S.S. Jain Subodh P.G. College

(Affiliated to University of Rajasthan)

SCHEME OF EXAMINATION

&

DETAILED COURSE STRUCTURE

(2023-24)

BACHELOR OF SCIENCE (B.Sc.)

DEPARTMENT OF CHEMISTRY

Session 2023-24 Semester I & II
Session 2024-25 Semester III & IV
Session 2025-26 Semester V & VI

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Nomenclature of Paper with Paper code

Session 2023-24

Semester I		
S.No.	**Nomenclature of Paper**	**Paper Code**
1	Inorganic and Organic Chemistry-I	BSCH101
2	Organic and Physical Chemistry-I	BSCH102
3	Chemistry Practical-I	BSCH151
Semester II		
4	Inorganic and Organic Chemistry-II	BSCH201
5	Organic and Physical Chemistry-II	BSCH202
6	Chemistry Practical-II	BSCH251
Semester III		
7	Inorganic and Organic Chemistry-III	BSCH301
8	Organic and Physical Chemistry-III	BSCH302
9	Chemistry Practical-III	BSCH351
Semester IV		
10	Inorganic and Organic Chemistry-IV	BSCH401
11	Organic and Physical Chemistry-IV	BSCH402
12	Chemistry Practical- IV	BSCH451
Semester V		
13	Inorganic and Organic Chemistry-V	BSCH501 A
14	Organic and Physical Chemistry-V	BSCH502 A
15	Inorganic and Organic Chemistry-V	BSCH501 B
16	Organic and Physical Chemistry-V	BSCH502 B
Semester VI		
17	Inorganic and Organic Chemistry-VI	BSCH601 A
18	Organic and Physical Chemistry-VI	BSCH602 A
19	Inorganic and Organic Chemistry-VI	BSCH601 B
20	Organic and Physical Chemistry-VI	BSCH602 B
21	Chemistry Practical -VI	BSCH651

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester I

Semester Scheme

Paper Code	Paper title	Course Category	Credit	Total contact hours per semester / per week		Maximum marks	Minimum marks	ESE in hrs	
								Theory	Practical
BSCH 101	Inorganic and Organic Chemistry-I	DSC	2	30	2	50	20	3	-
BSCH 102	Organic and Physical Chemistry-I	DSC	2	30	2	50	20	3	-
BSCH 151	Chemistry Practical-I	DSCP	2	60	4	50	20	-	4
			6		8				

The details of the courses with code and title assigned are given below:
DSC= Discipline Specific Core ESE = End Semester Examination DSCP= Discipline Specific Core Practical

Examination Scheme

S.No.	Paper	ESE	CIA	Total
1.	**Theory**	**70%**	**30%**	**100%**
2.	**Practical**	**60%**	**40%**	**100%**

Syllabus of each theory paper is divided into four units.
Each theory paper is of 3 hours duration . Each Practical /Lab work is of 4 hours duration .

The number of papers and the maximum marks for each paper/ practical is shown in the syllabus for the paper concerned. It will be necessary for a candidate to pass in theory as well as practical of a subject separately.

Note: Maximum marks for a theory paper is 50 which includes 35 marks for ESE and 15 marks for internal assessment. Maximum marks for a practical paper is which includes 30 marks for ESE and 20 marks for internal assessment.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester I

Evaluation Scheme

Theory Paper

Max. hrs: 3 hrs. Max. Marks: 50

PART A	Comprises of ten very short answer questions from all units. (It is compulsory to attempt any 7questions)	7x1= 7 Marks
PART B	Comprises of eight long answer questions with two questions from each unit. Candidates have to answer any four questions, selecting one question from each unit.	4x7 = 28 Marks
	Total marks for End Semester Examination	**35 Marks**
	Internal Assessment	**15 Marks**
	Total	**50 Marks**

Practical Paper

Max. hrs: 4 hrs. Max. Marks: 50

Experiment no. 1	Inorganic Chemistry	10 Marks
Experiment no. 2	Physical Chemistry	10 Marks
	Record	5 Marks
	Viva	5 Marks
	Total marks for End Semester Examination	**30 Marks**
	Internal Assessment	**20 Marks**
	Total	**50 Marks**

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester I

Paper I

BSCH 101 **Inorganic and Organic Chemistry-I** **30 Hrs (2 hrs/week)**

Unit -I
Chemical Bonding I and Periodicity of s-Block Elements

Chemical Bonding I: Covalent bond: properties and directional characteristics, hybridization and shapes of different molecules and ions, Valence Shell Electron Pair Repulsion (VSEPR) theory for H_2O, H_3O^+, NH_3, SF_4, ClF_3, ICl_2^-, Valance Bond Theory and its limitations.

Periodicity of s-Block elements**:** Atomic and ionic radii, Ionization potential, Electronegativity, density, melting points and boiling points, diagonal relationship, solvation and complexation tendencies including their functions in biosystem.

Unit-II
Chemical Bonding II and Hydrogen Bonding

Chemical bonding II**:** Linear combination of atomic orbitals, types of molecular orbitals,, molecular orbital theory for homonuclear molecules and ions (H_2^+ - Ne_2), Molecular Orbital Theory for heteronuclear molecules and ions (HF, CO, NO, NO^+) , comparison of Valence Bond Theory and Molecular Orbital Theory, multicentre bonding in electron deficient molecules.

Hydrogen bonding**:** Characteristics of Hydrogen bond, factors affecting Hydrogen bond, theories of Hydrogen bond formation, types of hydrogen bonding and its consequences.

Unit-III
Mechanism of Organic Reactions

Mechanism of organic reactions: Curved arrow notation, homolytic and heterolytic bond cleavage, types of reagents: electrophiles and nucleophiles. Types of organic reactions, reactive intermediates-carbocations, carbanions, free radicals, carbenes, arynes and nitrenes with examples. Assigning formal charges on intermediates and other ionic species. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effect, kinetic and stereo chemical studies).

Unit-IV
Alkanes and Cycloalkanes

Alkanes**:** IUPAC nomenclature of branched and unbranched alkanes, isomerism in alkanes sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey House reaction and decarboxylation of carboxylic acids.) Physical properties and chemical reactions of alkanes, mechanism of free radical halogenations of alkanes, orientation, reactivity and selectivity.

Cycloalkanes**:** Nomenclature, methods of formation, chemical reactions, Baeyer Strain Theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring: banana bond.

