FACULTY OF SCIENCES

SYLLABUS FOR BATCH 2024-28

Programme Code: *BSHM/ BSHP*

B. Sc. Maths (3 Years)/B. Sc. (Hons.) Maths (4 Year)

B. Sc. Physics (3 Years)/B. Sc. (Hons.) Physics (4 Year)

Academic Session: 2024-25

Batch 2024: Semester I-II

Department of Chemistry
Khalsa College, Amritsar

COURSE SCHEME											
SEMESTER - I											
Course Code	**Course Name**	**Hours /Week**	**Credits**			**Total Credits**	**Max Marks**				**Page No.**
			L	**T**	**P**		**Th**	**P**	**IA**	**Total**	
CHX 111	Organic Chemistry	3	3	0	0	3	56		19	75	
CHX 112	Organic Chemistry Lab	2	0	0	1	1		19	06	25	

SEMESTER – II											
Course Code	**Course Name**	**Hours /Week**	**Credits**			**Total Credits**	**Max Marks**				**Page No.**
			L	**T**	**P**		**Th**	**P**	**IA**	**Total**	
Minor Courses (If Any)											
CHX 121	Inorganic Chemistry	3	3	0	0	3	56		19	75	
CHX 122	Inorganic Chemistry Lab	2	0	0	1	1		19	06	25	

Semester-I

B. Sc. Maths (3 Years)/B. Sc. (Hons.) Maths (4 Year)
B. Sc. Physics (3 Years)/B. Sc. (Hons.) Physics (4 Year)

Semester-I
CHX 111
Organic Chemistry-I

Total Hours: 45
Total Hours/week: 3
Total Credits: 3
L T P
3 0 0

Maximum Marks: 75
Theory: 56
Internal Assessment: 19

INSTRUCTIONS FOR PAPER SETTERS AND CANDIDATES

(Scientific calculator is allowed)

I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
III. Section-I will consist of eight six short questions carrying 2 marks each and students are required to attempt any six question.
IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 11 Marks.
V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

COURSE OBJECTIVES:

The objective of Organic Chemistry-I course is to enhance the knowledge of students on the topics of Stereochemistry especially in reference to the OPTICAL ISOMERISM. The course is also targeted to increase the knowledge of students for the various methods of preparation and properties of Alkanes, Alkenes, Alkynes, Arenes, aromaticity and Nucleophilic addition and Substitution reactions

COURSE CONTENTS:

UNIT-I 15Hrs

Stereochemistry: Molecular chirality, enantiomers/symmetry in achiral structures, chiral centres in chiral molecules, properties of chiral molecules-optical activity, absolute and relative configuration, the Cahn-Ingold Prelog R-S notional system physical properties of enantiomers. Resolution of enantiomers.

UNIT-II 15Hrs

Chemistry alkanes and alkenes: Conformations of alkanes and cycloalkanes: conformational analysis of ethane and n-butane; conformational analysis of cyclohexane, axial and equatorial bonds. Difference between configuration and conformation. Stereochemistry of alkenes. Mechanism of hydrogenation of alkenes, stereochemistry of hydrogenation of alkenes, Dehydration of alcohols and regioselectivity of these reactions. Acid catalysed dehydration of alcohols with complete mechanistic discussion,

Alkynes: Acidity of acetylene and terminal alkenes, metal ammonia reduction of alkyne, addition of hydrogen halides and water to alkynes with mechanism.

UNIT-III. 15Hrs

Nucleophilic substitution and addition reaction:

(a) Mechanism of nucleophilic substitution (SN^1/SN^2), stereochemistry of SN^1/SN^2 reactions, carbocation stability and the rate of substitution by the SN^1 mechanism, stereochemistry of SN^1 reactions, carbocation rearrangements in SN^1 reactions, solvent effects, substitution and elimination as competing reactions.

(b) Principles of nucleophillic addition to carbonyl groups : Hydration, acetal formation, cyanohydrin formation, reactions with primary and secondary amines, Wittig reaction, steroselective addition to carbonyl groups, mechanism of halogenation and aldol condensation

UNIT-IV 15Hrs

Arenes and Aromaticity

Structure of benzene and its derivatives, molecular formula and kekule structure. Stability and resonance structure of benzene with its MO picture. Aromaticity: the Huckel's 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/pararatio.

