

**BSc- I YEAR- I SEMESTER
CHEMISTRY
2019-20**

CODE	DESCRIPTION	PD/W	PD/SEM	EXAM	CIA	ESE	TOTAL
BSCH111	INORGANIC CHEMISTRY-I	2	30	3 hrs.	20	80	100
BSCH112	ORGANIC CHEMISTRY-I	2	30	3 hrs.	20	80	100
BSCH121	LABORATORY COURSE-I**	4	60	3 hrs.	20	80	100
Grand Total							300

LABORATORY COURSE-I**

Division of Marks

A. Inorganic Chemistry	-	40 Marks
B. Organic Stereochemistry	-	20Marks
C. Viva voce	-	20Marks
Total	-	80 Marks

Marking Scheme

A. Inorganic Chemistry		
<u>Acid Radicals</u>		
Correct preliminary Test	-	3 x 2 = 06 Marks
Correct confirmatory Test	-	3 x 2 = 06 Marks
Correct formula of radical	-	2 x 2 = 04 Marks
Total	-	16 Marks
<u>Basic Radicals</u>		
Correct Group	-	4 x 2 = 08 Marks
Correct Separation procedure	-	4 x 2 = 08 Marks
Correct confirming Test	-	4 x 2 = 08 Marks
(With correct formula & Oxidation States.)		
Total	-	24 Marks
B. Stereochemistry		
2 Problems	-	10 x 2 = 20 Marks
Grand Total	-	80 Marks

Note:

Student can consult the book only for basic radicals after reporting the group detection for separation of a group radicals.

For consultation a book can be kept on the examiner's table.

BSCH111- INORGANIC CHEMISTRY-I		
Unit 1	<p>Atomic Structure. Concept of orbital, quantum numbers & their significance, radial and angular wave functions and probability distribution curves, shapes of s, p, and d orbitals. Pauli's exclusion principle, Hund's rule of maximum multiplicity, Aufbau principal & its limitations. Electronic configurations of the elements, effective nuclear charge & their calculation using Slater's rule.</p>	6 Hours
Unit 2	<p>Periodic Trends of Different Properties: Periodic trends of following properties with reference to s, p & d block elements Atomic and ionic radii: Covalent, metallic & Vander Waal's radii, determination of ionic radii using X-ray electron density maps, Lande's method, Pauling method Ionization enthalpy: Definition, successive ionization enthalpies, factors affecting their values and applications of ionization enthalpy. Electron Affinity: Definition, successive values of electron gain enthalpy, factors affecting their values and application of electron affinity. Electronegativity: Definition, Pauling's, Mulliken's, Allred Rachow's and Mulliken-Jaffe's electronegativity scale, method of determination and applications.</p>	6 Hours
Unit 3	<p>Ionic bonding Energetics of crystal formation: Lattice enthalpy, Experimental determination of Lattice Energy, Born-Haber cycle and its application, calculation of lattice enthalpies: Born-Lande's equation, Madelung Constant, Kapustinski equation, factors affecting lattice enthalpy and consequences of lattice enthalpies, thermal stability of ionic solids, stability of oxidation states and solubility of ionic compounds. Radius ratio: Radius ratio effect and coordination number, calculation of limiting radius ratio values for coordination number 4 & 6, limitation of radius ratio rule. Covalent character in ionic bond: Polarizing power and polarizability of ions, Fajan's rule and their application.</p>	6 Hours
Unit 4	<p>Weak Interactions & Metallic Bonding Hydrogen bonding: Types of hydrogen bond, symmetrical and unsymmetrical H bonding, H-bond energy and bond length, effects of Intermolecular and intramolecular H-bond on physicochemical properties, theories of hydrogen bonding: electrostatic, VBT & MOT and consequences of hydrogen bonding. Vander Waal forces of interaction: Attractive intermolecular forces: dipole-dipole, dipole induced dipole and instantaneous dipole induced dipole interactions, repulsive intermolecular forces of interactions. Interaction between ionic and covalent compounds: ion-dipole and ion-induced dipole interactions. Metallic bonding: Theories of metallic bond: classical free electron theory and metallic properties, valence bond theory and band theory and physical properties</p>	6 Hours
Unit 5	<p>s-Block Chemical properties: Diagonal relationship, solvation, complexation tendencies and Zintl Phase compounds. Industrial Applications: Sodium- Sulfur Battery, Lithium ion Battery and Cement: composition, manufacture and setting and hardening of cement. Biochemical role: Na-K pump, role of Ca and Mg. Fundamental Principles in Qualitative Inorganic Analysis: Common ion effect and its quantitative effect, Solubility Product: Basic concept, condition of Precipitation, fractional precipitation and solubility of precipitates: effect of acid, temperature and solvent.</p>	6 Hours

Suggested Readings:

- Principles of Inorganic Chemistry by B.R.Puri, L.R.Sharma and Kalia.
- Advanced Inorganic Chemistry, vol I, by Satyaprakash, G.D.Tuli, S.K.Basu and R.D.Madan.
- Selected Topics in Inorganic Chemistry by Wahid.U.Malik, G.D.Tuli, R.D.Madan.
- Fundamental concepts of Inorganic Chemistry, vol.I, by Asim.K.Das.
- Inorganic Chemistry, vol I by Ameta, Daga, Sharma and Mehta, Himanshu publication (Hindi)
- Inorganic Chemistry, vol I by Ojha, Chaturvedi, Ramesh book depot (Hindi & English)
- Inorganic Chemistry, vol I by Bhagchandani (Hindi)