Learning Outcomes:

Students will be able to:

- learn about chemical bonding, hybridization and draw shapes and geometrics of various inorganic molecules.
- understand the basic concept of organic reaction mechanism and saturated aliphatic hydrocarbons, their structures, physical and chemical properties.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry
Semester I

Paper II

BSCH 102 **Organic and Physical Chemistry-I** **30 Hrs (2 hrs/week)**

Unit-I
Stereochemistry-I

Stereochemistry of organic compounds: Concept of isomerism, Optical isomerism; elements of symmetry, molecular chirality- allenes and biphenyl, enantiomers, stereogenic centre, optical activity, properties of enantiomers. Chiral and achiral molecules with two stereogenic centres, distereomers threo, and erythro diastereomers, meso compounds. Resolution, inversion, retention and racemisation. Relative and absolute configuration, sequence rule, D-L and R-S system of nomenclature.

Unit -II
Stereochemistry-II

Geometrical Isomerism**:** Concept of geometrical isomerism, E-Z system of nomenclature, geometrical isomerism in oximes and in cyclic compounds.

Conformational Isomerism**:** Conformational analysis of ethane and n-butane. Newman projection and sawhorse formulae, Fischer and Flying wedge formula. Difference between configuration and conformation.

Unit- III
Gaseous State

Gaseous laws, postulates of kinetic theory of gases and its derivation, deviation from ideal behavior (with respect to pressure and volume), Vander Waal's equation of gases, critical phenomenon, PV isotherm of real gases, continuity of state, isotherms of Vander Waal's equation, relationship between critical constant and Vander Waal's constant, the law of corresponding states, reduced equation of state.
Root mean square, average and most probable velocity. Qualitative discussion of the Maxwell`s distribution of molecular velocities. Collision number, mean free path and collision diameter. Liquefaction of gases.

Unit- IV
Liquid State & Solid State

Liquid State**:** Intermolecular forces, structure of liquids, Liquid crystals: Classification, structure and applications of liquid crystals.

Solid State**:** Definition of space lattice, unit cell. Laws of crystallography: law of constancy of interfacial angles , law of rationality of indices, law of symmetry. Symmetry elements in crystals. X ray diffraction by crystals, derivation of Bragg's equation. Determination of crystal structure of NaCl, KCl and CsCl, (Laue's method and powder method).

Learning Outcomes:

Students will be able to:

- learn about the states of matter viz. Solid, liquid and gases and applications of laws to define their properties.
- understand the basic concepts of stereochemistry and spatial arrangement of atoms and groups in a molecule and their nomenclature.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry
Semester I

BSCH 151 **Chemistry Practical- I** **60 hrs (4 hrs/week)**

Inorganic Chemistry

Qualitative analysis: Separation and identification of three cations and three anions in the given inorganic mixture, specific tests for some typical combination of acid radicals (carbonate – sulphite, sulphite - sulphide – sulphate , sulphite - sulphide, nitrite – nitrate and chloride – bromide – iodide)

Physical Chemistry

Viscosity and Surface Tension

(a) Determination of the relative viscosity of given unknown organic liquid by Ostwald viscometer
(b) Determination of the percentage composition of a given mixture (non-interacting systems) by viscosity method
(c) Determination of the relative surface tension of given unknown organic liquid by Stalagmometer.
(d) Determination of the percentage composition of a given binary mixture by surface tension method.

Preparation of standard solutions (primary and secondary) and verify its strength.

(a) Preparation of N/10 HCl
(b) Preparation of N/10 NaOH.

Viva voce

Record

Learning Outcomes:

Students will be able to:

- learn about the identification of acidic (cation) and basic (anion) radicals in inorganic mixture experimentally.
- understand the concept of viscosity and surface tension and their determination.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester II

Semester Scheme

Paper Code	Paper title	Course Category	Credit	Total contact hours per semester / per week		Maximum marks	Minimum marks	ESE in hrs	
								Theory	Practical
BSCH 201	Inorganic and Organic Chemistry-II	DSC	2	30	2	50	20	3	-
BSCH 202	Organic and Physical Chemistry-II	DSC	2	30	2	50	20	3	-
BSCH 251	Chemistry Practical-II	DSCP	2	60	4	50	20	-	4
			6		8				

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S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester II

Evaluation Scheme

Theory Paper

Max. hrs: 3 hrs. Max. Marks: 50

PART A	Comprises of ten very short answer questions from all units. (It is compulsory to attempt any 7questions)	7x1= 7 Marks
PART B	Comprises of eight long answer questions with two questions from each unit. Candidates have to answer any four questions, selecting one question from each unit.	4x7 = 28 Marks
	Total marks for End Semester Examination	**35 Marks**
	Internal Assessment	**15 Marks**
	Total	**50 Marks**

Practical Paper

Max. hrs: 4 hrs. Max. Marks: 50

Experiment no. 1	Inorganic Chemistry	10 Marks
Experiment no. 2	Physical Chemistry	10 Marks
	Record	5 Marks
	Viva	5 Marks
	Total marks for End Semester Examination	**30 Marks**
	Internal Assessment	**20 Marks**
	Total	**50 Marks**

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester II

Paper I

BSCH 201 **Inorganic and Organic Chemistry-II** **30 Hrs (2 hrs/week)**

Unit -I
Ionic Solids and Chemistry of p-Block Elements & some of its important Compounds

Ionic Solids**:** Radius ratio and coordination number, calculation of limiting radius ratio for tetrahedral, octahedral and cubic crystal structure, limitations of radius ratio rules, Polarizing power and polarisability of ions, Fajans rule, lattice energy and Born Haber Cycle and its applications, solvation energy and solubility of ionic solids.

Chemistry of p-Block Elements & some of its important compounds**:** Comparative study of p-block elements: group trends, electronic configuration, atomic and ionic radii, ionization energy, electron affinity, electronegativity, catenation, inert pair effect. Some important compounds of p- block elements (borazines, fullerenes, tetrasulphur tetranitride).

Unit-II
Metallic Bond and Chemistry of Noble Gases

Metallic Bond: Introduction of metallic bond, properties of metals, theories of metallic bond- Free Electron Theory, Valance Bond Theory, limitations of Valence Bond Theory, Molecular Orbital and Band theory, semiconductors, lattice defects in ionic solids.

Chemistry of Noble Gases**:** Chemical properties of noble gases, structures of xenon fluorides, oxyfluorides and oxides.

Unit-III
Alkenes and Cycloalkenes

Alkenes**:** Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydrations. The Saytzeff rule, Hofmann elimination. Physical properties and relative stabilities of alkenes. Chemical reactions of alkenes—mechanisms involved in hydrogenations, Markownikoffs rule, hydroboration–oxidation, oxymercuration-reduction, epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$, polymerization of alkenes. Subsititution at the allylic and vinylic position of alkenes.

Cycloalkene**s :** Method of formation, conformation and chemical reactions of cycloalkenes.

Unit-IV
Dienes and Alkynes

Diene**s:** Nomenclature and classification of dienes, isolated, conjugated and cumulated dienes, structure of allenes and butadiene, methods of formation, polymerization, chemical reactions, 1,2- and 1,4- additions, Diels-Alder reaction.