BOOKS PRESCRIBED

1. R.T. Morison and R.N. Boyd, Organic Chemistry.
2. I.L. Finar, Organic Chemistry, Vol. I IV ed.
3. Advanced Organic Chemistry, Reactions Mechanisms and Structure by J. March.
4. Schaum's Outlines Series Theory and Problems of Organic Chemistry by Herbert Meislickand Jacob Sharefkin
5. Problems and their solution in Organic chemistry by I.L. Finar, Modern Organic Chemistryby J.D. Robbert and M.C. Caserio.
6. Organic Chemistry by D.J. Cram and G.S. Hammond.
7. J.E. Banks, Naming Organic Compounds – Programmed Introduction to Organic Chemistry.
8. E.L. Eliel, Stereochemistry of carbon compounds.
9. W. Camp, Organic Spectroscopy.
10. F.A. Carey, Organic Chemistry.

COURSE OUTCOMES:

S. No.	On completing the course, Students will
CO1	Learn about SN1, SN2 and SNi Mechanism and the related stereochemistry.
CO2	Understand the concept, principle and applications of UV, IR and NMR Spectroscopy and the problems pertaining to the structure elucidation of simple organic compounds.
CO3	Learn how to solve the elimination reaction problems
CO4	Learn to distinguish between type of addition, elimination and substitution reaction.
CO5	Learn E and Z nomenclature ,Stereo chemical principal, enantiomeric relationship R and S

B. Sc. Maths (3 Years)/B. Sc. (Hons.) Maths (4 Year)
B. Sc. Physics (3 Years)/B. Sc. (Hons.) Physics (4 Year)
Semester-I
CHX-112
Organic Chemistry Lab-I

Total Hours: 30
Total Hours/week: 2
Total Credits: 1
L T P
0 0 1

Maximum Marks: 25
Practical: 19
Internal Assessment: 06

INSTRUCTIONS FOR PAPER SETTERS AND CANDIDATES:

I. Examiner will give one organic salt to the students.
II. Each student will get different salt and analyse it for elements, functional group and prepare its derivatives.
III. The question paper will be 19 marks with split as under:
(Write up = 6, Performance = 6, Viva-voce = 5, Practical note book = 2)

COURSE OBJECTIVES:

In organic chemistry practical students will learn about the Evaluation of organic compounds for the detection of element, functional group and preparation of their derivatives. It includes following functional groups: Acids, ketones, aldehyde, carbohydrates, aromatic hydrocarbons, aromatic amines and phenols.

COURSE CONTENTS:

The preliminary examination of physical and chemical characteristics (physical state, colour, odour and ignition tests), elemental analysis (nitrogen, sulphur, chlorine, bromine, and iodine), solubility tests including acid-base reactions, classification tests involving functional reactivity other than acid-base test, preparation of derivatives for given pure organic compounds.

The following categories of compounds should be analyzed.
-phenols, carboxylic acids
-carbonyl compounds - ketones, aldehydes
-carbohydrates
-aromatic amines
-aromatic hydrocarbons

BOOKS PRESCRIBED:
Practical Organic Chemistry by F.G. Mann and B.C. Saunders

COURSE OUTCOMES:

S. No.	On completing the course, the student will be able to
CO1	Perform functional group analysis
CO2	Prepare derivatives of organic compounds
CO3	Determine physical constant: Melting point, Boiling point.
CO4	Learn different separation techniques.
CO5	Learn how to perform TLC

Semester-II

B. Sc. Maths (3 Years)/B. Sc. (Hons.) Maths (4 Year)
B. Sc. Physics (3 Years)/B. Sc. (Hons.) Physics (4 Year)
Semester-II
CHX 121
Inorganic Chemistry-II

Total Hours: 45
Total Hours/week: 3
Total Credits: 3
L T P
3 0 0

Maximum Marks: 75
Theory: 56
Internal Assessment: 19

INSTRUCTIONS FOR PAPER SETTERS AND CANDIDATES

(Scientific calculator is allowed)

I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
III. Section-I will consist of eight six short questions carrying 2 marks each and students are required to attempt any six question.
IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 11 Marks.
V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

COURSE OBJECTIVES:

