short answer questions that will cover the entire syllabus and will be of 2 marks each.

INSTRUCTIONS FOR THE CANDIDATES

Students have to attempt four questions in all from Section A and B by selecting two questions from each section. Section C will be compulsory.

COURSE OBJECTIVES:

The aim of the course is to enhance the basic knowledge of students on the topic aromaticity, arenes, halides, Mechanism of organic reactions, chemistry of alcohols, aldehydes and ketones.

COURSE OUTCOMES:

Sr. No.	On completing the course
CO1	Students will have a thorough knowledge about the chemistry of some selected functional groups of organic compounds and their reactions.
CO2	To enable the students to understand and study Organic reaction mechanisms.
CO3	Enable the students to study the structure, preparation and reactivity of arenes, halides, and Phenols.
CO4	Students will be able to study about alcohols, aldehyde and ketones containing compounds in detail.

Vinodh

Section-A

Arenes and Aromaticity

Nomenclature of benzene derivatives.The aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure.

Aromaticity: the Huckel rule, aromatic ions. Aromatic electrophilic substitution-general pattern of the mechanism, role of σ and π complexes. Mechanism or nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio.

Alkyl and Aryl Halides

Nomenclature and classes of alkyl halides, methods of formation chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, S_N2 and S_N1 reactions with energy profile diagrams. Methods of formation of aryl halides, nuclear and side chain reactions. The addition elimination and the elimination-additional mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides allyl, vinyl and aryl halides

Alcohols

Classification and nomenclature.Monohydric Alcohols-nomenclature, methods of formation by reduction of aldehydes, ketone, carboxylic acids and esters. Hydrogen bonding, Acidic nature, Reactions of alcohols. Dihydric alcohols-nomenclature, methods of formation, chemical reactions of vicinal glycols-nomenclature, methods of formation chemical reaction of vicinal glycols, oxidative cleavage with [$Pb(OAc)_4$and HIO_4] and Pinacol-Pinacolone rearrangement.

Section-B

Phenols

Nomenclature, structure and bonding.Preparation of Phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonanace stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic subsititution, acylation and carboxylation Mechanisms of Fries rearrangement. Gatterman synthesis, Hauben.Hostch reaction. Lederer-Mianasse reaction and Reimer-Tiemann reaction.

Aldehydes and Ketones

Nomenclature and structure of the carbonyl group, Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehyes and ketones using 1,3- dithianes, synthesis of ketones from nitrites and from carboxylic acids. Physical properties and Mechanism of nucleophillic addition to carbonyl group with particular emphasis of Benzoin, Aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives, Wittig reaction, and Mannich reaction.

Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV (MeerweinPondoroffVorley) reaction, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions. Halogenation of enolizable ketones.

An Introduction to α, β unsaturated aldehydes and ketones, Michael addition.

BOOKS PRESCRIBED:

1. Organic Chemistry. Morrison and Boyd, Prentice Hall.
2. Organic Chemistry. L.G. Wade Ir.Prentice Hall.
3. Fundamentals of Organic Chemistry. Solomons, John Wiley.
4. Organic Chemistry. Vol. I, II & III. S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International)
5. Organic Chemistry. F.A. Aarey, McGraw Hill India.
6. Introduction to Organic Chemistry. Stretwieser, Heathcock and Kosover, Machmilan.

Vanath

SEMESTER IV
CHEMISTRY PRACTICAL
PAPER CODE: BCHEM202L

Max. Marks: 50
External Exam: 35 Marks
Internal Assessment: 15 Marks
Passing Marks: 35%

Credits: 01
Time allowed: 3hrs

INSTRUCTIONS FOR EXAMINERS AND CANDIDATES

The practical examination will be held in single session (morning/evening). Candidates are required to perform practicals from Qualitative Organic Analysis and TLC Experiments. (Books may be consulted)

Distribution of marks will be as under:

(1)	Organic Qualitative Analysis	=	15 marks
	(Detection of elements identification and confirmation of functional group by 2 confirmatory tests.)		
(2)	TLC	=	10 marks (Performance and result)
(3)	Viva-Voce	=	05 marks
(4)	Practical Record	=	05 marks
	Total	=	**35 marks**

Laboratory Techniques

Thin Layer Chromatography

Determination of R_f values of different components.

(a) Separation of green leaf pigments (spinach leaves may be used)

(b) Preparation and separation of 2,4-dinitrophenylhydrazones of acetone, benzophenone and cyclohexanone using toluene and light petroleum mixture (40 : 60).

(c) Separation of a mixture of dyes.

Qualitative Analysis

Detection of elements (N, S and halogens) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.

BOOKS PRESCRIBED:

1. Experimental Organic Chemistry. Vol. I &II, P. R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
2. Laboratory Manual in Organic Chemistry. R. K. Bansal, Wiley Eastern.
3. Vogel's Textbook Practical Organic Chemistry. B.S. Furniss, A. L. Hannaford, Vogels, P.W.G. Smith and A.R. Tatchell, ELBS.
4. Experiments in General Chemistry. C. N. R. Rao and U.E. Aggarwal. East- West Press.

(Semester-IV)
Interdisciplinary Course (IDC)
FUNDAMENTALS OF GREEN CHEMISTRY
Paper Code: BIDC202

Max Marks: 100
External Exam: 70 marks
Internal Assessment: 30 marks
Pass Marks: 35%

Credits: 03
Exam Time Duration: 3 hrs.
Total Teaching hours: 36hrs.

