BACHELOR OF SCIENCE

Subject: Chemistry

Semester I

Paper code	Paper Title	Type of paper	Contact Hours Per semester	Per week	Maximum marks	Minimum marks	ESE in hrs.	
							Theory	Practical
BCHE101	Inorganic chemistry	Theory	30	2	50	20	3	-
BCHE102	Organic chemistry	Theory	30	2	50	20	3	-
BCHE103	Physical chemistry	Theory	30	2	50	20	3	-
BCHE151	Chemistry Practicals	Lab work	60	4	75	30	-	4
				10				

The details of the courses with code and title assigned are given below.

ESE = End Semester Examination

SCHEME OF EXAMINATION

(Semester Scheme)

Examination scheme

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

Each theory paper syllabus is divided into four units. Each theory paper 3 hours duration

Each Practical /Lab work 4 hours duration

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

Note: Maximum marks for a theory paper is 50 marks which include 35 marks for ESE and 15marks for internal assessment.

BACHELOR OF SCIENCE

Subject : Chemistry
Semester I

Max.hrs: 3 hrs. **Max. marks : 35**

Part A- comprises of ten very short answer questions from all units.
(It's a compulsory question and attempt any seven) 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

PAPER I Inorganic Chemistry BCHE 101 **30 Hrs (2 hrs/week)**

Unit I

Chemical Bonding Part I: Introduction of chemical bonding, properties of covalent bond, electron pair concept and its limitations directional characteristics of covalent bond, hybridization, energetics of hybridisation and shapes of different molecules and ions, Valence shell electron pair repulsion (VSEPR) theory to $SnCl_2$, H_3O^+, NH_4^+, NH_3, H_2O, $TeCl_4$, ClF_3, ICl_2^-, BrF_5, ICl_4^-, Valance bond theory and its limitations.

Unit II

Chemical Bonding Part II: Linear combination of atomic orbitals, types of molecular orbitals, nonbonding combination of atomic orbitals, MO theory for homonuclear molecules and ions (H_2+ to 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, bond strength and bond energy, dipole moment, percentage ionic character from dipole moment and electronegativity difference.

Unit III

Periodicity of p- block elements: Comparative study of p-block elements: group trends, electronic configuration, atomic and ionic radii, ionization energy, electron affinity, electronegativity, oxidation states, catenation , inert pair effect.

Chemistry of noble gases: Introduction of noble gases, characterstics and group tendency, Chemical properties of the noble gases, compounds of noble gases, chemistry of xenon, bonding and stereochemistry of xenon compounds.

Unit IV

Theory of Qualitative and Quantitative Inorganic Analysis: Common ion effect, solubility product and super saturation, Chemistry of analysis of various groups of basic and acidic radicals, chemistry of identification of acid radicals in typical combinations. Chemistry of interfering radicals including their removal in the analysis of basic radicals. Theory of oxidation- reduction (Redox) titration, redox indicators, complexometric titrations, theory in reference to EDTA, complexometric indicators- direct and indirect methods.

BACHELOR OF SCIENCE

Subject : Chemistry
Semester I

PAPER II Organic Chemistry BCHE 102 30 Hrs (2 hrs/week)

Unit I

Mechanism of organic reaction: Curved arrow notation , drawing electron movement with arrows, Half headed and double headed arrow, homolytic and heterolytic bond breaking, Types of reagents , electrofiles and nucleofiles. Types of organic reactions, energy considerations, reactive intermediates-Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes with examples. Assigning formal charges on intermediates and other ionic species. Method of determination of reaction mechanism (product analysis, intermediates, isotope effect, kinetic and stereo chemical studies)

Unit II

Alkanes: IUPAC nomenclature of branched and unbranched alkanes. The alkyl group. Isomerism in alkanes sources, methods of formation (with special reference of 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, method 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.

Unit III

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—mechanism 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. Industrial applications of ethylene and propene.

Cycloalkenes : Method of formation, conformation and chemical reactions of cycloalkenes.

Unit IV

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

Alkynes : Nomenclature, structure and bonding in alkynes, methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrofilic and nucleofilic addition reactions, Hydroboration-oxidation, metal – ammonia reduction, oxidation and polymerisation.