Students will learn naming of coordination complexes, Factors affecting co-ordination numbers and stereo-chemistry. The objective of the course is to teach the various theories dealing with the bonding in co-ordination compounds like VBT theory, CFT and MOT theory applied to homonuclear diatomic molecules and heteronuclear Diatomic molecules charge transfer transitions, π-Acid Ligands, and Alkali metal and alkaline earth metal chelators

COURSE CONTENTS:

UNIT-I 15Hrs

Co-ordination Chemistry: Introduction, Werner's coordination theory, naming of co-ordinate complexes. Co-ordination numbers 1-12 and their stereo-chemistries. Factors affecting co-ordination numbers and stereo-chemistry

(a) Configurational Isomers

(b) Conformational isomerism,

Bonding in metal complexes: Valence bond theory for co-ordinate complexes, inner and outer orbital complexes, Electro-neutrality and back bonding, limitations of V.B. theory.

UNIT-II 15Hrs

Crystal field theory: Splitting of d-orbitals in octahedral, tetrahedral. Pairing Energy, Calculation of C.F.S.E. in high spin and low spin octahedral and High spin tetrahedral complexes, factors affecting the 10 Dq Value. Structural effects of crystal field splitting (Jahn-Teller distortion, variation of Ionic radii with increase in atomic number). Thermodynamics effects of C.F. splitting, variation in lattice energies and Hydration energies.

UNIT-III 15Hrs

Electronic spectra, Beer Lambert Law, Angular Momentum of electron spectra, Total angular momentum, Microstates and spectroscopic terms, a calculation of spectroscopic terms ford, electronic configurations, L S coupling, Hund's rule for finding the ground state terms, Electronic spectral properties of Ist transition series, Orgel Diagrams for d^1 - d^{10} systems, for weak field octahedral and tetrahedral complexes, limitations of C.F.T

UNIT-IV 15Hrs

Alkali metal and alkaline earth metal chelators: Macrocyclic ligands, macrocyclic effect, crownethers and podands, coronands, cryptands, structure of 18 crown-6 complex with KNCS, ion cavity complex, effect of anion and cation type on complex structure, simultaneous complexation of metal ion and water or of two metal ions, sandwich formation.

BOOKS PRESCRIBED:

1. J.E. Huheey, Inorganic Chemistry, 3rd Ed.
2. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry.
3. B.E. Douglas and D.H. McDaniel, Concepts and Models of Inorganic Chemistry.
4. R. Hilgenfeld and W. Saengar, Topics in current chemistry Vol-II.

COURSE OUTCOMES:

Sr. No.	On completing the course, the student will be able to
CO1	Learn about the coordination compounds, theory, their nature of bonding,
CO2	Gain knowledge to apply ligand field theory CFT on simple molecules.
CO3	Learn about Molecular orbital theory
CO4	Learn about VSEPR theory, VBT
CO5	Learn and apply HSAB principle, Orgel Diagram, Macrocyclic ligands

B. Sc. Maths (3 Years)/B. Sc. (Hons.) Maths (4 Year)
B. Sc. Physics (3 Years)/B. Sc. (Hons.) Physics (4 Year)
Semester-II
CHX 122
Inorganic Chemistry Lab-II

Total Hours: 30
Total Hours/week: 2
Total Credits: 1
L T P
0 0 1

Maximum Marks: 25
Practical: 19
Internal Assessment: 06

INSTRUCTIONS FOR PAPER SETTERS AND CANDIDATES:

I. Examiner will give one organic salt to the students.
II. Each student will get different salt and analyse it for elements, functional group and prepare its derivatives.
III. The question paper will be 19 marks with split as under:
(Write up = 6, Performance = 6, Viva-voce = 5, Practical note book = 2)

COURSE OBJECTIVE:
Students learn to identify and separate different cations in the inorganic mixtures through different methods. Students will be able to perform special tests for anions.

