Bachelor of Science

Chemistry

Syllabus

Faculty of Science

MAULANA AZAD UNIVERSITY, JODHPUR

B.Sc. Semester-I

Schemes for Internal Assessments and End Semester Examinations Semester-wise

Course	Subject	Code	Paper	CIA-I	CIA-II	ESE	Total
ELECTIVE COURSES	**Botany**	BSBO 111	Algae, Lichens and Bryophytes	10	10	80	100
		BSBO 112	Mycology, Microbiology and Phytopathology	10	10	80	100
		BSBO 121	**Botany Lab-I**	10	10	80	100
	Chemistry	BSCH 111	Inorganic Chemistry-I	10	10	80	100
		BSCH 112	Organic Chemistry-I	10	10	80	100
		BSCH 121	**Laboratory Course-I**	10	10	80	100
	Mathematics	BSMT 111	Algebra	10	10	80	100
		BSMT 112	Differential Calculus	10	10	80	100
		BSMT 113	Co-Ordinate Geometry in 2-Dimensions and 3-Dimensions	10	10	80	100
	Physics	BSPH 111	Mechanics	10	10	80	100
		BSPH 112	Electromagnetics	10	10	80	100
		BSPH 121	**Physics Lab-I**	10	10	80	100
	Zoology	BSZO 111	Taxonomy of Lower Non Chordate	10	10	80	100
		BSZO 112	Cytology and Genetics-I	10	10	80	100
		BSZO 121	**Zoology Lab-I**	10	10	80	100
	Public Health	PHLT 111	Human Biology	10	10	80	100
		PHLT 112	Introduction to Public Health	10	10	80	100
		PHLT 121	**Human Biology and First Aid Lab**	10	10	80	100
Core Courses	**Compulsory Paper**	**BHN 131**	**General Hindi**	**10**	**10**	**80**	**100***
		BEN 131	**General English**	**10**	**10**	**80**	**100***

B.Sc. Semester-II

Schemes for Internal Assessments and End Semester Examinations Semester-wise

Course	Subject	Code	Paper	CIA-I	CIA-II	ESE	Total
ELECTIVE COURSES	**Botany**	BSBO 211	Pteridophytes	10	10	80	100
		BSBO 212	Gymnosperms and Palaeobotany	10	10	80	100
		BSBO 221	**Botany Lab-II**	10	10	80	100
	Chemistry	BSCH 211	Physical Chemistry-I	10	10	80	100
		BSCH 212	Organic Chemistry-II	10	10	80	100
		BSCH 221	**Laboratory course-II**	10	10	80	100
	Mathematics	BSMT 211	Differential Equations	10	10	80	100
		BSMT 212	Integral and Vector Calculus	10	10	80	100
		BSMT 213	Co-ordinate Geometry in 3-Dimensions	10	10	80	100
	Physics	BSPH 211	Optics	10	10	80	100
		BSPH 212	Waves and Oscillations	10	10	80	100
		BSPH 221	**Physics Lab-II**	10	10	80	100
	Zoology	BSZO 211	Evolution and Biology of Higher Non Chordate	10	10	80	100
		BSZO 212	Molecular Biology and Genetics II	10	10	80	100
		BSZO 221	**Zoology Lab-II**	10	10	80	100
	Public Health	PHLT 211	Epidemiology	10	10	80	100
		PHLT 212	Biostatistics and Computer Applications	10	10	80	100
		PHLT 221	**Epidemiology and Biostatistics Lab**	10	10	80	100
Core Courses	**Compulsory Paper**	**BES 231**	**Environmental Studies**	**10**	**10**	**80**	**100***

B.Sc. Semester-III

Schemes for Internal Assessments and End Semester Examinations Semester-wise

Course	Subject	Code	Paper	CIA-I	CIA-II	ESE	Total
ELECTIVE COURSES	**Botany**	BSBO 311	Anatomy of Angiosperms, Economic Botany and Ethnobotany	10	10	80	100
		BSBO 312	Cell and Molecular Biology	10	10	80	100
		BSBO 321	**Botany Lab-III**	10	10	80	100
	Chemistry	BSCH 311	Inorganic Chemistry-II	10	10	80	100
		BSCH 312	Physical Chemistry-II	10	10	80	100
		BSCH 321	**Laboratory Course-III**	10	10	80	100
	Mathematics	BSMT 311	Partial Differential Equation and Laplace Transform	10	10	80	100
		BSMT 312	Numerical Analysis	10	10	80	100
		BSMT 313	Dynamics of a Particle	10	10	80	100
	Physics	BSPH 311	Statistical and Thermal Physics	10	10	80	100
		BSPH 312	Electronic Devices and Circuits	10	10	80	100
		BSPH 321	**Physics Lab-III**	10	10	80	100
	Zoology	BSZO 311	Biology of Chordates	10	10	80	100
		BSZO 312	Immunology & Microbiology	10	10	80	100
		BSZO 321	**Zoology Lab-III**	10	10	80	100
	Public Health	PHLT 311	Determination of Health and Disease	10	10	80	100
		PHLT 312	Essentials of Demography	10	10	80	100
		PHLT 321	**Demography Lab.**	10	10	80	100