Alkyne**s:** Nomenclature, structure and bonding in alkynes, methods of formation, chemical reactions of alkynes, acidity of alkynes, mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal – ammonia reduction, oxidation and polymerization.

Learning Outcomes:

Students will be able to:

- get deep insight about ionic & metallic solids and also periodicity of p- block elements.
- gain knowledge of preparation, properties of acyclic and cyclic unsaturated hydrocarbons.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester II

Paper II

BSCH 202 **Organic and Physical Chemistry-II** **30 Hrs (2 hrs/week)**

Unit -I
Aromaticity, Arene and Electrophilic Substitution Reactions

Aromaticit**y:** The Huckel's rule, aromatic ions

Arenes**:** Nomenclature of benzene derivatives - aryl group, aromatic nucleus and side chain. Structure of benzene - molecular formula, Kekule structure, M.O. diagram. Stability and carbon-carbon bond length of benzene and its resonance structure.

Electrophilic Substitution reactions **:** General pattern of the mechanism, role of sigma and pi complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel Craft's reaction with energy profile diagrams. Directive influence and reactivity of substituents, ortho/para ratio and Birch reduction.

Unit-II
Alkyl & Aryl Halides and Polyhalogenated Compounds

Alkyl & Aryl halides**:** Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanism of nucleophilic substitution reaction, reactions of alkyl halides, S_N^1 and S_N^2 reactions with energy profile diagram.

Polyhalogenated Compounds **:** Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Synthesis and applications of DDT, BHC, chloroform and carbon tetra chloride.

Unit-III
Chemical Kinetics

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction. Mathematical characteristics of simple chemical reactions- zero, first, second and pseudo order reactions, half life and mean life. Determinations of the order of reaction- differential methods, methods of integration, methods of half-life period and isolation methods. Radioactive decay.
Experimental methods of chemical kinetics: conductometric, potentiometric, optical methods, polarimetry and spectrophotometric. Theories of chemical kinetics - Arrhenius concept of activation energy, simple collision theory based on hard sphere model and Transition State Theory.

Unit-IV
Colloidal State

Definition of colloids, classification of colloids, Solids in liquids (sols) properties- kinetic, optical and electrical. Stability of colloids, protective action, Hardy Schulze Law, Gold number.
Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloid. Liquids in liquids (emulsions) - types of emulsions, preparation, Emulsifiers.

Learning Outcomes:

Students will be able to :

- understand the structure and properties of aromatic hydrocarbons and directive influence of various functional groups on arenes.
- interpret rate & mechanism of chemical reactions and also day to day applications of colloids.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester II

BSCH 251 **Chemistry Practical II** **60 hrs (4 hrs/week)**

Inorganic Chemistry

Quantitative Analysis: Volumetric Analysis

(a) Determination of acetic acid in commercial vinegar using NaOH.
(b) Determination of alkali content in antacid tablet using HCl.
(c) Estimation of calcium content in chalk as calcium oxalate by permanganometery.
(d) Estimation of ferrous and ferric ions by dichromate method.
(e) Estimation of copper using thiosulphate.

Organic Chemistry

1. Laboratory Techniques
(a) Determination of melting point of Naphthalene, Benzoic acid, Urea etc.
(b) Determination of boiling point of Ethanol , Methanol, Cyclohexane, etc
2. Qualitative analysis
Detection of elements (N, S and halogens) and functional group (phenolic, alcoholic, carboxylic, carbonyl, ester, amine, amide, nitro & carbohydrate) and hydrocaron in simple organic compounds.

Viva voce

Record

Learning Outcomes:

Students will be able to :

- determine the functional groups in organic compound through element detection.
- determine quantitative estimation of inorganic compounds by volumetric analysis.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester III

Semester Scheme

Paper Code	Paper title	Course Category	Credit	Total contact hours per semester / per week		Maximum marks	Minimum marks	ESE in hrs	
								Theory	Practical
BSCH 301	Inorganic and Organic Chemistry-III	DSC	2	30	2	50	20	3	-
BSCH 302	Organic and Physical Chemistry-III	DSC	2	30	2	50	20	3	-
BSCH 351	Chemistry Practical-III	DSCP	2	60	4	50	20	-	4
			6		8				

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Note: Maximum marks for a theory paper is 50 which includes 35 marks for ESE and 15 marks for internal assessment. Maximum marks for a practical paper is 50 which includes 30 marks for ESE and 20 marks for internal assessment.

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BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester III

Evaluation Scheme

Theory Paper

Max. hrs: 3 hrs. Max. Marks: 50

PART A	Comprises of ten very short answer questions from all units. (It is compulsory to attempt any 7questions)	7x1= 7 Marks
PART B	Comprises of eight long answer questions with two questions from each unit. Candidates have to answer any four questions, selecting one question from each unit.	4x7 = 28 Marks
	Total marks for End Semester Examination	**35 Marks**
	Internal Assessment	**15 Marks**
	Total	**50 Marks**

Practical Paper

Max. hrs: 4 hrs. Max. Marks: 50

Experiment no. 1	Inorganic Chemistry	10 Marks
Experiment no. 2	Physical Chemistry	10 Marks
	Record	5 Marks
	Viva	5 Marks
	Total marks for End Semester Examination	**30 Marks**
	Internal Assessment	**20 Marks**
	Total	**50 Marks**

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester III

Paper I

BSCH 301 **Inorganic and Organic Chemistry-III** **30 Hrs (2 hrs/week)**

Unit -I
Acids, Bases and HSAB

Acids and Bases**:** Brønsted - Lowry (the proton donor acceptor system), proton affinity, Lewis concept of acids and bases (the electron donor acceptor concept), the Lux-Flood (oxide ion concept), solvent system concept and their limitations.

Hard and Soft Acids and Bases (HSAB): Hard & Soft Acids and Bases and their Classification, Pearson's HSAB concept, Symbiosis, Theoretical basis of hardness and softness, limitations and applications of HSAB.

Unit-II
Non-aqueous Solvents and Chromatography

Non-Aqueous Solvents**:** Physical properties of solvent, types of solvent and their general characteristics, reactions in non-aqueous solvents with reference to liq. NH_3.

Chromatography**:** Types of chromatographic methods (Paper, Thin Layer and Column Chromatography) and their applications, principle of differential migration, adsorption phenomenon, nature of the adsorbent, solvent systems, R_f values.

Unit-III
Chemistry of Functional group-I (Alcohols)

Alcohols**:** Classification and Nomenclature. Monohydric Alcohols**:** Methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding, acidic nature, reaction of alcohols. Dihydric Alcohols: Methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and Pinacol- Pinacolone rearrangement. Trihydric Alcohols- Methods of formation and chemical reactions of glycerol.