COURSE CONTENTS:

Section-A

Identification of cations and anions in a mixture which may contain combinations of acid ions.
a) Special Tests for Mixture of Anions
(i) Carbonate in the presence of sulphate.
(ii) Nitrate in the presence of nitrite
(iii) Nitrate in the presence of bromide and iodide.
(iv) Nitrate in the presence of chlorate.
(v) Chloride in the presence of bromide and iodide.
(vi) Chloride in the presence of iodide.
(vii) Bromide and iodide in the presence of each other and of chloride.
(viii) Phosphate, arsenate and arsenite in the presence of each other.
(ix) Sulphide, sulphite, thiosulphate and sulphate in the presence of each other.
(x) Borate in the presence of copper and barium salts.
(xi) Oxalate in the presence of fluoride.

Section-B

Identification of Cations in Mixtures
Identification of Group I, Group II (Group IIA and IIB), Group III, Group IV, Group V and Group VI cations.

BOOKS PRESCRIBED:

Vogel's book on Inorganic Qualitative Analysis

COURSE OUTCOMES:

Sr. No.	On completing the course, the student will be able to
CO1	Identify the anions present in the mixture.
CO2	Identify the cations present in the mixture.
CO3	Gain hands-on practice of handling different Chemicals in the lab
CO4	Learn to prepare basic solution required to identify cations and anions in the mixture
CO5	Learn about determination of boiling points of various compounds.

FACULTY OF SCIENCES

SYLLABUS FOR BATCH 2024-28

Programme Code: *BSHM/ BSHP*

B. Sc. (Hons) Maths /B. Sc. (Hons.) Physics

Academic Session: 2024-25

Batch 2023: Semester III-IV

Department of Chemistry
Khalsa College, Amritsar

COURSE SCHEME											
SEMESTER - III											
Course Code	**Course Name**	**Hours /Week**	**Credits**			**Total Credits**	**Max Marks**				**Page No.**
			L	**T**	**P**		**Th**	**P**	**IA**	**Total**	
CHX-231	Physical Chemistry-III	3	2	1	0	3	56		19	75	
CHX-232	Physical Chemistry Lab-III	2	0	0	1	1		19	06	25	

COURSE SCHEME											
SEMESTER - IV											
Course Code	**Course Name**	**Hours /Week**	**Credits**			**Total Credits**	**Max Marks**				**Page No.**
			L	**T**	**P**		**Th**	**P**	**IA**	**Total**	
CHX-241	Molecular Spectroscopy-IV	3	2	1	0	3	56		19	75	
CHX-242	Physical Chemistry Lab-IV	2	0	0	1	1		19	06	25	

Semester-III

B.Sc. (Hons) Maths/Physics
Semester-III
CHX 231
Physical Chemistry-III

Total Hours: 45
Total Hours/week: 3
Total Credits: 3
L T P
2 1 0

Maximum Marks: 75
Theory: 56
Internal Assessment: 19

INSTRUCTIONS FOR PAPER SETTERS AND CANDIDATES

(Scientific calculator is allowed)

I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
III. Section-I will consist of eight six short questions carrying 2 marks each and students are required to attempt any six question.
IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 11 Marks.
V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

COURSE OBJECTIVES:

The Physical Chemistry-III course enables the students to learn deeply about the states of matter and inculcate the theory for further practical approach. Students will learn about the gaseous, liquid states and the colloidal state. The mathematical derivations and formulas will provide knowledge of the various analytical properties of gases and liquids. The colligative properties and solutions topic is very crucial for exploring the day to day life phenomenon, and also from the perspective of research for solution preparations. Some important topics such as emulsions, gels and adsorption are very important for students in daily life.

COURSE CONTENTS:

UNIT I

1. Solutions and Colligative Properties 15Hrs.

Ideal and non–ideal solutions, methods of expressing concentrations of solutions, dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure, elevation of boiling point and depression of freezing point.

UNIT-II

2. Electrochemistry 15 Hrs.

Electrical transport-conduction in metals and in electrolyte solutions, specific conduction and equivalent conduction, variation of specific and equivalent conduction with dilution, Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte, dissociation, weak and strong electrolytes, Ostwald's dilution law.

UNIT-III

3. Chemical Kinetics 15 Hrs.

Rate of reaction, rate constant and rate laws, the order of reaction, first, second & third and zero order reactions, half-lives; determination of reaction order. Temperature dependence of reaction rates, reaction mechanism, rate-determining step approximation, steady-state approximation. Catalysis, homogeneous catalysis, autocatalysis, oscillation reactions. Enzyme catalysis, heterogeneous catalysis.