B.Sc. Semester-IV

Schemes for Internal Assessments and End Semester Examinations Semester-wise

Course	Subject	Code	Paper	CIA-I	CIA-II	ESE	Total
ELECTIVE COURSES	**Botany**	BSBO 411	Taxonomy and Embryology of Angiosperms	10	10	80	100
		BSBO 412	Cytogenetics, Genetics, Plant Breeding, Evolution and Biostatistics	10	10	80	100
		BSBO 421	**Botany Lab-IV**	10	10	80	100
	Chemistry	BSCH 411	Inorganic Chemistry-III	10	10	80	100
		BSCH 412	Organic Chemistry-III	10	10	80	100
		BSCH 421	**Laboratory Course-IV**	10	10	80	100
	Mathematics	BSMT 411	Optimization Techniques	10	10	80	100
		BSMT 412	Abstract Algebra	10	10	80	100
		BSMT 413	Statics	10	10	80	100
	Physics	BSPH 411	Electrodynamics	10	10	80	100
		BSPH 412	Quantum Mechanics	10	10	80	100
		BSPH 421	**Physics Lab-IV**	10	10	80	100
	Zoology	BSZO 411	Comparative Anatomy of Chordates	10	10	80	100
		BSZO 412	Animal Embryology	10	10	80	100
		BSZO 421	**Zoology Lab-IV**	10	10	80	100
	Public Health	PHLT 411	Fundamentals of Epidemiology	10	10	80	100
		PHLT 412	Biostatistics And Research Methods	10	10	80	100
		PHLT 421	**Epidemiology and Biostatstics Lab**	10	10	80	100

B.Sc. Semester-V

Schemes for Internal Assessments and End Semester Examinations Semester-wise

Course	Subject	Code	Paper	CIA-I	CIA-II	ESE	Total
ELECTIVE COURSES	**Botany**	BSBO 511	Plant Physiology and Biochemistry	10	10	80	100
		BSBO 512	Plant Tissue Culture	10	10	80	100
		BSBO 521	**Botany Lab-V**	10	10	80	100
	Chemistry	BSCH 511	Organic Chemistry-IV	10	10	80	100
		BSCH 512	Physical Chemistry-III	10	10	80	100
		BSCH 521	**Laboratory Course-V**	10	10	80	100
	Mathematics	BSMT 511	Metric and Vector Spaces	10	10	80	100
		BSMT 512	Complex Analysis	10	10	80	100
		BSMT 513	Hydrostatics	10	10	80	100
	Physics	BSPH 511	Atomic and Molecular Spectroscopy and Laser Physics	10	10	80	100
		BSPH 512	Solid State Physics	10	10	80	100
		BSPH 521	**Physics Lab-V**	10	10	80	100
	Zoology	BSZO 511	Animal Physiology	10	10	80	100
		BSZO 512	Ecology	10	10	80	100
		BSZO 521	**Zoology Lab-V**	10	10	80	100
	Public Health	PHLT 511	Epidemiology of Communicable and Non Communicable Diseases	10	10	80	100
		PHLT 512	Health Care Systems	10	10	80	100
		PHLT 521	**Health Care System Lab**	10	10	80	100