Unit-IV
Chemistry of Functional group-II (Phenols)

Phenols: Nomenclature, structure and bonding, preparation of phenols, physical properties and acidic character. Comparative acidic strength of alcohols and phenols, resonance stabilization of phenoxide ion, reaction of phenols, electrophilic aromatic substitions, acylations and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gattermann synthesis, Houben- Hoesch reaction, Lederer- Manasse reaction and Reimer -Tiemann reaction.

Learning Outcomes:

Students will be able to:

- learn the concept and theories of acids and bases and get acquainted with the principle & applications of chromatographic techniques.
- augment knowledge of alkyl and aryl hydroxy derivatives with their preparation and properties.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry
Semester III

Paper II

BSCH 302 **Organic and Physical Chemistry-III** **30 Hrs (2 hrs/week)**

Unit -I
Chemistry of Functional group-III (Aldehyde and Ketone)

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 aldehydes and ketones using 1, 3 dithianes, synthesis of ketones from nitriles and from carboxylic acids, physical properties, mechanism of nucleophilic addition to carbonyl group: Benzoin, Aldol, Perkin and Knovenagel condensations, Wittig reaction, Mannich reaction, Cannizzaro reaction, Bayer-Villiger, Meerwein–Ponndorf–Verley reduction (MPV), Clemmensen's reduction, Wolf- Kishner reduction, $LiAlH_4$ and $NaBH_4$ reduction, condensation with ammonia and its derivatives, use of acetals as protecting group, oxidation of aldehydes and ketones.

Unit-II
Chemistry of Functional group-IV (Ether and Epoxide)

Nomenclature of ethers and methods of their formation, physical properties, chemical reactions- cleavage and auto-oxidation, Ziesel 's method. Synthesis of epoxides, Acid and base catalyzed ring opening of epoxides, orientation of epoxide ring opening. Reactions of Grignard and organolithium reagents with epoxides.

Unit-III
Thermodynamics-I and Thermochemistry

Thermodynamics-I : Definition of thermodynamic terms: systems, surroundings etc. Types of systems, intensive and extensive properties, State & path functions and their differentials. Thermodynamic process, concept of heat and work. First law of thermodynamics - statement, definition of internal energy and enthalpy, heat capacity. Heat capacities at constant volume and constant pressure and their relationship. Joule's law, Joule Thomson co-efficient and inversion temperature.

Themochemistry**:** Standard state, standard enthalpy of formation- Hess`s Law of heat summations and its applications, heat of reactions at constant pressure and constant volume. Enthalpy of neutralization, Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation.

Unit -IV
Chemical Equilibrium and Corrosion

Equilibrium constant and free energy, Thermodynamic derivation of law of mass action, Le-Chatelier`s principle. Reaction isotherm and reaction isochore, Clausius- Clapeyron equation and its applications.

pH : Definition of pH and pKa, determination of pH using hydrogen, quinhydrone and glass electrodes and by poteniometric methods. Buffers - mechanism of buffer action. Henderson- Hazel equation. Hydrolysis of salts.

Corrosion: Fundamentals of electrolytic corrosion- theories and kinetics, corrosion prevention. Batteries – primary(Zinc-carbon, Zinc- air) and secondary (Lithium ion and Lead Acid) and fuel cells (Hydrogen fuel cell).

Learning Outcomes:

Students will be able to :

- conversant with synthesis, physical and chemical properties of aldehydes, ketones, ethers and epoxides.
- interpret definitions of different thermodynamic processes and assess thermodynamic applications using First law of thermodynamics.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester III

BSCH 351 **Chemistry Practical III** **60 hrs (4 hr/week)**

Inorganic Chemistry

Gravimetric Estimation:(Any one)

(a) Cu as CuSCN ,
(b) Ni as Ni $(DMG)_2$
(c) Ba as $BaSO_4$

Volumetric Analysis: (Any One)

(a) Redox titration of ferrous ammonium sulphate against $KMnO_4$
(b) Determination of hardness of water by EDTA solution.

Organic Chemistry

Qualitative Analysis: Identification of organic compounds through the functional group analysis, determination of melting point/boiling point and preparation of suitable derivatives.

Viva-Voce

Record

Learning Outcomes:

Students will be able to :

- identify the organic compounds through the functional group analysis and melting point determination.
- execute the quantitative estimation of inorganic compounds through gravimetric and volumetric methods.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester IV

Semester Scheme

Paper Code	Paper title	Course Category	Credit	Total contact hours per semester / per week		Maximum marks	Minimum marks	ESE in hrs	
								Theory	Practical
BSCH 401	Inorganic and Organic Chemistry-IV	DSC	2	30	2	50	20	3	-
BSCH 402	Organic and Physical Chemistry-IV	DSC	2	30	2	50	20	3	-
BSCH 451	Chemistry Practical- IV	DSCP	2	60	4	50	20	-	4
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BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester IV

Evaluation Scheme

Theory Paper

Max. hrs: 3 hrs. Max. Marks: 50

PART A	Comprises of ten very short answer questions from all units. (It is compulsory to attempt any 7questions)	7x1= 7 Marks
PART B	Comprises of eight long answer questions with two questions from each unit. Candidates have to answer any four questions, selecting one question from each unit.	4x7 = 28 Marks
	Total marks for End Semester Examination	**35 Marks**
	Internal Assessment	**15 Marks**
	Total	**50 Marks**

Practical Paper

Max. hrs: 4 hrs. Max. Marks: 50

Experiment no. 1	Inorganic Chemistry	10 Marks
Experiment no. 2	Physical Chemistry	10 Marks
	Record	5 Marks
	Viva	5 Marks
	Total marks for End Semester Examination	**30 Marks**
	Internal Assessment	**20 Marks**
	Total	**50 Marks**

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester IV

Paper I

BSCH 401 **Inorganic and Organic Chemistry-IV** **30 Hrs (2 hrs/week)**

Unit -I
Inorganic Polymers and Bioinorganic Chemistry

Inorganic Polymers **:** Silicones- Classification, preparation and structure of silicones, silicone resin, silicone rubber, silicone fluid, industrial application of silicones. Phosphazenes- Structure and bonding, preparation, properties (substitution reaction) and applications.

Bioinorganic Chemistry: Metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with reference to Na^{+}, K^{+}, Ca^{+2} and Mg^{+2}.

Unit-II
Oxidation and Reduction

Oxidation and Reduction**:** Use of redox potential data, analysis of redox cycle, redox stability in water, disproportionation, the diagrammatic representation of redox potential data- Frost, Latimer and Pourbaix diagrams.