UNIT-IV

4. Liquid State 10 Hrs.

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

5. Colloidal State 5 Hrs.

Definition of colloids, classification of colloids. Solids in liquids (Sol): kinetic, optical and electrical, properties, stability of colloids, protective action, Hardy Schulze law, gold number. Liquids in liquids (emulsions): Types of emulsions, preparation. Emulsifiers. General applications of colloids.

BOOKS PRESCRIBED:

1. Physical Chemistry by P.W. Atkins, 8th Ed., Oxford University Press, 2006 (Indian Print).
2. Physical Chemistry by T. Engel & P. Reid, 1st ed., Pearson Education, 2006.
3. Physical Chemistry by Castellan, 3rd Ed., Addison Wisley/Narosa, 1985 (Indian Print)
4. Physical Chemistry by G. M. Barrow, 6th Ed., New York, McGraw Hill, 1996.
5. Physical Chemistry by R. J. Silbey, R. A. Albert &Moungi G. Bawendi, 4th Ed., New York: John Wiley, 2005.

COURSE OUTCOMES:

S. No.	On completing the course,
CO1	Students will learn about ideal and non–ideal solutions, methods of expressing concentrations of solutions, Dilute solution, colligative properties and Raoult's law
CO2	Students will be able to understand rate of reaction, rate constant and rate laws, the order of reaction, first, second & third and zero order reactions
CO3	Students will learn about homogeneous catalysis, autocatalysis, oscillation reactions.Enzyme catalysis and heterogeneous catalysis

CO4	Students will be able to understand the structure of liquids Structural differences between solids, liquids and gases. Liquid crystals
CO5	Students will understand the classification of colloids. kinetic, optical andelectrical, properties, stability of colloids,protective action, Hardy Schulze law, gold number, Types of emulsions, Emulsifiers and applications of colloids.

B.Sc. (Hons) Maths/Physics
Semester-III
CHX 232
Physical Chemistry Lab-III

Total Hours: 30
Total Hours/week: 2
Total Credits: 1
L T P
0 0 1

Maximum Marks: 25
Practical: 19
Internal Assessment: 06

INSTRUCTIONS FOR PAPER SETTERS AND CANDIDATES:

I. Examiner will give one organic salt to the students.
II. Each student will get different salt and analyse it for elements, functional group and prepare its derivatives.
III. The question paper will be 19 marks with split as under:
(Write up = 6, Performance = 6, Viva-voce = 5, Practical note book = 2)

COURSE OBJECTIVES:

This practical course enables the students to understand the physical properties of liquids such as surface tension, density and viscosity. Students are able to understand the measurement techniques of some of the physical properties. Students will learn to handle apparatus like stalagmometer, Ostwald's viscometer and calorimeter. Students will be able to understand the acid-base titrations in the laboratory.

COURSE CONTENTS:

Section-A Crystallization:
Concept of indication of crystallization. Phthalic acid from hot water (using fluted filter paper & stem less funnel)
Acetanilide from boiling water.
Naphthalene from Ethanol
Benzoic acid from water

Section-B Physical Chemistry
1. To determine the specific reaction rate of hydrolysis of ethyl acetate catalyzed by Hydrogen ions at room temperature.
2. To study the effect of acid strength on hydrolysis of an ester.

Viscosity, Surface Tension (Pure Liquids)
3. To study the viscosity and surface tension of glycerin solution in water.
4. To determine the solubility of benzoic acid at different temperatures and to determine enthalpy of the dissolution process.

5. To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base.
6. To determine the enthalpy of dissolution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

BOOKS PRESCRIBED:

1. Findlay's Practical Physical Chemistry, 9th Edition, Revised by B.P. Levitt
2. Experimental Physical Chemistry by RC DAS and B. Behera 9th Edition,
3. Advance Practical Chemistry, J. B. Yadav

COURSE OUTCOMES:

S. No.	On completing the course,
CO1	Students will be able to measure important physical properties like surface tension, viscosity, density, enthalpy, heat of neutralization etc.
CO2	Students will learn to examine various physical parameters by different methods
CO3	Students will learn to handle important apparatus like stalagmometer, Ostwalds viscometer and calorimeter.
CO4	Students will learn to examine the rate of reactions (hydrolysis of ester)
CO5	Students will learn to perform acid-base titrations