BACHELOR OF SCIENCE

Subject : Chemistry
Semester I

PAPER III Physical Chemistry BCHE 103 30 Hrs (2 hrs/week)

Unit I

Gaseous States 1: Gaseous laws and their derivations, postulate of kinetic theory of gases and its derivation, deviation from ideal behavior, (with respect to pressure and volume), Vander Waals equation of state

Unit II

Gaseous States 2: Critical phenomenon : PV isotherm of real gases, continuity of state, the isotherms of Vander Waals equation, relationship between critical constant and Vander- Waals 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. Liquification of gases.

Unit III

Liquid state: Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solid, liquid and gases. Liquid crystals: difference between liquid crystal, solid and liquid. Classification, structure and application of liquid crystal

Unit IV

Solid state: Definition of space lattice, Unit cell. Law of crystallography (i)law of constancy of interfacial angles (ii) law of rationality of indices (iii)law of symmetry. Symmetry elements in crystals. X ray diffraction by crystals. Derivation of Braggs equation, Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method)**.**

BACHELOR OF SCIENCE

Subject : Chemistry
Semester I

Chemistry Practical **BCHE 151** **60 hrs (4 hr/week)**

Practicals

Note: Total marks for each semester practicals is 75, which include 45 marks for ESE and 30 marks for internal assessment.

Duration 4 hours		Max. Marks: 45
Experiment no. 1	Inorganic Chemistry	18 marks
Experiment no. 2	Physical Chemistry	12 marks
	Record	7 marks
	Viva	8 marks

Inorganic chemistry

Qualitative Analysis: Semi microanalysis; separation and identification of three cations and three anions in the given inorganic mixture, specific tests for some typical combination of acid radicals.

Physical chemistry

Viscosity, Surface Tension

1. To determine the percentage composition of a given mixture (non-interacting systems) by viscosity method.
2. To determine the relative viscosity of given unknown organic liquid by viscometer.
3. To determine the relative surface tension of given unknown organic liquid by stalagmometer.
4. To determine the percentage composition of a given binary mixture by surface tension method.

Viva-Voce and Record

BACHELOR OF SCIENCE

Subject : Chemistry
Semester II

Paper code	Paper Title	Type of paper	Contact Hours Per semester	Per week	Maximum marks	Minimum marks	ESE in hrs.	
							Theory	Practical
BCHE 201	Inorganic chemistry	Theory	30	2	50	20	3	-
BCHE 202	Organic chemistry	Theory	30	2	50	20	3	-
BCHE 203	Physical chemistry	Theory	30	2	50	20	3	-
BCHE 251	Chemistry Practicals	Lab work	60	4	75	30	-	4
				10				

The details of the courses with code and title assigned are given below.

ESE = End Semester Examination

SCHEME OF EXAMINATION

(Semester Scheme)

Examination scheme

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

Each theory paper syllabus is divided into four units. Each theory paper 3 hours duration

Each Practical /Lab work 4 hours duration

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

Note: Maximum marks for a paper is 50 marks which include 35 marks for ESE and 15marks for internal assessment.

BACHELOR OF SCIENCE

Subject : Chemistry
Semester II

Max.hrs: 3 hrs. **Max. marks: 35**

Part A- comprises of ten very short answer questions from all units.
(It's a compulsory question and attempt any seven) 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

PAPER I : Inorganic Chemistry BCHE 201 30 Hrs (2 hrs/week)

Unit I

Ionic Solids: Ionic structures (AB and AB_2 type), packing of ions, 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 lande equation, Born Haber cycle and its applications, solvation energy and solubility of ionic solids.

Unit II

Metallic Bond: Introduction of metallic bond, properties of metals, theories of Metallic bond- old electron free theory, valance bond theory, limitations of valence bond theory, molecular orbital or band theory, lattice defects in ionic solids, semiconductors.

Weak interactions: Hydrogen bonding and Vander Waals forces.

Unit III

s-Block Elements: Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems and introduction to alkyls and aryls.

Unit IV

Some important compounds of p- block elements: Hydrides of boron, diborane and higher boranes, borazines, borohydrides, fullerenes, carbides, flurocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalides.

BACHELOR OF SCIENCE

Subject : Chemistry
Semester II

PAPER II Organic Chemistry BCHE 202 30 Hrs (2 hrs/week)

Unit I

Stereochemistry of organic compounds: Concept of isomerism, type 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 of enantiomers , inversion, retention and racemisation. Relative and absolute configuration, sequence rule, D&L and R&S system of nomenclature.

Unit II

Geometrical isomerism: Determination of configuration of geometric isomers, E&Z- system of nomenclature, geometric 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

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

Unit III

Aromaticity: The Huckel's rule, aromatic ions.