BSCH112-ORGANIC CHEMISTRY-I		
Unit 1	Structure and Bonding Bond lengths , bond angles and bond energy: Localized and delocalized chemical bond, Resonance, Hyperconjugation, inductive and field effects, formal charge, polar covalent bond, curved arrow notations, drawing electron movement with arrows, half headed and double headed arrow, homolytic and heterolytic bond breaking.	6 Hours
Unit 2	Mechanism of Organic reactions Types of Reagents Electrophiles and nucleophiles, types of organic reactions: substitution, addition, elimination and rearrangement. Reactive intermediates: carbocations, carbanions, free radicals, carbenes, benzyne and nitrene. Methods of determination of reaction mechanism: Product analysis, intermediates, isotopic labeling, Stereochemical studies and kinetic studies.	6 Hours
Unit 3	Stereochemistry – I Concept of isomerism, types of isomerism, optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic centers, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereoisomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configurations, sequence rules, D & L, R & S systems of nomenclature.	6 Hours
Unit 4	Stereochemistry – II Nomenclature E and Z system, geometrical isomerism in alicyclic compounds and oximes, determination of configuration of geometrical isomers. Conformation: conformational analysis of ethane and n-butane. Conformations of cyclohexane and its monosubstituted methyl derivative, axial and equatorial bonds, Newman projection and Sawhorse formulae, Fischer and Flying wedge formulae and inter conversion of Projection formulae.	6 Hours
Unit 5	Alkanes, Cycloalkanes and alkyl halides Mechanism of free radical halogenation of alkanes, reactivity and selectivity. Cycloalkanes: Nomenclature, methods of preparations, chemical reactions. Baeyer's strain theory and its limitations, ring strain in cyclopropane and cyclobutane. Alkyl Halides: Methods of formation, chemical reactions, mechanism of nucleophilic substitution reaction of alkyl halides, S_N^2 and S_N^1 reactions, with energy profile diagrams. Polyhalogen compounds: chloroform, carbon tetrachloride.	6 Hours

Suggested Readings:

1. Organic chemistry Vol I by M. Mukherji, P. Singh and P. Kapoor, New age international (p) limited
2. Organic chemistry Vol I by M.K. Jain and S.C Sharma, Shobanlal & Coeducational publisher
3. Organic chemistry Vol I by Dr. Jagdamba Singh and L.D.S Yadav, Pragatiprakashan
4. Organic chemistry by Morrison & Boyd, Pearson
5. Organic chemistry Vol I by Singh, Pardasani and Pathak, Ramesh book depot (Hindi & English)
6. Organic chemistry Vol I by Ameta, Sharma, Punjabi and Sharma, Himanshu publication
7. Understanding organic chemistry by Brown, Foote, Iverson, Anslyn, Cengage learning
8. Organic chemistry Vol I by Bhagchandani

BSCH121-LABORATRY COURSE-I

A. INORGANIC CHEMISTRY

Qualitative Analysis

Qualitative estimation of the inorganic mixture for four radicals including interfering acid radicals, their combinations.

B. ORGANIC CHEMISTRY

Stereochemistry: study through models.

1. Conformational Analysis of ethane, n-butane and cyclohexane.
2. Geometrical isomerism and their E/Z nomenclature.
3. Optical isomerism and assigning R/S configuration.

**BSc- I YEAR- II SEMESTER
CHEMISTRY
2019-20**

CODE	DESCRIPTION	PD/W	PD/SEM	EXAM	CIA	ESE	TOTAL
BSCH1211	INORGANIC CHEMISTRY-II	2	30	3 hrs.	20	80	100
BSCH212	ORGANIC CHEMISTRY-II	2	30	3 hrs.	20	80	100
BSCH221	LABORATORY COURSE-II **	4	60	3 hrs.	20	80	100
Grand Total							300

LABORATORY COURSE-II**

Division of Marks

A. Organic Preparation	-	15 Marks
B. Lab Techniques TLC/Paper	-	10Marks
C. Physical Chemistry	-	35Marks
D. Viva voce	-	20Marks
Total	-	80 Marks

Marking Scheme

A. Organic Preparation		
Correct Reaction	-	3 Marks
Correct Mechanism	-	3 Marks
Procedure	-	5 Marks
Theoretical Yield calculation	-	2 Marks
Yield	-	2Marks
Total	-	15 Marks
B. Lab Techniques TLC/Paper	Correct Group	
Procedure	-	4 Marks
R _f Value	-	3Marks
TLC/Paper	-	3Marks
Total	-	10 Marks
C. Physical Chemistry: Surface Tension/Viscosity		
Correct Theory& Formula	-	15 Marks
Observation Table	-	07 Marks
Calculation	-	08 Marks
Result with Unit	-	05 Marks
Total	-	35 Marks

BSCH211- PHYSICAL CHEMISTRY-I		
Unit 1	<p>Gaseous State I Postulates of kinetic theory of gases, derivation of Kinetic gas equation, deduction of gaseous laws-Boyle's Law, Charle's law, Avogadro's law, Graham's law of diffusion, Dalton's law of partial pressure, kinetic Energy and temperature, deviations of real gases from ideal behavior, Vander Waals equation of state, discussion of Vander Waals equation, Virial equation of state.</p>	6 Hours
Unit 2	<p>Gaseous State II Critical phenomenon: PV isotherms of real gases, continuity of states, the isotherms of van der Waals equations, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of states. Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision numbers, mean free path and collision diameter.</p>	6 Hours
Unit 3	<p>Liquid State Characteristics of Liquid state: Vappour pressure and its methods of determination, Viscosity, measurement of viscosity, specific viscosity (Ostwald's viscometer and Stokes falling sphere method) and effect of temperature on viscosity, Surface tension, phenomenon of capillary action, measurement of surface tension (drop weight and drop number method) and effect of temperature. Liquid crystals: Difference between liquid crystal, solid and liquid. Classification and structure of nematic, smectic and cholesteric phases, swarm theory of liquid crystal.</p>	6 Hours
Unit 4	<p>Solid State Introduction and classification of solids, definition of space lattice, unit cell, laws of crystallography (i) law of constancy of interfacial angles, (ii) law of rational indices, (iii) law of symmetry. Symmetry elements in crystals. Weiss and Miller indices, lattice planes in cubic system, interplanar distances for cubic system. Density of cubic crystal. X-ray diffraction by crystals, derivation of Bragg's equation, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, KCl and CsCl</p>	6 Hours
Unit 5	<p>Colloidal State Hydrophobic colloidal system: Electrical properties- origin of charge, electrical double layer, DLVO theory of stability of hydrophobic colloid, coagulation of colloidal sols. Emulsion: definition, types: Macroemulsion, microemulsion, formation of emulsions, factors determining stability, inversion of emulsions, theories of emulsion. Gel: Preparation of gel, elastic & non elastic gel.</p>	6 Hours