Semester-IV

B.Sc. (Hons) Maths/Physics
Semester-IV
CHX 241
Molecular Spectroscopy-IV

Total Hours: 45
Total Hours/week: 3
Total Credits: 3
L T P
2 1 0

Maximum Marks: 75
Theory: 56
Internal Assessment: 19

INSTRUCTIONS FOR PAPER SETTERS AND CANDIDATES

(Scientific calculator is allowed)

I. Examiner will make five sections of paper namely Section-I, II, III, IV and V
II. Examiner will set total of NINE questions comprising ONE compulsory question of short answer type covering whole syllabi and TWO questions from each unit.
III. Section-I will consist of eight six short questions carrying 2 marks each and students are required to attempt any six question.
IV. Section-II, III, IV and V of paper will consist of EIGHT questions in total having TWO questions from each unit of the syllabus and each question carry 11 Marks.
V. The students are required to attempt FIVE questions in all, taking ONE Compulsory question of section-I and one question from each section i.e. II, III, IV and V.

COURSE OBJECTIVES:

Students will acquire the knowledge of energy and electromagnetic spectrum, ultraviolet and visible spectroscopy, Infrared spectroscopy. They will know about the applications of Wood-Fischer rule and IR Spectroscopy selection rules, factor affecting wave number. This course will help the students to know the instrumentation and basic concepts of NMR and Mass spectroscopy. They will be able to solve problems related to UV, IR, NMR and mass spectroscopy.

COURSE CONTENTS:

UNIT – I

Energy and Electromagnetic Spectrum 15 Hrs

Introduction, the Electromagnetic Spectrum, Characteristics of Electromagnetic Radiations, Regions of the spectrum, Units of Frequency, Wavelength and Wave number, Interaction of radiation with matter, Absorption and emission spectroscopy, spectroscopic transition between two stationary states, energy levels, Transition probability and Selection Rules, spin-orbit coupling, singlet and triplet states, Fluorescence and Phosphorescence, Statement of Born-Oppenheimer approximation, Degree of freedom, Frank Condon Principle, Basic features of different spectrometers.

UNIT – II

Ultraviolet and Visible Spectroscopy 11 Hrs

Introduction, Theory (Origin) of UV-Visible Spectroscopy, the energy of electronic excitation, instrumentation, Sample handling, Measurement techniques, Sample and reference cells, Solvents

and solutions, Laws of light absorption-Beer's and Lambert's laws, Molar extinction coefficient, Electronic Transitions, Different types of transition noticed in UV spectrum of organic functional groups and their relative energies. Transition Probability: Allowed and Forbidden Transitions, Formation of Absorption Bands, Designation of Absorption Bands, Conjugated Systems and Transition Energies Chromophore, Auxochromes, Absorption and intensity shifts, Factors affecting λmax , Stereochemical Factors in Electronic Spectroscopy, Biphenyls and binaphthyls, Solvent effects, Applications of Electronic Spectroscopy-Conjugated Dienes and α,β-Unsaturated Carbonyl Compounds.

Applications of UV-visible spectroscopy 4 Hrs

Applications of UV spectroscopy, Woodward Fieser rules for calculating λ_{max} of conjugated polyenes and α,β-unsaturated carbonyl compounds..

UNIT – III

Infrared Spectroscopy 9 Hrs

Molecular Vibrations, Vibrational energy levels, Selection rules, Modes of vibration, Calculation of vibrational frequencies- degree of freedom, Force constant, Fundamental vibration frequencies, existence of overtones, Factors influencing Vibrational Frequencies (Vibrational Coupling, Hydrogen Bonding, Electronic effect, Bond Angles, Field Effect) of different functional groups. Instrumentation, sampling techniques-solids, liquids.

Applications IR Spectroscopy 6 Hrs

Applications of IR spectroscopy, Absorption of Common functional Groups, Interpretation of simple IR spectra, Finger print regions. Simple numerical problems based on UV and IR spectroscopy.

UNIT – IV

Nuclear Magnetic Resonance 9 Hrs

The Nuclear spin, Larmor frequency, the NMR isotopes, Population of nuclear spin level, Spin and Spin lattice relaxation. Measurement techniques (CW & FT method), Solvent used. Chemical shift, Reference compounds, Shielding constant, Range of typical chemical Shifts, Simple application of chemical shifts, Anisotropic effect. Spin spin splitting, Coupling constant.