Aromatic electrofilic substitution: General pattern of the mechanism, role of sigma and pi complexes. Mechanism of nitration, halogenations, sulphonation, mercuration and Friedel Craft reaction with energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction.

Unit IV

Alkyl and aryl halides: Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanism of nucleofilic substitution , reaction of alkyl halides, SN^1 and SN^2 reaction with energy profile diagram.

Poly halogen compounds: Chloroform, carbon tetra chloride. Methods of formation of aryl halides, nuclear and side chain reaction. The addition-elimination and the elimination addition mechanism of nucleofilic aromatic substitution reaction. Relative reactivities of alkyl halides v/s allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC.

BACHELOR OF SCIENCE

Subject : Chemistry

Semester II

PAPER III Physical Chemistry BCHE 203 30 Hrs (2 hrs/week)

Unit I

Colloidal state: Definition of colloids, classification of colloids. Solids in liquids (sols): properties- kinetics, optical and electrical. Stability of colloids, protective action, Hardy Schulze law. Gold number. Liquids in solids (gels): classification, preparation and properties, inhibition, general application of collides. Liquid in liquid (emulsions): types of emulsions, preparation, Emulsifiers.

Unit II

Chemical Kinetics I: Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction, concentrations, temperature, pressure, solvent, light, catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reaction- zero order, first order, second order, pseudo order, half life and mean life. Determinations of the order of reaction- differential method, method of integration, method of half-life period and isolation method. Radioactive decay as a first order phenomenon.

Unit III

Chemical Kinetics II: Experimental methods of chemical kinetics: conductometric, potentiometric, optical methods, polarimetry and spectrophotometer. Theories of chemical kinetics, Effect of temperature on the rate reaction, Arrhenius concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

Unit IV

Solutions, Dilute solutions: ideal and non ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient.

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

BACHELOR OF SCIENCE

Subject : Chemistry

Semester II

BCHE 251 **Chemistry Practical** **60 hrs(4hrs/week)**

Note: Total marks for each semester practicals is 75, which include 45 marks for ESE and 30 marks for internal assessment.

Max. marks 45

Experiment no. 1	Inorganic Chemistry		15 marks
Experiment no. 2	Organic Chemistry		
		a) M.P/b.p	3 marks
		b) Organic compound	12(6+6) marks
		Record	7 marks
		Viva	8 marks

Inorganic chemistry:

Quantitative analysis: Volumetric analysis

(a) Determination of acetic acid in commertial vinegar using NaOH.
(b) Determination of alkali content ant acid tablet using HCl.
(c) Estimation of calcium content in chalk as calcium oxalate by permanganometery.
(d) Estimation of hardness of water by EDTA.
(e) Estimation of ferrous and ferric by dichromate method.
(f) Estimation of copper using thiosulphate.

Organic chemistry:

(A) Laboratory techniques

a . Determination of m. p. of naphthalene, benzoic acid, urea etc.

OR

b. Determination of b. p. of ethanol , methanol, cyclohexane, etc

(B) Qualitative analysis; detection of extra elements (N, S. and halogens) and functional groups e.g. (phenolic , alcoholic, carboxylic, carbonyl, ester, carbohydrate, amine, amide and nitro) in simple organic compounds

Viva voce and record

BACHELOR OF SCIENCE

Subject : Chemistry

Semester III

Paper code	Paper Title	Type of paper	Contact Hours Per semester	Per week	Maximum marks	Minimum marks	ESE in hrs.	
							Theory	Practical
BCHE 301	Inorganic chemistry	Theory	30	2	50	20	3	-
BCHE 302	Organic chemistry	Theory	30	2	50	20	3	-
BCHE 303	Physical chemistry	Theory	30	2	50	20	3	-
BCHE 351	Chemistry Practicals	Lab work	60	4	75	30	-	4
				10				

The details of the courses with code and title assigned are given below.

ESE = End Semester Examination

SCHEME OF EXAMINATION

(Semester Scheme)

Examination scheme

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

Each theory paper syllabus is divided into four units. Each theory paper 3 hours duration

Each Practical /Lab work 4 hours duration

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

Note: Maximum marks for a paper is 50 marks which include 35 marks for ESE and 15marks for internal assessment.