Suggested Readings:

1. Physical Chemistry, G.M. Barrow, International Student Edition, McGrawHill.
2. Physical Chemistry, R.A. Alberty, Wiley Eastern Ltd.
3. The Elements of Physical Chemistry, P.W. Atkins, Oxford.
4. Physical Chemistry Through Problems, S.K. Dogra and S. Dogra, Wiley Eastern Ltd.
5. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and M.S. Pathania, Shobhan Lal Naginchand & Co.
6. Physical Chemistry, Bahadur Tuli, S. Chand & Co. (P) Ltd.
7. Physical Chemistry, Vol. I & II, S. Pahari, New Central Book Agency (P) Ltd.
8. Physical Chemistry, Vol. I, II & III, K.L. Kapoor, MacMillan
9. Physical Chemistry, S. Ameta, Himanshu Publication (Hindi)
10. Physical Chemistry, P.D. Sharma, Ramesh Book Depot
11. Physical Chemistry, Vol. I by Bhagchandani

BSCH212-ORGANIC CHEMISTRY-II		
Unit 1	<p>Alkenes Mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regio-selectivity in alcohol dehydration, the Saytzeff's rule, Hoffmann elimination, mechanisms involved in hydrogenation, hydroboration-oxidation, oxymercuration-reduction, epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO_4, Substitution at the allylic and vinylic positions of alkenes.</p>	6 Hours
Unit 2	<p>Dienes and Alkynes Dienes: Nomenclature and classification of dienes: isolated conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation. Chemical reactions-1,2 and 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 electrophilic and nucleophilic addition reactions and hydroboration-oxidation.</p>	6 Hours
Unit 3	<p>Arenes and Aromaticity Aromaticity : Huckel rule. Aromatic electrophilic substitution, general pattern of the mechanism, role of σ and π complexes, mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams, activating and deactivating substituent's, orientation and ortho/para ratio. Side chain reactions of benzene derivatives, nuclear and side chain reaction. Howarth synthesis of naphthalene, phenanthrene & anthracene and their chemical reactions, structure of naphthalene.</p>	6 Hours
Unit 4	<p>Alcohol Monohydric Alcohol: Classification and nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding, Acidic nature, Reactions of alcohols and distinction between 1°, 2° and 3° alcohol. Dihydric alcohol: Nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$\text{Pb}(\text{OAc})_4$] and HIO_4 and pinacol-pinacolone rearrangement. Trihydric alcohol: Nomenclature and methods of formation, chemical reactions of glycerol</p>	6 Hours
Unit 5	<p>Phenol Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohol and phenol, resonance stabilization of phenoxide ion. Reactions of phenols: Electrophilic aromatic substitution, acylation and carboxylation. Mechanism of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben Hoesch reaction, Lederer-Manasse reaction and Reimer Tiemann reaction.</p>	6 Hours

Suggested Readings:

1. Organic chemistry Vol I by M.Mukherji, P.singh and P.kapoor, New age international (p) limited
2. Organic chemistry Vol I by M.K Jain and S.C Sharma, Shobanlal & Co educational publisher
3. Organic chemistry Vol I by Dr.Jagdambasingh and L.D.S Yadav, Pragatiprakash
4. Organic chemistry by Morrison & Boyd, Pearson
5. Organic chemistry Vol I by Singh, Pardasani and Pathak, Ramesh book depot (Hindi & English)
6. Organic chemistry Vol I by Ameta, Sharma, Punjabi and Sharma, Himanshu publication
7. Understanding organic chemistry by Brown, Foote, Iverson, Anslyn, Cengage learning
8. Organic chemistry Vol I by Bhagchandani

BSCH221- LABORATORY COURSE-II

A. Organic Chemistry

1. Organic preparations: (Study of Mechanism of the reaction used in preparation, calculation of theoretical yield and melting point of the compound prepared)

- a. Iodoform from ethanol and acetone
- b. m-dinitrobenzene
- c. Methyl orange
- d. Picric acid

2. Laboratory Techniques:

- a. TLC/paper chromatography- separation of dyes.
- b. Determination of MP and BP of given organic compound.

B. Physical Chemistry

1. Surface Tension :

- a. To determine the surface tension of given liquid by stalagmometer.
(Acetone, Ethyl alcohol, Ethyl acetate).
- b. To determine the composition of a binary mixture by measurement of surface tension.

2. Viscosity:

- a. To determine the viscosity of the given organic liquid by Ostwald viscometer
(Acetone, Ethyl alcohol, Ethyl acetate).
- b. To determine the composition of a binary mixture by Viscosity measurement.
- c. To determine the viscosity and viscosity index of given lubricating oil using Redwood viscometer.

3. Study of the unit cells and crystal structure through models.

NaCl, KCl, CsCl, Na₂O, ZnS, CaF₂

Types of unit cell, coordination no, nature of voids, radius ratio and basic calculations involving the radius of ions and unit cell dimensions.

**BSc- II YEAR- III SEMESTER
CHEMISTRY
2020-21**

CODE	DESCRIPTION	PD/W	PD/SEM	EXAM	CIA	ESE	TOTAL
BSCH311	INORGANIC CHEMISTRY-II	2	30	3 hrs.	20	80	100
BSCH312	PHYSICAL CHEMISTRY-II	2	30	3 hrs.	20	80	100
BSCH321	LABORATORY COURSE-III **	4	60	3 hrs.	20	80	100
Grand Total							300

LABORATORY COURSE-III**

Division of Marks

A. Inorganic Chemistry	-	30 Marks
B. Physical Chemistry	-	30Marks
C. Viva voce	-	20Marks
Total	-	80 Marks

Marking Scheme

A. Inorganic Chemistry: Volumetric Analysis		
Theory	-	10 Marks
Observation Table	-	5 Marks
Calculation	-	8 Marks
Result with proper Unit	-	7 Marks
Total	-	30 Marks
B. Physical Chemistry: Chemical kinetics/ Distribution Law		
Theory	-	10 Marks
Observation Table	-	5 Marks
Calculation	-	8 Marks
Result with proper Unit	-	7 Marks
Total	-	30 Marks