Unit-III
Chemistry of Functional group-V (Carboxylic acids)

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength, preparation of carboxylic acids, reactions of carboxylic acids– Hell-Volhard- Zelinisky reaction, reduction of carboxylic acids, mechanism of decarboxylation. Hydroxy acids- malic, tartaric and citric acids. Dicarboxylic acids- effect of heat and dehydrating agents (Succinic, Glutaric and Adipic acid).

Unit-IV
Chemistry of Functional group-VI (Carboxylic acids derivatives)

Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides, relative stability of acyl derivatives, Preparation of carboxylic acid derivatives, Physical properties, inter conversion of acid derivatives by nucleophilic acyl substitution, chemical reactions, mechanism of esterification and hydrolysis (acidic and basic).

Learning Outcomes:

Students will be able to :

- demonstrate structure and functioning of metalloporphyrin and applications of redox potential data in stability of metal compounds.
- describe physical and chemical properties of aliphatic carboxylic acids along with relative stability and interconversion of acid derivatives.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester IV

Paper II

BSCH 402 **Organic and Physical Chemistry-IV** **30 Hrs (2 hrs/week)**

Unit -I
Spectroscopy-I (UV and IR)

Ultraviolet (UV) Absorption spectroscopy: absorption laws (Beer- Lambert Law) molar absorptivity, types of electronic transitions, effect of solvents on transitions, effect of conjugation, concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts.

Infrared (IR) Absorption Spectroscopy**:** Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, finger print region, characteristic absorptions of various functional groups and interpretation of IR spectra of Alcohols, Carbonyl compounds, Carboxylic acids, Amines, Amides and Phenols.

Unit-II
Chemistry of Functional group-VII (Amines)

Amines**:** Amonium salts as phase transfer catalysts, preparation of alkyl and aryl amines (reduction of nitro compounds and nitriles), Gabriel-Phthalamide reaction, Hofmann-Bromamide reactions. Reactions of amines- electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acids, Diazotization-mechanism, synthetic transformation of aryl diazonium salts, azo coupling.

Unit-III
Thermodynamics-II

Second Law of Thermodynamics: Need for the law, different statements of the law, Carnot cycle, Carnot Theorem and its efficiency, Thermodynamic scale of temperature. Entropy as a state function, entropy as a function of volume and temperature, entropy as a function of pressure and temperature. Clausius inequality, entropy as a criteria of spontaneity and equilibrium, Entropy change in ideal gases and mixing of gases.
Third Law of Thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities. Variation of G and A with P, V and T.

Unit -IV
Electrochemistry-I

Conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution, Migration of ions and Kohlrausch's law, Arrhenius theory of electrolytes, Ostwald's dilution law- its uses and limitations. Debye- Huckel - Onsager`s equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf's method and Moving Boundary method. Applications of conductivity measurements; determination of degree of dissociation, K_a of acids, solubility product of a sparingly soluble salts and conductometric titrations.

Learning Outcomes:

Students will be able to :

- interpret the structure of organic compounds through spectroscopic techniques viz. UV and IR
- analyse feasibility of chemical reactions, efficiency of machine and understand fundamentals of electrochemistry.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry
Semester IV

BSCH 451 **Chemistry Practical -IV** **60 hrs (4 hrs/week)**

Organic Chemistry

TLC/ Paper Chromatography

(a) Separation of Fluorescein and Methylene Blue
(b) Separation of leaf pigments from spinach leaves

Synthesis of Organic Compounds: (Any Four)

(a) Acetylation : Salicylic acid , aniline, glucose and hydroquinone
(b) Aliphatic Electrophilic Substitution **:** Preparation of iodoform from ethanol and acetone
(c) Aromatic Electrophilic Substitution : Nitration- Preparation of m-dinitrobenzene, Preparation of p-nitroacetanilide, Halogenations- Preparation of p-bromoacetanilide and Preparation of 2,4,6-tribromophenol
(d) Diazotization/Coupling**:** Preparation of methyl orange and methyl red
(e) Oxidation **:** Preparation of benzoic acid from toluene
(f) Reduction **:** Preparation of aniline from nitrobenzene, Preparation of m-nitroaniline from m-dinitrobenzene

Physical Chemistry

Phase equilibrium **:**

(a) Study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. Phenol-Water system) and determine the concentration of that solute in the given phenol-water system
(b) Construct the phase diagram of two component (e.g. diphenylamine-benzophenone) system by cooling curve method.

Chemical Kinetics:

(a) Study the kinetics of acid hydrolysis of an ester.

Thermochemistry **:**

(a) Determine the solubility of benzoic acid at different temperature and determine H^+ of the dissolution process.
(b) 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.
(c) Determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born -Haber cycle.

Viva-Voce

Record

Learning Outcomes:

Students will be able to :

- learn experimentally the synthesis of various organic compounds in laboratory using different types of organic reactions.
- determine transition temperature and the concept of critical solution temperature.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry
Semester V

Semester Scheme

Group	Paper Code	Paper title	Course Category	Credit	Total contact hours per semester / per week		Maximum marks	Minimum marks	ESE in hrs	
									Theory	Practical
Group A*	BSCH 501 A	Inorganic and Organic Chemistry-V	DSE	2	30	2	50	20	3	-
	BSCH 502 A	Organic and Physical Chemistry-V	DSE							
Group B*	BSCH 501 B	Inorganic and Organic Chemistry-V	DSE	2	30	2	50	20	3	-
	BSCH 502 B	Organic and Physical Chemistry-V	DSE							
	BSCH 551	Chemistry Practical- V	DSEP	2	60	4	50	20	-	4
				6		8				

The details of the courses with code and title assigned are given below:
DSE= Discipline Specific Elective ESE = End Semester Examination
DSEP= Discipline Specific Elective Practical

Note: Student has to choose any one elective paper from Group A* (501 A or 502 A) and the other paper will be allotted from Group B* (502 B or 501 B) accordingly.

Examination Scheme

S.No.	Paper	ESE	CIA	Total
1.	Theory	70%	30%	100%
2.	Practical	60%	40%	100%

Syllabus of each theory paper is divided into four units.
Each theory paper is of 3 hours duration . Each Practical /Lab work is of 4 hours duration .

The number of papers and the maximum marks for each paper/ practical is shown in the syllabus for the paper concerned. It will be necessary for a candidate to pass in theory as well as practical of a subject separately.