INSTRUCTIONS FOR THE PAPER SETTER
The question paper will consist of three sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and will carry 12 marks each. Section C will consist of 11 short answer questions that will cover the entire syllabus and will be of 2 marks each.

INSTRUCTIONS FOR THE CANDIDATES
Students have to attempt four questions in all from Section A and B by selecting two questions from each section. Section C will be compulsory.

COURSE OBJECTIVES:
The aim of the course is to expose the students to the emerging discipline of green chemistry of drugs.

COURSE OUTCOMES:

S. No.	On completing the course
CO1	Students will be having knowledge about the field of green chemistry.
CO2	Acquire knowledge of the 12 principles of green chemistry.
CO3	Students will develop an understanding of cleaner production and green synthesis methods.
CO4	Student will also acquire the Knowledge of catalysis, and microwave theory.

Section – A

Introduction to Green Chemistry

What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/Obstacles in the pursuit of the goals of Green Chemistry. Definition and concepts: green chemistry; sustainable consumption of resources; individual and community level participation such as small-scale composting pits for biodegradable waste.

Principles of Green Chemistry and Designing a Chemical synthesis

Twelve principles of Green Chemistry with their explanations and examples; Designing a Green Synthesis using these principles; Prevention of Waste/byproducts; maximum incorporation of the materials used in the process into the final products (Atom Economy).

Section – B

Cleaner Production

The Cleaner Production Concept, Why Cleaner Production, Difference With End of Pipe Concept, Cleaner Production and Sustainable Development, Implementation of Cleaner Production, Change of Raw Material, Technology Change, Good Operating Practice, Product Change, On Site Reuse And Recycling, Who Is Responsible For Cleaner Production, Goverment Rules, Green Synthesis of Nano Particles.

Green Chemical Strategies for Sustainable Development

Areas of green chemistry, Reaction mass balance-Atom Economy, Evaluation for Chemical Reaction Efficiency, Green Solvents/ reaction Media, Catalysis and Bio catalysis. Microwave oven as a reactor, Theory of Microwave Heating.

BOOKS PRESCRIBED:

1. Anastas, P. T., Warner, J. Green Chemistry: Theory and Practice; Oxford University Press: London, 1998.
2. Mukesh Doble, Anil Kumar Kruthiventi, in Green Chemistry and Engineering, 2007
3. V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry, Anamalaya Publishers (2005).
4. P.T. Anastes & J.K. Warmer: Oxford Green Chemistry- Theory and Practical, University Press (1998).
5. A.S. Matlack: Introduction to Green Chemistry, Marcel Deckkar (2001).
6. M.C. Cann & M.E. Connely: Real-World cases in Green Chemistry, American Chemical Society, Washington (2000).
7. M.A. Ryan & M. Tinnesand, Introduction to Green Chemistry, American Chemical Society, Washington (2002)

For Total Syllabus

BOOKS RECCOMENDED FOR COMPLETE COURSE (THEORY COURSES)

1. *Basic Inorganic Chemistry.* F.A. Cotton. G. Wilkinson and P.L..Gaus. Wiley.
2. *Concise Inorganic Chemistry. 1.D.* Lee. ELBS,1999.
3. *Concepts of Models of Inorganic Chemistry.* B. Doaglas. D. McDaniel and 1. Alexander, John Wiley.
4. *Inorganic Chemistry.* D.E. Shriver, P. W. Aikins and C.H. Langford. Oxford.
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6. *Inorganic Chemistry.* A.G. Sharpe, ELBS.
7. *Inorganic Chemistry.* G.L. Miessler and O.A. Tarr, Prentice Hall.
8. *Organic Chemistry.* Morrison and Boyd, Prentice Hall.
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12. *Organic Chemistry.* F.A. Aarey, McGraw Hill India.
13. *Introduction to Organic Chemistry.* Stretwieser, Heathcock and Kosover, Machmilan.
14. *Physical Chemistry.* G.M. Barrow, International Student Edition. McGraw Hill.
15. *Basic Programming with Application.* V.K. Jain, 1'ata McGraw Hill.
16. *Computers and Common. Sense.* B. Ryal and Shely, Prentice Hall.
17. *University General Chemistry.* C.N.B. Rao. Macmillan.
18. *Physical Chemistry.* R.A. Alberty, Wiley Eastern Ltd.
19. *The Elements of Physical Chemistry,* P.w. Aikins, Oxford.
20. *Physical Chemistry Through Problems.* S.K. Dogra and S. Dogra. Wiley Eastern Ltd.

BOOKS RECOMMENDED FOR COMPLETE COURSE (LABORATORY COURSES)

7. *Vogel's Qualitative Inorganic Analysis,*revised, Svehla, Orient Longman.
8. *Vogel's Textbook of Quantitative Inorganic Analysis* (revised), J. Basseff, R.C. Dennery, G.H. Jeffery and J. Mendham, ELBS.
9. *Standard Methods of Chemical Analysis,* W.w. Scott the Technical Press.
10. *Experimental Inorganic Chemistry:* W.G. Palmer, Cambridge.
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12. *Inorganic Synthesis,* McGraw Hill.
13. *Experimental Organic Chemistry.* Vol. I &II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
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17. *Experiments in Physical Chemistry.* R.C. Dass and B. Behra, Tata McGraw Hill.
18. *Advanced Practical PhysicalChemistry,* J.B. Yadav, Goel Publishing House.
19. *Advanced Experimental Chemistry.* Vol. I :Physical, J.N. Gurtu and R. Kapoor, S. Chand & CO.
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