BSCH311: INORGANIC CHEMISTRY-II		
Unit 1	<p>Covalent Bonding Definition, factors favouring formation of covalent bond, covalency and maximum covalency, Lewis dot structure.</p> <p>Valence shell electron pair repulsion (VSEPR) theory and shapes of simple molecules and ions containing lone pair and bonded pair of electrons.</p> <p>Valence Bond Theory: Heitler and London theory for H₂ molecule, Pauling and Slater – overlapping of orbitals, σ, π and δ bond approach.</p> <p>Hybridisation: Determination, rules and types of hybridization, equivalent & non-equivalent hybrid orbitals.</p>	6 Hours
Unit 2	<p>MO Theory LCAO approach, bonding and antibonding molecular orbitals, molecular orbital diagram of homodiatomic & heterodiatomic molecules N₂, O₂, C₂, B₂, F₂, CO, NO, HF & ICl and their ions (idea of s-p mixing and orbital interactions to be given).</p> <p>Dipole moment comparison of the dipole moment of common molecules, applications of dipole moment.</p> <p>Percentage ionic character in covalent bond: calculation by using electronegativity & dipole moment concept</p>	6 Hours
Unit 3	<p>Volumetric analysis Basic terminology: Titrant, titrand, equivalence point, end point of titration, back titration, basic requirement which must be fulfilled by reaction to be used in titration, classification of reaction used in titration, standard solutions: primary and secondary standards, use of equivalent concept in common acid-base, redox and iodometric titrations.</p> <p>Neutralisation Titrations: Basic theory of acid-base indicator, mixed and universal indicators, neutralization curves: SA-SB, SA-WB, WA-SB, WA-WB, neutralization of polyprotic acid by strong base and choice of indicators.</p> <p>Precipitation Titrations (Argentometric): Basic theory and titration curve and indicators used: coloured precipitate, coloured soluble compound and adsorption indicators.</p>	6 Hours
Unit 4	<p>p-block elements-I (13th, 14th, 15th GROUP) Electronic configuration, relative stability of different oxidation states, inert pair effect and anomalous behaviour of first member of each group.</p> <p>Diborane and Borazine: Preparation, structure and bonding and properties.</p> <p>Fullerene and Silicones: Preparation, properties and uses, types of silicates.</p> <p>Oxides and Oxyacids of N & P: structure and relative acidic and basic nature.</p> <p>Phosphazines: structure of hexachlorotriphosphazine and octachlorotetraphosphazine and inorganic rubber.</p> <p>Fertilizers: Nitrogenous Fertilizer: (NH₄)₂SO₄, CAN & urea; Phosphatic Fertilizer: Ca(H₂PO₄)₂ & phosphatic slag and mixed fertilizer.</p>	6 Hours
Unit 5	<p>p-block elements-II (16th, 17th & 18th GROUP) Oxides & oxoacids of group 16 & 17 elements: Structural features and relative acidic strength.</p> <p>Manufacture of sulfuric acid, preparation and properties of Caro's and Marshall's acid.</p> <p>Interhalogen compounds: Preparation, structure and properties (ICl, ICl₃, ICl₅, ICl₇)</p> <p>Discovery of Nobel gases and isolation from atmosphere, preparation, properties and geometries of XeF₂, XeF₄, XeF₆, XeOF₄, XeO₂F₂, clathrates formed by Nobel gases.</p>	6 Hours

Suggested Readings:

1. Principles of Inorganic Chemistry by B.R.Puri, L.R.Sharma and Kalia.
2. Advanced Inorganic Chemistry, vol I, by Satyaprakash, G.D.Tuli, S.K.Basu and R.D.Madan.
3. Selected Topics in Inorganic Chemistry by Wahid.U.Malik, G.D.Tuli, R.D.Madan.
4. Fundamental concepts of Inorganic Chemistry, vol.I, by Asim.K.Das.
5. Inorganic Chemistry, vol I by Ameta, Daga, Sharma and Mehta, Himanshu publication (Hindi)
6. Inorganic Chemistry, vol I by Ojha, Chaturvedi, Ramesh book depot (Hindi & English)

BSCH312: PHYSICAL CHEMISTRY-II		
Unit 1	Chemical Kinetics-I Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction: concentration, temperature, pressure, solvent, light, catalyst & concentration dependence of rates, mathematical characteristics of simple chemical reactions- zero order, first order & second order, half-life and mean life. Determination of the order of reaction: differential method, method of integration, method of half-life period and isolation method, kinetics of complex reactions: reversible, consecutive and parallel reactions.	6 Hours
Unit 2	Chemical Kinetics-II Experimental methods of chemical kinetics: Conductometric, potentiometric, optical methods, polarimetry and spectrophotometry. Theories of chemical kinetics: effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model & transition state theory (Thermodynamic formulation)	6 Hours
Unit 3	Phase Equilibrium-I Statement and meaning of the terms - phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system - water, CO ₂ and sulphur system. Phase equilibria of two component system: Solid -liquid equilibria, simple eutectic -Bi-Cd, Pb-Ag systems, desilverisation of lead.	6 Hours
Unit 4	Phase Equilibrium-II Solid solutions: Compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl- H ₂ O), (FeCl ₃ -H ₂ O) and CuSO ₄ -H ₂ O system. Freezing mixtures, acetone-dry Ice. Nernst distribution law: (i) distributing substance associated in one phase (ii) distributing substance dissociate in one phase (iii) solute combines with one of the solvent, Application of distribution law- solvent extraction.	6 Hours
Unit 5	Liquid-Liquid Mixtures Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system azeotropes: HCl, H ₂ O and ethanol - water systems. Partially miscible liquids -Phenol-water, trimethylamine-water, nicotine-water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature. Immiscible liquids, steam distillation.	6 Hours

Suggested Readings:

1. Physical Chemistry, G.M. Barrow, International Student Edition, McGrawHill.
2. Physical Chemistry, R.A. Alberty, Wiley Eastern Ltd.
3. The Elements of Physical Chemistry, P.W. Atkins, Oxford.
4. Physical Chemistry Through Problems, S.K. Dogra and S. Dogra, Wiley Eastern Ltd.
5. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and M.S. Pathania, Shobhan Lal Nagin Chand & Co.
6. Physical Chemistry, Bahadur Tuli, S. Chand & Co. (P) Ltd.
7. Physical Chemistry, Vol. I & II, S. Pahari, New Central Book Agency (P) Ltd.
8. Physical Chemistry, Vol. I, II & III, K.L. Kapoor, MacMillan
9. Physical Chemistry, S. Ameta, Himanshu Publication (Hindi)
10. Physical Chemistry, P.D. Sharma, Ramesh Book Depot