Note: Maximum marks for a theory paper is 50 which includes 35 marks for ESE and 15 marks for internal assessment. Maximum marks for a practical paper is 50 which includes 30 marks for ESE and 20 marks for internal assessment.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry
Semester V

Evaluation Scheme

Theory Paper

Max. hrs: 3 hrs. Max. Marks: 50

PART A	Comprises of ten very short answer questions from all units. (It is compulsory to attempt any 7questions)	7x1= 7 Marks
PART B	Comprises of eight long answer questions with two questions from each unit. Candidates have to answer any four questions, selecting one question from each unit.	4x7 = 28 Marks
	Total marks for End Semester Examination	**35 Marks**
	Internal Assessment	**15 Marks**
	Total	**50 Marks**

Practical Paper

Max. hrs: 4 hrs. Max. Marks: 50

Experiment no. 1	Inorganic Chemistry	10 Marks
Experiment no. 2	Physical Chemistry	10 Marks
	Record	5 Marks
	Viva	5 Marks
	Total marks for End Semester Examination	**30 Marks**
	Internal Assessment	**20 Marks**
	Total	**50 Marks**

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester V

Group A Paper I

BSCH 501 A **Inorganic and Organic Chemistry-V** **30 Hrs (2 hrs/week)**

Unit -I
Coordination Compounds

Werner's coordination theory and its experimental verification, Effective Atomic Number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, Valence Bond Theory of transition metal complexes with reference to tetrahedral, octahedral and sqaure planar complexes, Back bonding, limitations of Valence Bond Theory.

Unit-II
Chemistry of Elements of First Transition Series & Spectral Properties of Transition Metal Complexes

Chemistry of Elements of First Transition Series**:** Properties of the elements of the first transition series, complexes illustrating relative stability of their oxidation states, types of magnetic behaviour, magnetic and molar susceptibility, determination of magnetic susceptibility.

Spectral properties of transition metal complexes**:** Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states and spectroscopic terms (L-S Coupling), spectrochemical series, Orgel- energy level diagram for d^1 and d^9 states, electronic spectrum of $[Ti(H_2O)_6]^{+3}$ complex ion.

Unit-III
Spectroscopy (NMR)

Proton Magnetic Resonance ^{1}H-NMR spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin spin splitting and coupling constant, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, ethyl acetate and 1,1,2- tri bromo ethane. Problems pertaining to the structural elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

Unit-IV
Organometallic Compounds

The Grignard reagent- preparation, structure and chemical reactions, Organozinc compounds- preparation and chemical reactions, Organolithium compounds- preparation and chemical reactions.

Learning Outcomes:

Students will be able to :

- understand geometries of complex compounds and explain stability, magnetic properties and colour of transition compounds.
- interpret spectra of basic organic compounds and can design synthetic routes for drugs.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester V

Paper II

BSCH 502 A **Organic and Physical Chemistry-V** **30 Hrs (2 hrs/week)**

Unit-I
Bio Molecules: Introduction to Nucleic acid and Vitamins

Nucleic acids**:** Introduction, constituents of nucleic acids - ribo and deoxy ribonucleosides, nucleotides and structure of DNA and RNA.

Vitamins**:** Introduction, Biological importance and diseases caused by the deficiency of Vitamin A, B, C, D, E and K. Structural elucidation of Vitamin C and E.

Unit-II
Synthetic dyes

Colour and constitution (electronic concept), Classification of dyes. Chemistry and synthesis of methyl orange, congo red, malachite green, crystal violet, phenolphthalein, fluorescein, alizarin and indigo.

Unit-III
Quantum Mechanics

Black-body radiation, Planck`s radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects. de Broglie hypothesis, Heisenberg's uncertainty principle, Sinusoidal wave equation. Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance. Molecular orbital theory- Basic idea, criteria for forming M.O's. from A.O's. Construction of M.O' s by LCAO method (H^+ ion). Hybrid orbitals sp, sp^2, and sp^3. Calculation of coefficients of atomic orbitals used in these hybrid orbitals.

Unit -IV
Adsorption and Photochemistry

Adsorption: Difference between adsorption, absorption and sorption, chemisorption, adsorbent and adsorbate, reversible and irreversible adsorption, characteristics of adsorption, adsorption of gases by solids, factors affecting adsorption, types of adsorptions, types of adsorption isotherms- Freundlich and Langmuir adsorption isotherms.

Photochemistry: Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-Drapper law, Stark-Einstien law, Jablonski diagram depicting various processes occurring in the excited state., qualitative description of fluorescence, phosphorescence, non radiative process (internal conversion, inter system crossing) quantum yield, photosensitized reaction-energy transfer process (simple examples)

Learning Outcomes:

Students will be able to :

- demonstrate about differentiating nucleic acids and gain knowledge of structure of dyes and their colour.
- describe dual behavior of matter and quantitative approach of hybridization.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester V

Group B **Paper I**

BSCH 501 B **Inorganic and Organic Chemistry-V** **30 Hrs (2 hrs/week)**

Unit-I
Solvent Extraction

Principles and process of solvent extraction, distribution law and partition coefficient, batch extraction, continuous extraction and counter current distribution.

Unit-II
Qualitative and Quantitative Inorganic Analysis

Common ion effect, solubility product and their applications in qualitative analysis, chemistry of analysis of various groups of basic and acidic radicals, Theory of oxidation reduction (Redox) titration, redox indicators, complexometric titrations with the reference to EDTA, complexometric indicators.

Unit-III
Molecular Rearrangements

General mechanism of following molecular rearrangements- Benzil-Benzilic acid, Pinacol- Pinacolone, Bayer-Villiger, Favorskii, Schmidt, Wolf and Claisen - Cope rearrangements.

Unit-IV
Fats, Oils and Detergents

Natural fats, edible and industrial oils of vegetable resins, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, Iodine Value, Acid Value, soaps, synthetic detergents, alkyl and aryl sulphonates.

Learning Outcomes:

Students will be able to :

- develop skills required for qualitative and quantitative inorganic analysis and separation processes.
- understand fundamental aspects of fats, oils & detergents and rearrangement reactions.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester V

Paper II

BSCH 502 B **Organic and Physical Chemistry-V** **30 Hrs (2 hrs/week)**

Unit -I
Carbohydrates

Classification and nomenclature, monosaccharides, mechanism of osazone formation, inter conversion of glucose and fructose, chain lengthing and chain shortening of aldose. Configuration of monosaccharides. erythro and thereo diastereomers. Conversion of glucose into mannose, formation of glucosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D (+)-glucose. Mechanism of mutarotation. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

Unit-II
Chemistry of Enolates

Acidity of α hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Ethylacetoacetate: Synthesis, Claisen condensation and keto-enol tautomerism. Alkylation of 1,3- dithianes, alkylation and acylation of enamines.

Unit III
Electrochemistry-II

Types of reversible electrodes, gas metal ion, metal-metal ion, metal insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation and single electrode potential. Standard hydrogen electrode, reference electrodes, standard electrode potential, electrochemical series and its significance. E.M.F and its measurements. Electrolytic and Galvanic cells-reversible and irreversible cells. Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K). Polarization and overvoltage. Concentration cell with and without transport, liquid junction potential. Potentiometric titrations.