BACHELOR OF SCIENCE

Subject : Chemistry

Semester III

Max.hrs: 3 hrs. **Max. marks : 35**

Part A- comprises of ten very short answer questions from all units.
(It's a compulsory question and attempt any seven) 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

Semester III

PAPER I Inorganic Chemistry BCHE 301 30 Hrs (2 hrs/week)

Unit I

Acids and Bases : Arrhenius (Water- ion system), Bronsted- Lowry (The proton donor acceptor system), The Lux-Flood (oxide ion concept), Lewis concepts of acids and bases (The electron donor acceptor concept) and solvent system and solvolysis, ionic product of solvent, limitations of solvent system.

Unit II

Hard and soft acids and bases (HSAB): Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid- base strength and hardness and softness, symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness, limitations of HSAB.

Unit III

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 and liq. SO_2, HF.

Unit IV

Seperation methods and Analysis Process: Principles and process of solvent extraction, the distribution law and partition coefficient, batch extraction, continuous extraction and counter current distribution, Gravimetric methods, theory of precipitation, co-precipitation, post precipitation, theory of purifying the precipitates.

BACHELOR OF SCIENCE

Subject : Chemistry
Semester III

PAPER II Organic Chemistry BCHE 302 30 Hrs (2 hrs/week)

Unit I

Alcohols: Classification and nomenclature. Monohydric alcohols- Methods of formation by reduction of aldehyde, ketones, carboxylic acids and esters. Hydrogen bonding, acidic nature, reaction of alcohols. Dihydric alcohols- methods of formation, chemical reactions of vicinal glycols, oxidation cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol- pinacolone rearrangement. Trihydric alcohols- methods of formation, chemical reactions of glycerol.

Unit II

Phenol: 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, Hauben- Hoesch reaction, Lederer Manasse reaction and Reimer Tiemann reaction.

Unit III

Aldehyde and ketones: Nomenclature and structure of the carbonyl group. Synthesis of aldehyde and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehyde and ketones using 1, 3 dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, perkin and Knovenagel condensations, condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction, use of acetals as protecting group, oxidation of aldehyde and ketones, Cannizzaro reaction, Bayer Villiger oxidation of ketones, MPV, Clemmensen's reduction, Wolf Kishner reduction, $LiAlH_4$ and $NaBH_4$ reduction, Halogenation of enolizable ketones.

Unit IV

Ethers and epoxides: 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.

Organic synthesis via Enolates: Acidity of α hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethylacetoacetate; The Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1,3- dithianes, alkylation and acylation of enamines.

BACHELOR OF SCIENCE

Subject : Chemistry

Semester III

PAPER III Physical Chemistry BCHE 303 30 Hrs. (2hrs/week)

Unit I

Thermodynamics-I: Definition of thermodynamics terms: systems, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamics 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 pressure and their relationship. Joule law-Joule Thomsan co-efficient and inversion temperature. Calculation of w,q,dU &dH for the expansion of ideal gases under isothermal and adiabatic condition for reversible process.

Unit II

Themochemistry: Standard state, standard enthalpy of formation- Hess`s Law of heat summations and its applications, Heat of reaction 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 III

Electrochemistry I: Electrical transport- 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 law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes. Ostwald dilution law its uses and limitations. Debye Huckel–Onsager`s equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method. Application of conductivity measurements; determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, condutometric titrations.

Unit IV

Chemical equilibrium: Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le- Chatelier`s principle. Reaction isotherm and reaction isochore – Clapeyron equation and Clausious- Clapeyron equation, application.

BACHELOR OF SCIENCE

Subject : Chemistry

Semester III

BCHE 351 Chemistry Practical 60 hrs (4 hr/week)

Note: Total marks for each semester practicals is 75, which include 45 marks for ESE and 30 marks for internal assessment.

Duration 4 hours Max. Marks: 45

Experiment no. 1	Inorganic Chemistry	14 marks
Experiment no. 2	Organic Chemistry	16marks
	Record	7 marks
	Viva	8 marks

Inorganic Chemistry

Gravimetric analysis:(Any One)

i) Analysis of Cu as CuSCN ,

ii) Analysis of Ni as Ni (dimethylglyoxime) and

iii) Analysis of Zn as $Zn_3(PO_4)_2$

Organic Chemistry

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

Viva-Voce and Record

BACHELOR OF SCIENCE

Subject : Chemistry

Semester IV

Paper code	Paper Title	Type of paper	Contact Hours Per semester	Per week	Maximum marks	Minimum marks	ESE in hrs.	
							Theory	Practical
BCHE 401	Inorganic chemistry	Theory	30	2	50	20	3	-
BCHE 402	Organic chemistry	Theory	30	2	50	20	3	-
BCHE 403	Physical chemistry	Theory	30	2	50	20	3	-
BCHE 451	Chemistry Practicals	Lab work	60	4	75	30	-	4
				10				

The details of the courses with code and title assigned are given below.