B.Sc. Semester-VI

Schemes for Internal Assessments and End Semester Examinations Semester-wise

Course	Subject	Code	Paper	CIA-I	CIA-II	ESE	Total
ELECTIVE COURSES	**Botany**	BSBO 611	Ecology and Environmental Biology	10	10	80	100
		BSBO 612	Recombinant DNA Technology	10	10	80	100
		BSBO 621	**Botany Lab-VI**	10	10	80	100
	Chemistry	BSCH 611	Inorganic Chemistry-IV	10	10	80	100
		BSCH 612	Physical Chemistry-IV	10	10	80	100
		BSCH 621	**Laboratory Course-VI**	10	10	80	100
	Mathematics	BSMT 611	Discrete Mathematics	10	10	80	100
		BSMT 612	Real Analysis	10	10	80	100
		BSMT 613	Computer Oriented Numerical Analysis	10	10	80	100
	Physics	BSPH 611	Nuclear Physics	10	10	80	100
		BSPH 612	Analog and Digital Electronics	10	10	80	100
		BSPH 621	**Physics Lab-VI**	10	10	80	100
	Zoology	BSZO 611	Biodiversity and Ethology	10	10	80	100
		BSZO 612	Applied Zoology	10	10	80	100
		BSZO 621	**Zoology Lab-VI**	10	10	80	100
	Public Health	PHLT 611	Health Education and Health Promotion and Communication	10	10	80	100
		PHLT 612	Global Health	10	10	80	100
		PHLT 621	**Field Project**	10	10	80	100

B.Sc. Chemistry

Schemes for Internal Assessments and End Semester Examinations Semester-wise

Semester	Subject	Code	Paper	CIA-I	CIA-II	ESE	Total
I Sem.	**Core Subjects**	BSCH 111	Inorganic Chemistry-I	10	10	80	100
		BSCH 112	Organic Chemistry-I	10	10	80	100
		BSCH 121	**Chemistry Lab-I**	10	10	80	100
	Compulsory Paper	**BHN131/ BEN131**	**Samanya Hindi/ General English**	**10**	**10**	**80**	**100***
II Sem.	**Core Subjects**	BSCH 211	Physical Chemistry-I	10	10	80	100
		BSCH 212	Organic Chemistry-II	10	10	80	100
		BSCH 221	**Chemistry Lab-II**	10	10	80	100
	Compulsory Paper	**BES 231**	**Environmental Studies**	**10**	**10**	**80**	**100***
III Sem.	**Core Subjects**	BSCH 311	Inorganic Chemistry-II	10	10	80	100
		BSCH 312	Physical Chemistry-II	10	10	80	100
		BSCH 321	**Chemistry Lab-III**	10	10	80	100
IV Sem.	**Core Subjects**	BSCH 411	Inorganic Chemistry-III	10	10	80	100
		BSCH 412	Organic Chemistry-III	10	10	80	100
		BSCH 421	**Chemistry Lab-IV**	10	10	80	100
V Sem.	**Core Subjects**	BSCH 511	Organic Chemistry-IV	10	10	80	100
		BSCH 512	Physical Chemistry-III	10	10	80	100
		BSCH 521	**Chemistry Lab-V**	10	10	80	100
VI Sem.	**Core Subjects**	BSCH 611	Inorganic Chemistry-IV	10	10	80	100
		BSCH 612	Physical Chemistry-IV	10	10	80	100
		BSCH 621	**Chemistry Lab-VI**	10	10	80	100

Semester-I		
BSCH 111: Inorganic Chemistry-I		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	**ATOMIC STRUCTURE** **Wave partical duality:** de Broglie's concept of matter waves, Davision Germer Experimment & explanation of Bohr's quantum restriction, Heisenberg's uncertainty principle & its significance. **Wave Mechanical Model of Atom:** Schrödinger's wave equation, eign value &eign function, physical significance of wave function, 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 principle & its limitations. Electronic configurations of the elements, effective nuclear charge & their calculation using Slater's rule.	09
II	**PERIODIC TRENDS OF DIFFERENT PROPERTIES** Periodic trends of following properties with refrence to s & p 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:** defination, successive ionization enthalpies, factors affecting their values and applications of ionization enthalpy. **Electron Affinity:** defination, 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.	09
III	**IONIC BONDING** **Energetics of crystal formation:** Lattice enthalpy, Experimantal determination of Lattice Energy Born-Haber cycle and its application, caculation of lattice enthalpies: Born-Lande's equation, Madelung Constant, Kapustinki equation, factors affecting lattice enthalpy and consequences of lattice enthalpies: thermal stability of ionic soloids, 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 3, 4 & 6, limitation of radius ratio rule. **Covalent character in ionic bond**: polarizing power and polarizability of ions, Fajan's rule and their application.	09
IV	**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 physiochemical properties, theories of hydrogen bonding: electrostatic, VBT & MOT and consequences of hydrogen bonding. **Vander Waal forces of interactions:** Attractive intermolecular forces: dipole-dipole, dipole induced dipole and instantaneous dipole induced dipole interactions, repulsive inter molecular 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.	09
V	**S-BLOCK** **Physical properties:** Flame colouration, reducing tendency **Chemical properties:** diagonal relatioship, solvation and complexation tendencies **Hydrides:** classification, preparation properties and uses of s-block elements and Lithium aluminium Hydride. **Industrial uses of s-block elements: Portland cement:** raw material, composition of cement, methods of preparation, setting and hardening of cement. **Glass:** raw material, metods of manufacturing, types and their uses.	09