Unit IV
Quantum Mechanics

Black Body Radiation, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (without derivation) and its defects. de-Broglie hypothesis, Heisenberg's uncertainty principle, Sinusoidal wave equation. Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance.
Molecular Orbital Theory: Basic ideas, criteria for forming M.O.'s from A.O.'s. construction of M.O.'s by LCAO method (H^+ ion). Hybrid orbitals sp, sp^2 and sp^3 . Calculation of coefficients of atomic orbitals used in these hybrid orbitals.

Learning Outcomes:

Students will be able to :

- develop scientific skills to describe naturally occurring poly hydroxyl aldehydes and ketones mostly used as energy providing food.
- investigate principles and phenomena of electrochemistry and related devices.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester V

BSCH 551 **Chemistry Practical -V** **60 hrs (4 hrs/week)**

Inorganic Chemistry

Preparation:

(a) Preparation of Sodium trioxalatoferrate(III) .
(b) Preparation of $[Ni(DMG)_2]$complex.
(c) Preparation of Tetraamminecopper(II) sulphate complex .
(d) Preparation of cis- and trans- diaquabisoxalatochromate(III) ion.
(e) Preparation of Sodium tetrathionate.

Physical Chemistry:

Molecular weight determination:

(a) Determination of molecular weight of a non volatile solute by Rast method/ Beckmann freezing point method.
(b) Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebullioscopy.

Colorimetry:

Verify Beer- Lambert law using $KMnO_4/K_2Cr_2O_7$ and determine the concentration of the given solution .

Viva voce

Record

Learning Outcomes:

Students will be able to :

- learn experimentally the synthesis of various inorganic complexes in laboratory.
- understand the concept of Beer- Lambert law by using $KMnO_4/K_2Cr_2O_7$ solution in laboratory.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester VI

Semester Scheme

Group	Paper Code	Paper title	Course Category	Credit	Total contact hours per semester / per week		Maximum marks	Minimum marks	ESE in hrs	
									Theory	Practical
Group A*	BSCH 601 A	Inorganic and Organic Chemistry-VI	DSE	2	30	2	50	20	3	-
	BSCH 602 A	Organic and Physical Chemistry-VI	DSE							
Group B*	BSCH 601 B	Inorganic and Organic Chemistry-VI	DSE	2	30	2	50	20	3	-
	BSCH 602 B	Organic and Physical Chemistry-VI	DSE							
	BSCH 651	Chemistry Practical	DSEP	2	60	4	50	20	-	4
				6		8				

The details of the courses with code and title assigned are given below:
DSE= Discipline Specific Elective ESE = End Semester Examination DSEP= Discipline Specific Elective Practical

Note: Student has to choose any one elective paper from Group A* (501 A or 502 A) and the other paper will be allotted from Group B* (502 B or 501 B) accordingly.

Examination Scheme

S.No.	Paper	ESE	CIA	Total
1.	Theory	70%	30%	100%
2.	Practical	60%	40%	100%

Syllabus of each theory paper is divided into four units.
Each theory paper is of 3 hours duration . Each Practical /Lab work is of 4 hours duration .

The number of papers and the maximum marks for each paper/ practical is shown in the syllabus for the paper concerned. It will be necessary for a candidate to pass in theory as well as practical of a subject separately.

Note: Maximum marks for a theory paper is 50 which includes 35 marks for ESE and 15 marks for internal assessment. Maximum marks for a practical paper is 50 which includes 30 marks for ESE and 20 marks for internal assessment.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester VI

Evaluation Scheme

Theory Paper

Max. hrs: 3 hrs. Max. Marks: 50

PART A	Comprises of ten very short answer questions from all units. (It is compulsory to attempt any 7questions)	1x7= 7marks
PART B	Comprises of eight long answer questions with two questions from each unit. Candidates have to answer any four questions, selecting one question from each unit.	7x4 = 28 marks
	Total marks for End Semester Examination	**35 marks**
	Internal Assessment	**15 marks**
	Total	**50 marks**

Practical Paper

Max. hrs: 4 hrs. Max. Marks: 50

Experiment no. 1	Inorganic Chemistry	10 marks
Experiment no. 2	Physical Chemistry	10 marks
	Record	5 marks
	Viva	5 marks
	Total marks for End Semester Examination	**30 marks**
	Internal Assessment	**20 marks**
	Total	**50 marks**

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester VI

Group A **Paper I**

BSCH 601 A **Inorganic and Organic Chemistry-VI** **30 Hrs (2 hrs/week)**

Unit -I
Metal Ligand Bonding and Thermodynamic & Kinetic aspects of Transition Metal Complexes.

Metal – Ligand Bonding in Transition Metal Complexes: An elementary idea of Crystal-Field Theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal – field parameters, colour of transition metal ions, limitations of Crystal Field Theory.

Thermodynamic and Kinetic aspects of Transition Metal Complexes**:** Thermodynamic and kinetic stability, thermodynamic stability and factors affecting the stability, substitution reactions of square planar complexes and trans effect.

Unit-II
Chemistry of Lanthanide and Actinide Elements

Chemistry of Lanthanide Elements: Position in periodic table, electronic structure, oxidation states and ionic radii, lanthanide contraction and its consequences, complex formation, spectral properties, magnetic properties, Separation of lanthanides.

Chemistry of Actinide Elements**:** Position in periodic table, electronic configuration, general features and chemistry of actinides, oxidation states and magnetic properties. Chemistry of separation of Np, Pu and Am from U. Comparison of lanthanides and actinides.

Unit -III
Heterocyclic Chemistry-I

Introduction, Molecular Orbital diagram and aromatic characteristic of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Reaction mechanism of nucleophilic substitution reaction in pyridine derivatives. Comparision of basicity of pyridine, piperidine and pyrrole.

Unit -IV
Polymer Chemistry

Addition or chain growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol-formaldehyde resin, urea-formaldehyde resin, epoxy resins and polyurethanes. Natural and synthetic rubbers.

Learning Outcomes:

Students will be able to :

- describe spectroscopy of transition metal complexes and successfully explain magnetic properties, colour and stability of transition metal complexes.
- understand wide applications of heterocyclic compounds in pharmaceutical and agricultural industries.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester VI

Paper II

BSCH 602 A **Organic and Physical Chemistry-VI** **30 Hrs (2 hrs/week)**

Unit-I
Basics of Green Chemistry

Introduction, Principle and Concepts of Green Chemistry, Need for Green Chemistry, Twelve principles of Green Chemistry with their explanations and examples, Green chemistry in day to day life.