ESE = End Semester Examination

SCHEME OF EXAMINATION

(Semester Scheme)

Examination scheme

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

Each theory paper syllabus is divided into four units. Each theory paper 3 hours duration

Each Practical /Lab work 4 hours duration

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

Note: Maximum marks for a paper is 50 marks which include 35 marks for ESE and 15marks for internal assessment.

BACHELOR OF SCIENCE

Subject : Chemistry
Semester IV

Max.hrs: 3 hrs. **Max. marks : 35**

Part A- comprises of ten very short answer questions from all units.
(It's a compulsory question and attempt any seven) 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**

PAPER I Inorganic Chemistry BCHE 401 30 Hrs. (2hrs/week)

Unit I

Chromatography: Types of chromatographic methods and their applications, principle of differencial migration, Adsorption phenomenon, nature of the adsorbent, solvent systems, Rf values.

Unit II

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

Unit III

Polymer chemistry:

Silicones: Classification, Preparation and Structure of silicons, silicon resin, silicon rubber, silicon fluid, industrial application of silicones.

Phosphazenes: preparation, properties, substitution reaction and structure.

Unit IV

Bioinorganic chemistry: Essential and trace elements in biological processes, 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}, nitrogen fixation.

BACHELOR OF SCIENCE

Subject : Chemistry
Semester IV

PAPER II Organic Chemistry BCHE 402 30 Hrs (2 hrs/week)

Unit I

Carboxylic acids: Nomennclature, 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, synthesis of acid chlorides, esters and amides, reduction of carboxylic acids, mechanism of decarboxylation. Method of formation and chemical reaction of haloacids, hydroxyl acids, malic tartaric and citric acids. Methods of formation and chemical reactions of α, β- unsaturated monocarboxylic acids. Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents (succinic, glutaric and adipic acids).

Unit II

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

Synthetic polymers: 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.

Unit III

Alkyl nitrates and nitroarenes: Preparation of nitroalkanes and nitroarenes. chemical reactions of nitro alkanes, 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 effecting basicity of amines.

Unit IV

Amines:

Amines salts as phase transfer catalyst, preparation of alkyls and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehylic and ketonic compounds. Gabriel- Pthalamide reaction, Hofmann bromamide reaction.

Reaction of amines, electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acids. Diazotization, mechanism, synthetic transformation of aryl diazonium salts, azocoupling.

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.

BACHELOR OF SCIENCE

Subject : Chemistry
Semester IV

PAPER III Physical Chemistry BCHE 403 30 Hrs. (2 hrs/week)

Unit I

Thermodynamics-II

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

Concept of entropy: Entropy as a state function, entropy as a function of Volume and temperature, entropy as a function of pressure and temperature, entropy change in physical change, 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 and Helmholtz functions: Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.

Unit II

Electrochemistry II-: Types of reversible electrodes, gas metal ion, metal-metal ion, metal insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode, reference electrodes, standard electrode potential, sign convention, electrochemical series and its significance.

Electrolytic and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements, computation of cell EMF, calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K), polarization, over potential and overvoltage.

Concentration cell with and without transport, liquid junction potential, application of concentration cells, solubility product and activity coefficient, potentiometric titrations.

Unit III

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

Corrosion: Fundamental of electrolytic corrosion: theories and kinetics, corrosion prevention. Batteries, fuel cells

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 molecular magnetic properties-paramagnetism, dimagnetism and ferromagnetics.

BACHELOR OF SCIENCE

Subject : Chemistry

Semester IV

BCHE 451 **Chemistry Practical** **60 hrs (4 hr/week)**

Note: Total marks for each semester practicals is 75, which include 45 marks for ESE and 30 marks for internal assessment.

Duration 4 hours Max. Marks: 45

Experiment no. 1	Organic Chemistry	12 marks
Experiment no. 2	Physical Chemistry	18 marks
	Record	7 marks
	Viva	8 marks

Organic Chemistry

TLC/ Paper chromatography

Separation of fluorescein and methylene blue

Separation of leaf pigments from spinach leaves

Synthesis of organic compounds (Any Four)

(a) Acetylation of 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
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 :

1.To 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 to determine the concentration of that solute in the given phenol-water system.