Applications of NMR spectroscopy 6 Hrs

NMR spectra with various examples such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene, o-, m-, p- anisidine, o-, m-, p- nitrophenols, acetophenone. Simple numerical of structure elucidation of NMR spectroscopic data.

BOOKS PRESCRIBED:

1. Organic Spectroscopy By W. Kemp; Publisher- Palgrave, New York
2. D.H. Williams and I. Fleming. Spectroscopic Methods in Organic Chemistry.
3. Spectrometric Identification of Organic Compounds - R.M. Silverstein & F. X. Webster; Publisher: John Willey and Sons,Inc.
4. Introductory Problems in Spectroscopy- By R.C. Banks, E.R. Matjeha and G. Mercer; Publisher : The Benzamine / Cummings Publishing Company Inc.
5. Introduction to Spectroscopy – D. L. Pavia, G. M .Lampman, and G. S. Kriz Publisher: Brooks / Cole, a part of cengage learning

COURSE OUTCOMES:

Sr. No.	On completing the course, the student will be able to
CO1	Understand the spectrums, their types and characteristics.
CO2	Understand the various aspects of UV-Visible spectroscopy and behaviour of UV-peaks and its shifting under different conditions.
CO3	Ssolve the absorption wavelength of conjugated polyenes and α,ß -unsaturated carbonyl compounds.
CO4	Interpret the IR spectrum and relate the spectral peaks with the various types of bonds present in the molecules.
CO5	Interpret the actual NMR spectrum and calculate the chemical shift, coupling constant and correlate the NMR peaks with structure and proton counting.

B.Sc. (Hons) Maths/Physics
(SEMESTER–IV)
CHX 242
Physical Chemistry Lab-IV

Total Hours: 30
Total Hours/week: 2
Total Credits: 1
L T P
0 0 1

Maximum Marks: 25
Practical: 19
Internal Assessment: 06

INSTRUCTIONS FOR PAPER SETTERS AND CANDIDATES:

I. Examiner will give one organic salt to the students.
II. Each student will get different salt and analyse it for elements, functional group and prepare its derivatives.
III. The question paper will be 19 marks with split as under:
(Write up = 6, Performance = 6, Viva-voce = 5, Practical note book = 2)

COURSE OBJECTIVE:
Students will be able to find strength, normality of unknown solution through conductometric titration, adsorption isotherms, polarimetry, refractometric, use of calorimeter to find enthalpy of neutralization of strong acid and base.

COURSE CONTENTS:
Note. The question paper will be set by the examiner based on the syllabus.

1. Refractometry: Determine refractive index of a given liquid as a criterion for its purity. (Benzene i.e. commercial) benzene + A.R. acetone).

2. Polarimetry: Determine the %age composition of an optically active solution.

3. Calorimetry:
a) Determination of Heat of neutralization
(i) Strong acid-strong base
(ii) Weak acid-strong base.
b) Determination of Heat of solution of KCl, NH_4Cl, KNO_3

4. Conductometry:
a) Determination of cell constant.
b) Determination of specific and equivalent conductance of electrolyte (NaCl and HCl).
c) Precipitation titration of Na_2SO_4 vs. $BaCl_2$.
d) Neutralization titrations NaOH vs. HCl and NaOH vs. CH_3COOH.

5. Determination of adsorption isotherm of oxalic acid on charcoal.

BOOKS PRESCRIBED:

1. Advance Practical Chemistry, J. B. Yadav

COURSE OUTCOMES:

S. No.	On completing the course
CO1	Students will learn to measure refractive index of various solvents using refractometer.
CO2	Students will learn to measure angle of rotation with the help of polarimeter and then calculate the optical activity of various solutions.
CO3	Students will learn to calculate the heat of neutrilization, heat of solution of acids, bases and salts with the help of a calorimeter.
CO4	By doing the experiments on conductometer, students will learn measure the cell constant, equivalent conductance, specific conductations and will also perform conductometric titrations.
CO5	By performing the experiment of adsorption, they will learn about the adsorption isotherm.