BSCH321: LABORATORY COURSE-III

1. INORGANIC CHEMISTRY

a. Volumetric Analysis

I. Preparation of standard solutions and dilution of solutions

II. Acid Base titrations

- i.** Determine the strength of given Sodium hydroxide solution, prepare your own standard oxalic acid solution for titration.
- ii.** Estimate the amount of sodium carbonate and sodium bicarbonate present in the given sample, you have been provided standardized 0.1N HCl.
- iii.** Estimate the amount of sodium hydroxide and sodium carbonate present in the given sample, you have been provided standardized 0.1N HCl.

III. Redox titration

- i.** Estimation of cupric sulphate iodometrically.

IV. To estimate the strength of oxalic acid and sodium oxalate in the mixture of two, you have been provided with 0.05N NaOH and 0.1N KMnO_4 solution.

2. Physical Chemistry: Chemical Kinetics

- a.** To determine the order of acid hydrolysis of ester and its rate constant using integrated rate law method and graphical method.
- b.** Determine the rate constant and order of base hydrolysis of ester.
- c.** To study the kinetics of acetone iodine reaction and determine the order with respect to iodine.

**BSc- II YEAR- IV SEMESTER
CHEMISTRY
2020-21**

CODE	DESCRIPTION	PD/W	PD/SEM	EXAM	CIA	ESE	TOTAL
BSCH411	INORGANIC CHEMISTRY-III	2	30	3 hrs.	20	80	100
BSCH412	ORGANIC CHEMISTRY-III	2	30	3 hrs.	20	80	100
BSCH421	LABORATORY COURSE-IV**	4	60	3 hrs.	20	80	100
Grand Total							300

LABORATORY COURSE-IV**

Division of Marks

A. Inorganic Chemistry	-	20 Marks
B. Organic Chemistry	-	40 Marks
C. Viva voce	-	20 Marks
Total	-	80 Marks

Marking Scheme

A. Inorganic Chemistry: Gravimetric Estimation		
Theory with proper reaction	-	5 Marks
Correct procedure & observation	-	5 Marks
Calculation with correct conversion factor-	5 Marks	
Result with proper Unit	-	5 Marks
Total	-	20 Marks
B. Organic Chemistry: Organic Compound (Solid/Liquid)		
Ignition Test	-	2x2= 4 Marks
Unsaturation Test with reaction	-	2x3= 6 Marks
Element detection with proper list & reaction- Functional Group		2x5= 10 Marks
(a) Preliminary	-	2x2= 4 Marks
(b) Confirmatory	-	2x3= 6 Marks
Melting/ Boiling Point	-	2x2= 4 Marks
Confirmatory test of compound	-	2x3= 6 Marks
Total	-	40 Marks

Note:

Student can consult the book for the specific test of the compounds after reporting all initial tests up to functional group and Melting/ Boiling point of the compounds.

BSCH411: INORGANIC CHEMISTRY-III		
Unit 1	<p>Quantitative analysis and errors in analysis Gravimetric Analysis: Precipitation methods, condition of precipitation, purity of precipitate: Co-precipitation and post-precipitation, precipitation from homogeneous solutions, washing and ignition of precipitate. Errors in chemical analysis: Limitations of analytical methods, classification of errors, accuracy and precision and Minimization of errors. Calculation of absolute and relative error and Standard Deviation.</p>	6 Hours
Unit 2	<p>Chemistry of Transition Metals Electronic configuration and variable oxidation states of 3d, 4d and 5d series elements. Spectral properties, catalytic properties and complex formation tendency in 3d series elements, magnetic properties: types of magnetic behaviours, magnetic moment: spin only formula, magnetic susceptibility and method of determination of magnetic susceptibility (Gouy's and Faraday's method).</p>	6 Hours
Unit 3	<p>Bio Chemical Applications of Iron: Haemoglobin and Myoglobin Chemistry of Inner-Transition Metals Lanthanides: Electronic structure, oxidation state, atomic and ionic radii, lanthanide contraction and its consequences, colors or spectral and magnetic properties. Actinides: General characteristics, comparative treatment with lanthanides with respect to ionic radii, oxidation states, magnetic behavior and spectral properties.</p>	6 Hours
Unit 4	<p>Chemistry of Redox Reaction Oxidation and Reduction, Electrode potential. Application of electrochemical series: oxidising and reducing property of substances in aqueous solution, reactivity of metals & non-metals, spontaneity of redox reactions & disproportionation reaction. Diagrammatic representation of potential data: Latimer, Frost & Ellingham diagrams and their use in extraction of metals.</p>	6 Hours
Unit 5	<p>Concepts of Acids and Bases Arrhenius, Bronsted-Lowry: Levelling and Differentiating effect of solvent, Lewis and Usanovich concept. Non aqueous solvents: Physical properties of solvent, types of solvents and their general characteristics. Reactions in non-aqueous solvents with reference to liquid NH₃ and SO₂.</p>	6 Hours

Suggested Readings:

1. Principles of Inorganic Chemistry by B.R.Puri, L.R.Sharma and Kalia.
2. Advanced Inorganic Chemistry, vol I, by Satyaprakash, G.D.Tuli, S.K.Basu and R.D.Madan.
3. Selected Topics in Inorganic Chemistry by Wahid.U.Malik, G.D.Tuli, R.D.Madan.
4. Fundamental concepts of Inorganic Chemistry, vol.I, by Asim.K.Das.
5. Inorganic Chemistry, vol II by Ameta, Daga, Sharma and Mehta. , Himanshu publication (Hindi)
6. Inorganic Chemistry, vol II by Ojha ,Chaturvedi, Ramesh book depot (Hindi & English)