2.To construct the phase diagram of two component (e.g. diphenylamine-benzophenone) system by cooling curve method.

Transition Temperature:

1. Determination of the transition temperature of the given substance by thermometric/dialometric method (e.g. $MnCl_2$ $4H_2O$/$SrCl_2$ $2H_2O$).

Thermochemistry :

1. To determine the solubility of benzoic acid at different temperature and to determine H of the dissolution process.
2. 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.
3. To 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 and Record

BACHELOR OF SCIENCE

Subject : Chemistry
Semester V

Paper code	Paper Title	Type of paper	Contact Hours Per semester	Per week	Maximum marks	Minimum marks	ESE in hrs.	
							Theory	Practical
BCHE 501	Inorganic chemistry	Theory	30	2	50	20	3	-
BCHE 502	Organic chemistry	Theory	30	2	50	20	3	-
BCHE 503	Physical chemistry	Theory	30	2	50	20	3	-
BCHE 551	Chemistry Practicals	Lab work	60	4	75	30	-	4
				10				

The details of the courses with code and title assigned are given below.

ESE = End Semester Examination

SCHEME OF EXAMINATION

(Semester Scheme)

Examination scheme

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

Each theory paper syllabus is divided into four units. Each theory paper 3 hours duration

Each Practical /Lab work 4 hours duration

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

Note: Maximum marks for a paper is 50 marks which include 35 marks for ESE and 15marks for Internal assessment.

BACHELOR OF SCIENCE

Subject : Chemistry

Semester V

Max.hrs: 3 hrs. **Max. marks : 35**

Part A- comprises of ten very short answer questions from all units.
(It's a compulsory question and attempt any seven) 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

PAPER I Inorganic Chemistry BCHE 501 **30 Hrs (2hrs/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 cubic complexes, back bonding, Limitations of valence bond theory.

Unit II

Chemistry of elements of first transition series: Characteristic properties of d block elements, properties of the elements of the first transition series, complexes illustrating relative stability of their oxidation states, coordination number and geometry, Types of magnetic behaviour, magnetic and molar susceptibility, determination of magnetic susceptibility, orbital contribution of magnetic moments , spin-only formula, correlation of μ_s and μ_{eff} values, applications of magnetic moment.

Unit III

Chemistry of lanthanide elements: Position in periodic table, occurrence and isolation, Electronic structure, oxidation states and ionic radii, lanthanide contraction and its consequenses, complex formation, spectral properties, magnetic properties, Separation of lanthanides Application of lanthanides.

Unit IV

Chemistry of actinides: Occurrence, electronic configuration, General features and chemistry of actinides, oxidation states and stereochemistry, spectral properties, magnetic properties , chemistry of separation of Np, Pu and Am from U, comparison of lanthanide and actinide.

BACHELOR OF SCIENCE

Subject : Chemistry
Semester V

PAPER II Organic Chemistry BCHE 502 30 Hrs (2 hrs/week)

Unit I

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

Infrared IR absorption spectroscopy – Molecular vibrations, Hookes law, selection rules, intensity and position of IR bands, measurement of IR spectrum, finger print region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds

Unit II

Organometallic compounds: The Grignard reagent- formation, structure and chemical reaction, organozinc compound: formation and chemical reactions.

Organolithium compounds: Formation and chemical reactions.

Organo sulphur compounds : Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamide and sulpha guanidine.

Unit III

Heterocyclic compounds- I: Introduction, molecular orbital picture and aromatic characteristic of pyrrole, furane, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reaction in pyridine derivatives. Comparision of basicity of pyridine, piperidine and pyrrole

Unit IV

Heterocyclic compounds- 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.

BACHELOR OF SCIENCE

Subject : Chemistry
Semester V

PAPER III Physical Chemistry BCHE 503 30 Hrs (2hrs/week)

Unit I

Phase Equilibrium I: Statement and meaning of the terms-phase, component and degree of freedom, thermodynamic derivation of Gibbs phase rule, phase equilibria of one component system-water, CO_2 and S systems.

Phase equilibria of two component system: Solid-liquid equilibria, simple eutectic Bi-Cd, Pb-Ag systems, desilverisation of lead.

Solid solutions**:** Compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-H_2O), ($FeCl_3$-H_2O) and $CuSO_4$-H_2O) system. Freezing mixtures, acetone-dry ice.