Unit-II
Synthesis and Synthetic Applications of some Organic Reagents

Synthesis and Synthetic Applications of some Organic Reagents - DDQ, DCC, Lead tetra acetate, NBS, $TiCl_4$ and Wilkinson catalyst.

Unit-III
Spectroscopy

Electromagnetic radiation of the spectrum, basic features of different spectrometers, Born Oppenheimer approximation, degree of freedom. Rotational spectrum - derivation and energy levels of rigid rotator & non rigid rotator. Selection rules, isotope effect, spectral intensity, population distribution (Maxwell Boltzmann distribution).
Vibrational spectrum - Infrared spectrum, Energy levels of simple harmonic and anharmonic oscillator, selection rules, pure vibrational spectrum, determination of force constant.
Raman spectrum - Concept of polarizability. Derivation of pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.
Electronic spectrum - Concept of potential energy curves for bonding and anti bonding molecular orbital's, qualitative description of selection rules and Frank –Condon principle.

Unit IV
Physical Properties and Molecular Structure

Optical activity, polarization (Clausius-Mosotti equation) orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment: temperature method and refractivity method, dipole moment and structure of molecules,magnetic properties paramagnetism, dimagnetism and ferromagnetism.

Learning Outcomes:

Students will be able to :

- demonstrate skills of safer use of chemicals in pharmaceutics and agriculture.
- understand interaction of electromagnetic radiation with matter as a function of wavelength or frequency.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester VI

Group B **Paper I**

BSCH 601 B **Inorganic and Organic Chemistry-VI** **30 Hrs (2 hrs/week)**

Unit-I
Organometallic Chemistry

Definition, nomenclature and classification of organometallic compounds, preparation, properties, bonding and applications of alkyls and aryls of Al and Ti, a brief account of metal – ethylenic complexes and homogenous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

Unit-II
Basics of Nuclear Chemistry and Radio Chemistry

Fundamental particles of nucleus. Nuclides- representation and classification of nuclides. Isotopes, isobars and isotones with specific examples. Natural and artificial radioactivity, radioactive disintegration series, radioactive displacement law, radioactivity decay rates, half life and average life.

Fuel of the future Helium-3 (^{3}He): natural abundance, human production- Tritium decay and use as nuclear fuel

Unit-III
Nitroalkanes & Nitroarenes

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes, mechanism of nucleophilic substitution in nitro arenes and their reduction in acidic, neutral and alkaline medium, picric acid. Halonitroarenes - reactivity, structure and nomenclature of amines, physical properties, stereochemistry of amines. Separation of mixture of primary, secondary and tertiary amines, structural features affecting basicity of amines.

Unit-IV
Organosulphur Compounds

Nomenclature, structural features, methods of formation and chemical reactions of sulphonic acids and sulphonamide. **S**ulpha Drugs- Methods of formation and applications of Sulpha Drugs: Sulphanilmide, Siphadiazine, Sulphaguanidine, Sulphonal.

Learning Outcomes:

Students will be able to :

- implement knowledge of nuclear power, medical treatment, carbon dating and isotope labeling.
- demonstrate skills of understanding organometallic compounds and applications of sulpha drugs in life.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester VI

Paper II

BSCH 602 B **Organic and Physical Chemistry-VI** **30 Hrs (2 hrs/week)**

Unit -I
Heterocyclic Chemistry-II

Introduction to condensed five and six membered hetrocycles. Preparation and reaction of indole, quinoline and isoquinoline with special reference to Fischer indole synthesis, Skraup synthesis and Bischler- Napieralski synthesis. Mechanism of electrophilic substitution reaction of indole, quinoline and iso quinoline.

Unit- II
Amino Acids and Proteins

Classification, structure, acid base behaviour and stereochemistry of amino acids, essential and other protein amino acids. Isoelectric point and electrophoresis. Preparation and reaction of α amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins, levels of protein structure. Protein denaturation / renaturation. Determination of peptide structure, end group analysis, selective hydrolysis of peptides. Classical peptides synthesis, solid phase peptide synthesis.

Unit III
Phase Equilibrium

Statement and meaning of the terms -phase, component and degree of freedom, Gibbs phase rule, phase equilibria of one component system-water, CO_2 and Sulphur systems. Phase equilibria of two component system -simple eutectic Bi-Cd, Pb-Ag systems, desilverisation of lead. Freezing mixtures - acetone-dry ice. Solid solutions - Compound formation with congruent melting point (Mg-Zn) and incongruent melting point (NaCl-H_2O) system, ($FeCl_3$-H_2O) system and ($CuSO_4$-H_2O) system.
Liquid- liquid mixtures, Raoult's and Henry`s law. Ideal and Non ideal Solutions. Azeotropes- HCl –H_2O and ethanol-water systems. Partially miscible liquids- Phenol-water, trimethylamine-water, nicotine-water systems. Lower and upper consulate temperature. Effect of impurity on consulate temperature. Immiscible liquids, steam distillation. Nernst distribution law- Thermodynamic derivation and applications.

Unit IV
Solutions, Dilute Solutions and Colligative Properties

Solutions, dilute solutions**:** Ideal and non ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient.

Dilute solution and 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 in boiling point and depression of freezing point. Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

Learning Outcomes:

Students will be able to :

- apply concept of phase rule in industries viz. purification of components, food production and alloy industries.
- implement knowledge to investigate building blocks of life, enzymes and hormones.

S.S. Jain Subodh P.G. College, Jaipur

BACHELOR OF SCIENCE (B. Sc.)
Chemistry

Semester VI

BSCH 651 **Chemistry Practical -VI** **60 hrs (4 hr/week)**

Organic Chemistry

Qualitative analysis:

Separation and analysis of an organic mixture containing two solid components using water, $NaHCO_3$, and NaOH and preparation of suitable derivatives.

Analysis of oils and fats (Any one)

(a) Determination of Saponification value.
(b) Determination of iodine value.
(c) Determination of acid value.

Physical Chemistry

1. Electrochemistry:

(a) Determine the strength of the given acid conductometrically using standard alkali solution
(b) Determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically
(c) Study the saponification of ethyl acetate acetate conductometrically
(d) Determine the ionization constant of a weak acid conductrometrically
(e) Titrate potentiometrically the given ferrous ammonium sulphate solution using $KMnO_4/K_2Cr_2O_7$ as titrant and calculate the redox potential of Fe^{++}/Fe^{+++} system on the hydrogen scale.

1. Refractometry/Polarimetry**:**

(a) Verify law of refraction of mixtures using Abbe"s refractometer for glycerol- water system.
(b) Determine the specific rotation of a given optically active compound.

Viva voce

Record

Learning Outcomes:

Students will be able to :

- cultivate confidence for using various equipments like potentiometer, conductometer in laboratory.
- develop skills of separation of organic mixture by using various solvents and their analysis.