BSCH412: ORGANIC CHEMISTRY- III		
Unit 1	<p>Spectroscopy I Ultraviolet (UV) absorption spectroscopy: Absorption laws: (Lambert's law, Beer's law & LambertBeer's law), types of electronic transitions, effect of conjugation, Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. Infrared (IR) absorption spectroscopy: Basic Principle, Hooke's law, Number of fundamental bands in polyatomic linear and non-linear molecules, overtone and Fermi resonance, Factors affecting position of IR bands and fingerprint region.</p>	6 Hours
Unit 2	<p>Spectroscopy II NMR: Proton Magnetic Resonance Spectroscopy Theory, Nuclear shielding and deshielding, chemical shift, spin spin coupling, coupling constant, area of signals. Interpretation of PMR spectra of ethyl bromide, acetaldehyde, 1,1,2- tribromoethane, ethylacetate, toluene, acetophenone and simple organic compounds.</p>	6 Hours
Unit 3	<p>Chemistry of Carbonyl Compounds-I Structure and bonding. 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 and synthesis of ketones from nitriles and from carboxylic acids. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, Aldol, Perkin, Cannizzaro reaction, Knoevenagel condensations, condensation with ammonia and its derivatives.</p>	6 Hours
Unit 4	<p>Chemistry of Carbonyl Compounds-II Baeyer-Villiger oxidation of ketones. MPV, Clemmensen, Wolff-Kishner, LiAlH₄ and NaBH₄ reduction. Chemistry of Carboxylic acids 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-Zelinsky reaction. Reduction of carboxylic acids, decarboxylation, esterification and hydrolysis of esters (acidic and basic).</p>	6 Hours
Unit 5	<p>Reactive Methylene Compounds Preparation and Synthetic applications of malonic ester and acetoacetic ester. Fat, Oils, Detergent Common fatty acids, hydrogenation of unsaturated oils, saponification value, iodine value, cleaning action of soaps and detergents.</p>	6 Hours

Suggested Readings:

1. Organic Spectroscopy, YR Sharma, S Chand Publication.
2. Organic Chemistry, Solomon and Fryhle, Wiley
3. Organic Chemistry, Louden, Roberts and Company Publishers.
4. Organic chemistry, M.Mukherji, P. Singh and P. Kapoor, New age international (p) limited
5. Organic chemistry Vol II & III by M.K Jain and S.C Sharma, Shobanlal & Co educational publisher
6. Organic chemistry Vol II & III, Dr.Jagdamba Singh and L.D.S Yadav, Pragatiprakashan
7. Organic chemistry by Morrison & Boyd, Pearson
8. Organic chemistry Vol II& III by Singh, Pardasani and Pathak, Ramesh book depot (Hindi & English)
9. Organic chemistry Vol II& III by Ameta, Sharma, Punjabi and Sharma, Himanshu publication
10. Understanding Organic Chemistry by Brown, Foote, Iverson & Anslyn, Cenage learning

BSCH421: LABORATORY COURSE-IV

A. Inorganic chemistry: Gravimetric estimation

- i. Barium as barium sulphate.
- ii. Copper as copper oxide

B. Organic Chemistry: Complete identifications of organic compounds including element detection, melting/boiling point and functional group. **(Two compounds may be given).**

C. Distribution Law: To determine the distribution coefficient of benzoic between benzene and water and hence show that benzoic acid dimerises in benzene.

**BSc- III YEAR- V SEMESTER
CHEMISTRY
2021-22**

CODE	DESCRIPTION	PD/W	PD/SEM	EXAM	CIA	ESE	TOTAL
BSCH511	ORGANIC CHEMISTRY-IV	2	30	3 hrs.	20	80	100
BSCH512	PHYSICAL CHEMISTRY-III	2	30	3 hrs.	20	80	100
BSCH521	LABORATORY COURSE-V **	4	60	5 hrs.	20	80	100
Grand Total							300

LABORATORY COURSE-V**

Division of Marks

A. Physical Chemistry	-	15 Marks
B. Organic Chemistry	-	45 Marks
C. Viva voce	-	20 Marks
Total	-	80 Marks

Marking Scheme

A. Physical Chemistry		
Theory	-	5 Marks
Observation	-	5 Marks
Result	-	5 Marks
Total	-	15 Marks
B. Organic Chemistry		
Separation	-	5 Marks
Ignition Test	-	4 Marks
Unsaturation Test with reaction	-	6 Marks
Element detection with proper list & reaction- Functional Group		10 Marks
(a) Preliminary	-	4 Marks
(b) Confirmatory	-	6 Marks
Melting/ Boiling Point	-	4 Marks
Confirmatory test of compound	-	6 Marks
Total	-	45 Marks

Note:

Student can consult the book for the specific test of the compounds after reporting all initial tests up to functional group and Melting/ Boiling point of the compounds.

BSCH511: ORGANIC CHEMISTRY-IV		
Unit 1	<p>Heterocyclic Compounds Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Method of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reaction in pyridine. Basicity and acidity of nitrogen heterocycles.</p>	6 Hours
Unit 2	<p>Condensed heterocycles: Preparation of Indole: Fischer indole synthesis and its chemical reactions. Chemistry of Carbohydrates Configuration of monosaccharides, Cyclic structure D glucose. Mechanism of mutarotation. Mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldose. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharide : Starch and cellulose without involving structure determination.</p>	6 Hours
Unit 3	<p>Chemistry Of Nitrogen Containing Compounds Preparation of nitroalkanes and nitroarenes, Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline medium.. Picric acid. Stereochemistry of amines. Structural features affecting basic nature of amines Gabriel – phthalimide reaction. Hoffmann bromamide reaction. Reaction of amines (alkylation, reaction with acid chlorides, nitrous acid, phenyl isocyanate). Synthetic transformations of aryl diazonium salts, azocoupling. Amine salts as phase – transfer catalysts.</p>	6 Hours
Unit 4	<p>Ethers and Epoxides, Organomagnesium and Organosulfur Compounds: Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions-cleavage and autoxidation, Ziesel's method for methoxy group estimation. Synthesis of epoxides, acid and base-catalyzed ring opening of epoxide. Organosulfur compounds: Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers. Grignard reagent: Preparation and reactions.</p>	6 Hours
Unit 5	<p>Chemistry of Biomolecule: Amino Acids and Peptides Classification, structure and stereochemistry of amino acids, acid-base behavior, isoelectric point. Preparation and reactions of amino acids. Structure and nomenclature of peptides. Group Determination of peptide structure (hydrolysis, sequential degradation and specific cleavage). Classical and solid phase peptide synthesis. Electrophoresis.</p>	6 Hours