Unit II

Phase Equilibrium II : Liquid –Liquid mixtures- Ideal liquid mixtures. Raoult`s and Henry`s law. Non ideal system-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, applications.

Unit III

Quantum Mechanics I-: Black-body radiation, Planck`s radiation law, photoelectric effect, heat capacity of solids, Behr`s model of hydrogen atom(no derivation) and its defects. Compton Effect. De Broglie hypothesis, Heisenberg`s uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, 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, hydrogen like wave functions, radial wave functions, angular wave functions.

Unit IV

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 adsorption, types of adsorption isotherms, Freundlich and Langmuir adsorption isotherms.

BACHELOR OF SCIENCE

Subject : Chemistry
Semester V

BCHE 551 **Chemistry Practical** **60 hrs (4 hr/week)**

Practicals

Note: Total marks for each semester practicals is 75, which include 45 marks for ESE and 30 marks for internal assessment.

Duration 4 hours Max. Marks: 45

Experiment no. 1	Inorganic Chemistry	12 marks
Experiment no. 2	Physical Chemistry	18 marks
	Record	7 marks
	Viva	8 marks

Inorganic chemistry:

Preparation:

(a) preparation of sodium trioxalato ferrate (III), Na_3 $[Fe(C_2O_4)_3]$

(b) preparation of Ni-DMG complex [$Ni(DMG)_2$]

(c) preparation of copper tetraammine complex $[Cu(NH_3)]SO_4$

(d) preparation of cis- and trans- bisoxalato diaqua chromates (III) ion

(e) preparation of sodium tetrathionate

Physical Chemistry:

Molecular weight determination :

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

Colorimetry:

To verify Beer- Lambert law $KMnO_4/K_2Cr_2O_7$ and determine the concentration of the given solution of the substance.

Viva-Voce

Record

BACHELOR OF SCIENCE

Subject : Chemistry
Semester VI

Paper code	Paper Title	Type of paper	Contact Hours Per semester	Per week	Maximum marks	Minimum marks	ESE in hrs.	
							Theory	Practical
BCHE 601	Inorganic chemistry	Theory	30	2	50	20	3	-
BCHE 602	Organic chemistry	Theory	30	2	50	20	3	-
BCHE 603	Physical chemistry	Theory	30	2	50	20	3	-
BCHE 651	Chemistry Practicals	Lab work	60	4	75	30	-	4
				10				

The details of the courses with code and title assigned are given below.

ESE = End Semester Examination

SCHEME OF EXAMINATION

(Semester Scheme)

Examination scheme

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

Each theory paper syllabus is divided into four units. Each theory paper 3 hours duration

Each Practical /Lab work 4 hours duration

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

Note: Maximum marks for a paper is 50 marks which include 35 marks for ESE and 15marks for Internal assessment.

BACHELOR OF SCIENCE

Subject : Chemistry
Semester VI

Max.hrs: 3 hrs. **Max. marks : 35**

Part A- comprises of ten very short answer questions from all units.
(It's a compulsory question and attempt any seven) 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

PAPER I Inorganic Chemistry BCHE 601 **30 Hrs. (2hrs/week)**

Unit I

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.

Unit II

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

Unit III

Thermodynamic and kinetic aspects of metal complexes: Thermodynamic and kinetic stability, thermodynamic stability and factors affecting the stability, substitution reactions of square planar complexes, types of substitution reactions and trans effect.

Unit IV

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

BACHELOR OF SCIENCE

Subject : Chemistry
Semester VI

PAPER II Organic Chemistry BCHE 602 30 Hrs (2 hrs/week)

Unit I

Nuclear magnetic resonance(NMR) spectroscopy: 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, 1,1,2 tri bromo ethane, ethyl acetate, toluene and acetophenone.Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

Unit II

Carbohydrates: Classification and nomenclature, monosaccharides, mechanism of osazone formation, inter conversion of glucose and fructose, chain lengthing and chain shortening of aldose. Configuration of monosaccharide. erythro and threo 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. Structure of ribose and deoxy ribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

Unit III

Amino acids, peptides, proteins and nucleic acid: Classification, structure and stereochemistry of amino acids. Acid base behaviour of isoelectric point and electrophoresis. Preparation and reaction of α amino acid. Structure and nomenclature of peptides and proteins. Classification of proteins, peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptides synthesis, solid phase peptide synthesis. Structre of peptides and proteins, levels of protein structure. Protein denaturation / renaturation. **Nucleic acids;** introduction. Constituents of nucleic acid ribo and ribonucieosides , nucleotides. The double helical structure of DNA/RNA

Unit IV

Fats, oils and detergents: Natural fats edible and industrial oils of vegetable resin common fatty acids, glycerides, hydrogenation of unsaturated oils. saponification value, iodine value, acid value, soaps, synthetic detergents, alkyl and aryl sulphonates.