RECOMMENDED READINGS

- Principles of Inorganic Chemistry byB.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)

Semester-I		
BSCH 112: Organic Chemistry-I		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	**STRUCTURE AND BONDING** Hybridizations, Bond lengths and bond angles, bond energy: Localized and delocalized chemical bond, van-der Waals interactions, resonance, hyperconjugation, inductive and field effects, formal charge, polar covalent bond.	09
II	**MECHANISM OF ORGANIC REACTIONS** Curved arrow notations, drawing electron movement with arrows, half headed and double headed arrow, homolytic and heterolytic bond breaking. **Types of Reagents** Electrophiles and nucleophiles, types of organic reactions, Energy consideration, 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.	09
III	**STEREOCHEMISTRY –I** Concept of isomerism, types of isomerism, optical isomerism, elements of symmetry, molecular chirallity, enantiomers, stereogeniccentres, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccentres, distereoisomers, mesocompounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configurations, sequence rules, D & L, R & S systems of nomenclature.	09
IV	**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 cyclohexanes and monosubstituted cyclohexane derivatives axial and equatorial bonds, Newman projection and Saw horse formulae, Fischer and Flying wedge formulae and inter conversion of Projection formulae.	09
V	**ALKANES, CYCLOALKANES AND ALKYL HALIDES** Mechanism of free radical halogination of alkanes, reactivity and selectivity. **Cycloalkanes:** nomenclature, methods of preparations, chemical reactions. Bayer's strain theory and its limitations, ring strain in cyclopropane and cyclobutanes. **Alkyl Halides:** Nomenclature and classes of alkyl halides, methods of formation, chemical reactions mechanims of nucleophilic substitution reaction of alkyl halides, SN2 and SN1 reactions, with energy profile diagrams. Polyhalogen compounds: chloroform, carbon tetrachloride.	09

RECOMMENDED READINGS

- Organic chemistry Vol I by M.Mukherji, P.singh and P.kapoor, New age international (p) limited
- Organic chemistry Vol I by M.k Jain and S.C Sharma, Shobanlal $ Co educational publisher
- Organic chemistry Vol I by Dr.Jagdambasingh and L.D.S Yadav, Pragatiprakash
- Organic chemistry by Morrison & Boyd, Pearson
- Organic chemistry Vol I by Singh, Pardasani and Pathak, Ramesh book depot (hindi&english)
- Organic chemistry Vol I by Ameta, Sharma, Punjabi and Sharma, Himanshu publication
- Understanding organic chemistry by Brown, Foote, Iverson, Anslyn, Cenage learning

Semester-I

BSCH 121: Practical - Chemistry Lab-I | **45 Hrs**

- **A. INORGANIC CHEMISTRY**
  - **a. Volumetric Analysis**
    - **I. Preparation of standard solutions.**
    - **II. Dilution of solutions.**
    - **III. Redox titrations**
      1. Determination of the strength of oxalic acid & ferrous sulphate by titrating it against the $KMnO_4$ (Concept of self-Indicator).
      2. Determine the strength of the ferrous ammonium sulphate by titrating it against $K_2Cr_2O_7$ using external indicator & internal indicator.
      3. Estimation of the potassium dichromate iodometrically.
      4. Estimation of copper iodometrically.

- **B. ORGANIC CHEMISTRY**
  - **b. Laboratory Techniques:** TLC/paper chromatography- separation of dyes.
  - **c. 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.