Suggested Readings:

1. Organic Chemistry, Solomon and Fryhle, Wiley.
2. Organic Chemistry, Louden, Roberts and Company Publishers.
3. Organic Chemistry VOL. II, IL Finar, Pearson.
4. Organic chemistry, M. Mukherji, P. Singh and P. Kapoor, New age international (p) limited.
5. Organic chemistry Vol II & III by M.K Jain and S.C Sharma, Shobanlal & Co educational publisher.
6. Organic chemistry Vol II & III, Dr. Jagdamba Singh and L.D.S Yadav, Pragati prakashan.
7. Organic chemistry by Morrison & Boyd, Pearson.
8. Organic chemistry Vol II & III by Singh, Pardasani and Pathak, Ramesh book depot (Hindi & English).
9. Organic chemistry Vol II & III by Ameta, Sharma, Punjabi and Sharma, Himanshu publication.
10. Understanding Organic Chemistry by Brown, Foote, Iverson & Anslyn, Cenage learning.

BSCH512: PHYSICAL CHEMISTRY-III		
Unit 1	<p>Thermodynamics -I Definition of some basic thermodynamic terms, State functions First Law of Thermodynamics: Statement, definition of internal energy and enthalpy. Heat capacity: heat capacities at constant volume, constant pressure and their relationship. Joule's law, Joule Thomson effect and coefficient for ideal and real gases and inversion temperature. Calculation of W, q, dU and dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. Kirchoff's equation.</p>	6 Hours
Unit 2	<p>Thermodynamics-II Second Law of Thermodynamics: need of the second law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Concept of entropy: Entropy as a state function, entropy as a function of V&T, entropy as a function of pressure & 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</p>	6 Hours
Unit 3	<p>Thermodynamics-III Criteria for reversible and irreversible process, Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, Gibbs-Helmholtz equation, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of Gibbs free energy with P, V and T. Chemical Equilibrium: Equilibrium constant and free energy. Reaction isotherm and reaction isochore, Clapeyron equation, Clausius-Clapeyron equation and its applications. Third Law of thermodynamics: Nernst heat theorem, statement and evaluation of absolute entropy from heat capacity data.</p>	6 Hours
Unit 4	<p>Electrochemistry –I Electrical transport: Conduction in metals and in electrolyte solutions, Faradays law of electrolysis, specific conductance and equivalent conductance, Ionic strength, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlraushs law, 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, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.</p>	6 Hours
Unit 5	<p>Electrochemistry-II Electrolytic and Galvanic cells, conventional representation of electrochemical cells, reversible and irreversible cells, types of reversible electrodes: gas metal ion, metal-metal ion, metal-insoluble salt-anion (reference electrode) and redox electrodes. Nernst equation: single electrode potential electrochemical series and its significance. Measurement of EMF of cell and calculation of E_{cell}, ΔG, ΔH and ΔS. Definition of pH, determination of pH using hydrogen, quinhydrone and glass electrode, potentiometric titration, Concentration cell and their types: electrode concentration cell and electrolytic concentration cell (with and without transference).</p>	6 Hours

Suggested Readings:

1. Physical Chemistry, G.M. Barrow, International Student Edition, McGrawHill.
2. Physical Chemistry, R.A. Alberty, Wiley Eastern Ltd.
3. The Elements of Physical Chemistry, P.W. Atkins, Oxford.
4. Physical Chemistry Through Problems, S.K. Dogra and S. Dogra, Wiley Eastern Ltd.
5. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and M.S. Pathania, Shobhan Lal Nagin chand & Co.
6. Physical Chemistry, Bahadur Tuli, S. Chand & Co. (P) Ltd.
7. Physical Chemistry, Vol. I & II, S. Pahari, New Central Book Agency (P) Ltd.
8. Physical Chemistry, Vol. I, II & III, K.L. Kapoor, MacMillan.
9. Physical Chemistry, S. Ameta, Himanshu Publication (Hindi).
10. Physical Chemistry, P.D. Sharma, Ramesh Book Depot.

BSCH521: LABORATORY COURSE-V

A. PHYSICAL CHEMISTRY

a. pH metry

- i.** To measure the pH of the given solution using pH meter.
- ii.** Determine the strength of given strong/weak acid by titrating it against the strong base pH metrically.

b. Conductometry

- i.** To determine the specific conductivity, molar and equivalent conductivity of the given solution.
- ii.** Determine the strength of given strong/weak acid by titrating it against the strong base conductometrically.

B. ORGANIC CHEMISTRY

Systematic analysis of two components Organic Mixture using water, sodium bicarbonate and NaOH.

**BSc- III YEAR- VI SEMESTER
CHEMISTRY
2021-22**

CODE	DESCRIPTION	PD/W	PD/SEM	EXAM	CIA	ESE	TOTAL
BSCH611	INORGANIC CHEMISTRY-IV	2	30	3 hrs.	20	80	100
BSCH612	PHYSICAL CHEMISTRY-IV	2	30	3 hrs.	20	80	100
BSCH621	LABORATORY COURSE-VI **	4	60	5 hrs.	20	80	100
Grand Total							300

LABORATORY COURSE-VI**

Division of Marks

A. Inorganic Chemistry	-	15+30= 45 Marks
B. Physical Chemistry	-	15 Marks
C. Viva voce	-	20 Marks
Total	-	80 Marks

Marking Scheme

A. Inorganic Chemistry

Preparation

Correct reaction & Theory	-	5 Marks
Procedure	-	5 Marks
Total Theoretical yield	-	3 Marks
Result	-	2 Marks
Total	-	15 Marks

Water & Soil Analysis

Theory	-	10 Marks
Observation Table	-	5 Marks
Calculation Table	-	10 Marks
Result	-	5 Marks
Total	-	30 Marks