BACHELOR OF SCIENCE

Subject : Chemistry
Semester VI

PAPER III Physical Chemistry BCHE 603 30 Hrs (2 hrs/week)

Unit I

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)

Unit II

Spectroscopy I: Introduction: Electromagnetic radiation of the spectrum, basic features of different spectrometers, statement of the Born Oppenheimer approximation, degree of freedom.
Rotational spectrum: Diatomic molecules, Energy levels of rigid rotator, (semiclassical principles) selection rules, spectral intensity, distribution using population distribution (Maxwell Boltzmann distribution), determination of bond length, qualitative description of non rigid rotator, isotope effect.
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 III

Spectroscopy II: Vibrational spectrum: Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity., determination of force constant, qualitative relations of force constants and bond energy, effect of anharmonic motion and isotopes on the spectrum, idea of vibrational frequencies of different functional groups.
Raman spectrum: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

Unit IV

Quantum Mechanics II: Molecular orbital theory: Basic ideas criteria for forming M.O. from A.O. construction of M.O.`s by LCAO-H_2^+ ion, calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of σ, σ^* and π, π^* orbitals and their characteristics. Hybrid orbitals sp, sp^2, sp^3, calculation of coefficients of atomic orbitals used in these hybrid orbitals.

BACHELOR OF SCIENCE

Subject : Chemistry

Semester VI

BCHE 651 **Chemistry Practical** **60 hrs (4 hr/week)**

Practicals

Note: Total marks for each semester practicals is 75, which include 45 marks for ESE and 30 marks for internal assessment.

Duration 4 hours Max. Marks: 45

Experiment no. 1	Organic Chemistry	14 marks
Experiment no. 2	Physical Chemistry	16 marks
	Record	7 marks
	Viva	8 marks

Organic Chemistry

Qualitative analysis: Analysis of an organic mixture containing two solid components using water, $NaHCO_3$, and NaOH for separation and preparation of suitable derivatives.

Physical Chemistry

Electrochemistry

(a) To determine the strength of the given acid conductometrically using standard alkali solution
(b) To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically
(c) To study the saponification of ethyl acetate acetate conductometrically
(d) To determine the ionization constant of a weak acid conductrometrically
(e) To 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.

Refractometry,Polarimetry :

(a) To verify law of refraction of mixtures e.g. of glycerol and water using Abbe's refractometer.
(b) To determine the specific rotation of a given optically active compound.

Viva-Voce

Record

Suggested Books:

1. A New Concise Inorganic Chemistry; Fifth Edition; J.D. Lee; Blackwell Science, London, 1989.
2. Inorganic Chemistry; Third Edition; D.F. Shriver and P.W. Atkins; Oxford University Press, New York, 1999.
3. Inorganic Chemistry; Third Edition; Gary L. Miessler and Donald A. Tarr; Pearson Education Inc. Singapore, 2005.
4. Organic Chemistry; Seventh Edition; T.W. Graham Solomons & Craig B. Fryhle; John Wiley and Sons, 1998.
5. Organic Chemistry; Sixth Edition; Robert Thornton Morrison & Robert Neilson Boyd; PHI Pvt. Ltd, 2004.
6. Organic Chemistry Vol. I ; Fifth Edition; I.L. Finar; Longman Scientific and Technical, Singapore, 1975.
7. Organic Chemistry: Vol 1, Mukerjee and Singh
8. Organic Chemistry: Vol 2, Mukerjee and Singh
9. Organic Chemistry: Vol 3, Mukerjee and Singh
10. A Text Book of Physical Chemistry; A.S. Negi, S.C. Anand; New Age International (P) Limited, New Delhi, 2002.
11. The Elements of Physical Chemistry; P.W. Atkins; Oxford University Press, 1996.
12. University General Chemistry; C.N.R. Rao; Macmillan India Ltd., New Delhi, 1998.
13. Physical Chemistry: Puri Sharma and Pathania
14. Physical Chemistry: J. Moore