RECOMMENDED READINGS

-

Semester-II		
BSCH 211: Physical Chemistry-I		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	**MATHEMATICAL CONCEPTS** Logarithmic relations, curves stretching, linear graphs and calculation of slopes, Differentiation of functions like ax, ex, xn, sinx, logx; maxima and minima. Integration of some useful /relevant functions permutations, combinations and probability.	09
II	**GASEOUS STATES** Postulates of kinetic theory of gases, deviation from ideal behaviour, Van-der Waals equation of State. Critical phenomenon: PV isotherms of ideal 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.	09
III	**LIQUID STATE** Characteristics of Liquid state: Vapour pressure, vapour pressure and boiling point, measurement of vapour pressure (static method and gas saturation method), viscosity, measurement of viscosity, specific viscosity (Ostwald's viscometer and Stokes falling sphere method), effect of temperature on viscosity and viscosity of mixtures, Surface tension, phenomenon of capillary action, measurement of surface tension (drop weight and drop number method), effect of temperature and surface tension of mixtures. Liquid crystals: Difference between liquid crystal, solid and liquid. Classification and structure of nematic, smectic and cholestic phases, swarm theory of liquid crystal.	09
IV	**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. Defects in crystals: point and line defects in crystals.	09
V	**COLLOIDAL STATE** Colloidal: Definition, classification, preparation. Hydrophobic colloidal system: electrical properties (origin of charge, electrical double layer, DLVO theory of stability of hydrophobic colloid, coagulation of colloidal sols), Electrokinetic properties (electrophoresis, electro-osmosis). Micelle: Micelle formation, shapes & structure of micelle, micellar aggregation number. Emulsion: definition, types: macroemulsion, microemulsion, formation of emulsions, factors determining stability, inversion of emulsions, theories of emulsion. Gels: preparation of gels, elastic & non elastic gels.	09

RECOMMENDED READINGS

- PhysicalChemistry,G.M. barrow,InternationalStudent Edition, McGrawHill.
- PhysicalChemistry,R.A.Alberty, WileyEasternLtd.
- TheElementsofPhysicalChemistry, P.W.Atkins, Oxford.
- PhysicalChemistryThroughproblems, S.K.Dogra and S.Dogra, WileyEasternLtd.
- PrinciplesofPhysicalchemistry, B.R.Puri, L.R.Sharma and M.S. Pathania, ShobhanLalNaginchand& Co.
- Physical Chemistry, BahlandTuli, S.Chand& Co. (P) Ltd.
- PhysicalChemistry, Vol. I &II, S.Pahari, New Central Book Agency (P) Ltd.
- PhysicalChemistry, Vol. I, II & III, KL Kapoor, MacMillan

- PhysicalChemistry, S Ameta, Himanshu Publication (Hindi)
- PhysicalChemistry, PD Sharma, Ramesh Book Depot.

Semester-II		
BSCH 212: Organic Chemistry-II		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	**ALKENES** Mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regio-selectivity in alcohol dehydration, the Saytzeff rule, Hoffmann elimination, mechanisms involved in hydrogenation, hydroboration-oxidation oxymercuration-reduction, Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO4, Substitution at the allylic and vinylic positions of alkenes, industrial applications of ethylene and propene.	09
II	**CYCLOALKENES, DIENES AND ALKYNES** **Dienes:**Nomemclature and classification of dienes: isolated conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions-1,2 and 1,4 additions, Diels Alder reaction. **Alkynes:**Nomenclature, structure and bonding in alkynes. Methods of formation.Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidatiion and polymerization.	09
III	**ARENES AND AROMATICITY** Nomenclature of benzene derivatives, structure of benzene and its MO picture.Aromaticity the Huckelrule.Aromatic electrophilic substitution general pattern of the mechanism, role of σ and π complexes, Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction.Energy profile diagrams, activating and deactivating substituents, orientation and ortho/pararatio.Side chain reactions of benzene derivatives.Birchreduction.Mechanism of nucleophilic aromatic substitution (elimination-addition, addition-elimination).Method of formation of aryl halides, nuclear and side chain reaction.Methods of formation and chemical reactions of biphenyl. Howarth synthesis of napthalene, phenanthrene&anthracene and their chemical reactions, structure of napthalene.	09
IV	**ALCOHOL** **Monohydric Alcohols:**Classification and nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding, Acidic nature, Reactions of alcohols. **Dihydric alcohols:**Nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$] and HIO_4 and pinacol-pinacolone rearrangement. **Trihydricalcohols:**Nomenclature and methods of formation, chemical reactions of glycerol.	09
V	**PHENOL** Nomenclature, structure and bonding.Preparationof phenols, physicalproperties and acidic character.Comparative acidic strengths of alcohol and phenol, resonance stabilization of phenoxide ion. Reactions of phenols – electrophilic aromatic substitution, acylation and carboxylalion. Mechanism of Fries rearrangement, Claisenrearrangement. Gattermansynthesis. Hauben Hoeschreaction. Lederer-Manasse reaction and ReimerTiemann reaction.	09