B. Physical Chemistry

Theory	-	5 Marks
Observation Table	-	2 Marks
Graph & Calculation	-	3 Marks
Result	-	5 Marks
Total	-	15 Marks

BSCH611: INORGANIC CHEMISTRY-IV		
Unit 1	Coordination Chemistry Werner's coordination theory and its experimental verification, different types of ligands including chelates and pi acceptor ligands, nomenclature and formulation of coordination compounds, effective atomic number, stereoisomerism in complexes of coordination number 4 and 6.	6 Hours
Unit 2	Metal Ligand Bonding in Complexes Valence bond theory of complexes and its limitation, Crystal field theory, Crystal field splitting of energy levels in octahedral, tetrahedral and square planer complexes, crystal-field stabilization energy of octahedral complexes (Calculation Only). Application of crystal field theory and Jahn Teller effect.	6 Hours
Unit 3	Stability of Transition Metal Complexes A brief outline of thermodynamic stability of metal complexes and factors affecting the stability. Kinetic stability, labile and inert complexes, experimental determination of stability constant and composition of complex (Job's Method and Bjerrum's Method).	6 Hours
Unit 4	Electronic Spectra of Transition Metal Complexes: LS coupling and determination of spectroscopic ground states, selection rules for d-d transitions, Orgel-energy level diagrams for weak ligand field and explanation of number of peaks in spectrum (qualitative aspect only). Hard and Soft Acid & Bases Concept (HSAB) Classification of acid and base as hard and soft, Pearson's HSAB concept and its applications. Symbiosis and limitation of HSAB principle.	6 Hours
Unit 5	Complexometric Titrations: Titration curve, types of EDTA titrations, titration of mixtures: masking and demasking agents, metal ion indicators: general properties and its theory. Organometallic Chemistry Definition, nomenclature and classification of organometallic compounds, bonding, preparation, properties and application of organometallic compounds of Li, Al and Sn (alkyls and aryl). 18 electron rule and its limitations.	6 Hours

Suggested Readings:

1. Principles of Inorganic Chemistry by B.R.Puri, L.R.Sharma and Kalia.
2. Advanced Inorganic Chemistry, vol II, by Satyaprakash, G.D.Tuli, S.K.Basu and R.D.Madan.
3. Selected Topics in Inorganic Chemistry by Wahid.U.Malik, G.D.Tuli, R.D.Madan.
4. Fundamental concepts of Inorganic Chemistry, vol.I, by Asim.K.Das.
5. Inorganic Chemistry, vol III by Ameta, Daga, Sharma and Mehta. , Himanshu publication (Hindi)
6. Inorganic Chemistry, vol III by Ojha ,Chaturvedi, Ramesh book depot (Hindi & English)

BSCH612: PHYSICAL CHEMISTRY-IV		
Unit 1	Quantum Mechanics Black-body radiation, Planck's radiation law, photoelectric effect, Bohr's model of hydrogen atom and its defects. Compton Effect. De Broglie hypothesis, Heisenberg's uncertainty principle. Operators, Schrodinger wave equation and its physical interpretation of the wave function, postulates of quantum mechanics. Particle in a one dimensional box & its importance.	6 Hours
Unit 2	Spectroscopy-I Introduction: Electromagnetic radiation, regions of the spectrum, principle and basic features of different spectrometers, Born-Oppenheimer approximation and degrees of freedom. Rotational Spectrum: Diatomic molecules. Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum.	6 Hours
Unit 3	Spectroscopy-III Raman spectrum: Concept of polarizability, pure rotational and pure vibrational Raman spectra of Diatomic molecules and selection rules, raman rotational vibrational spectra. Electronic Spectrum: Concept of potential energy curves for bonding and antibonding molecular orbitals. Qualitative description of selection rules and Frank-Condon principle. Qualitative description of an σ , π and n MO, their energy levels and the respective transitions.	6 Hours
Unit 4	Photochemistry Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry : Grothus-Draper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, radiative processes (internal conversion, intersystem crossing), quantum yield and their methods of determination by using chemical actinometer, photosensitized reactions-energy transfer processes (simple examples).	6 Hours
Unit 5	Physical Properties and Molecular Structure Optical activity, polarization - (Clausius-Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment. Measurement of dipole moment-temperature and refractivity method, dipole moment and structure of molecules, magnetic properties-paramagnetism, diamagnetism and ferromagnetics.	6 Hours

Suggested Readings:

1. Physical Chemistry, G.M. Barrow, International Student Edition, McGrawHill.
2. Physical Chemistry, R.A. Alberty, Wiley Eastern Ltd.
3. The Elements of Physical Chemistry, P.W. Atkins, Oxford.
4. Physical Chemistry Through problems, S.K. Dogra and S. Dogra, Wiley Eastern Ltd.
5. Principles of Physical chemistry, B.R. Puri, L.R. Sharma and M.S. Pathania, Shobhan Lal Nagin chand & Co.
6. Physical Chemistry, Bahland Tuli, S. Chand & Co. (P) Ltd.
7. Physical Chemistry, Vol. I & II, S. Pahari, New Central Book Agency (P) Ltd.
8. Physical Chemistry, Vol. I, II & III, KL Kapoor, MacMillan
9. Physical Chemistry, S. Ameta, Himanshu Publication (Hindi)
10. Physical Chemistry, PD Sharma, Ramesh Book Depot

BSCH621: LABORATORY COURSE-VI

A. Inorganic

i. Inorganic preparations

- i. Ammonium Ferrous Sulphate.
- ii. Potash alum (Aluminiumpotassium sulphate).
- iii. Microcosmic salt.
- iv. Tetraamminecopper(II) sulphate.
- v. Hexathiourealead(II) nitrate.
- vi. Sodium trioxalato ferrate(III).

B. Soil & Chalk Analysis

- i. Determine the available carbon in the given soil sample.
- ii. Estimation of calcium in chalk by permanganometric titration.

C. Complexometric titrations:

- i. Determine the permanent, temporary and total hardness of the given water sample.
- ii. Estimation of nickel using EDTA by back titration method.

D. Physical

- i. To verify the Lambert-Beer's law and determine the concentration of given solution (CuSO_4 , KMnO_4 & NiSO_4).
- ii. Jobs method for composition of Fe(III) and SCN^- complex.