RECOMMENDED READINGS

- Organic chemistry Vol I by M.Mukherji, P.singh and P.kapoor, New age international (p) limited
- Organic chemistry Vol I by M.K Jain and S.C Sharma, Shobanlal& Co educational publisher
- Organic chemistry Vol I by Dr.Jagdambasingh and L.D.S Yadav, Pragatiprakash
- Organic chemistry by Morrison & Boyd, Pearson
- Organic chemistry Vol I by Singh, Pardasani and Pathak, Ramesh book depot (hindi $ english)
- Organic chemistry Vol I by Ameta, Sharma, Punjabi and Sharma, Himanshu publication

Semester-II

BSCH 221: Practical - Chemistry Lab-II **45 Hrs**

- **A. Organic Chemistry**
  1. **Organic preparations:**
     a. Iodoform from ethanol and acetone
     b. Urea oxalate
     c. Urea nitrate

- **B. Physical Chemistry**
  2. **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.
  3. **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.

- **C. Study of the unit cells and crystal structure through models.**

RECOMMENDED READINGS

•

Semester-III		
BSCH 311: Inorganic Chemistry-II		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	**COVALENT BONDING** Definition, factors favouring formation of covalent bond, covalency and maximum covalency, failure of octet rule: Sidgwick rule, Sugden's concept of singlet bond, Lewis dot structure. **Valence shell electron pair repulsion (VSEPR) theory**and shapes of simple molecules and ions containing lone pair and bonded pair of electrons. **Valence Bond Theory:**Heitler and London theory for H_2 molecule, Pauling and Slater – Overlapping of Orbitals, σ, π and δ bond approach. **Hybridisation:**Determination, rules and types of hybridization, equivalent & non-equiivalent hybrid orbitals.	09
II	**MO THEORY** LCAO approach, bonding and antibonding molecular orbitals molecular orbital diagram s of homodiatomic&heterodiatomic molecules N_2, O_2, C_2, B_2, F_2, CO, NO, HF &ICl and their ions(idea of s-p mixing and orbital interactions to be given). **Dipole moment**comparision of the dipole moment of common molecules, applications of dipole moment. Percentage ionic character in covalent bond: calculation by using electronegativity & dipole moment concept.	09
III	**p-block elements (13^{th}, 14^{th}, 15^{th} GROUP)** Electronic configuration, relative stability of different oxidation states, inert pair effect and anamolousbehaviour of first member of each group & oxides and hydrides-reactivity and nature and hydrolysis of oxides. Preparation, structure and nature of oxyacids of B, N and P.	09
IV	**p block elements (16^{th}, 17^{th} GROUP)** Electronic configuration, relative stability of different oxidation states, inert pair effect and anamolousbehaviour of first member of each group. Oxide- reactivity and nature.Oxy acids of S - sulpuric acid, sulphurous acid and relative nature of oxyacids of halogen. Interhalogen compounds –preparation, structure and properties (AB, AB_3, AB_5, AB_7).	09
V	**NOBEL GASES** Discovery of Nobel gases their seperation. Preparation and Properties and geometries of XeF_2, XeF_4, XeF_6, $XeOF_4$, XeO_2F_2 . Clathrates formed by Nobel gases.	09

RECOMMENDED 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)

Semester-III		
BSCH 312: Physical Chemistry-II		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	**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.	09
II	**CHEMICAL KINETICS-II** **Experimental methods of chemical kinetics:**Conductometric, potentiometic, 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.	09
III	**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, CO2 and sulphur system. **Phase equilibria of two component system:**solid -liquid equilibria, simple eutectic –Bi-Cd, Pb-Ag systems, desilverisation of lead.	09
IV	**PHASE EQUILIBRIUM-II** **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. **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).	09
V	**LIQUID-LIQUID MIXTURES** Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system azeotropes: HCl H2O 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.	09

RECOMMENDED READINGS

- PhysicalChemistry,G.M. barrow,InternationalStudent Edition, McGrawHill.
- PhysicalChemistry,R.A.Alberty, WileyEasternLtd.
- TheElementsofPhysicalChemistry, P.W.Atkins, Oxford.
- PhysicalChemistryThroughproblems, S.K.Dogra and S.Dogra, WileyEasternLtd.
- PrinciplesofPhysicalchemistry, B.R.Puri, L.R.Sharma and M.S. Pathania, Shobhan Lal Nagin chand & Co.
- Physical Chemistry, Bahland Tuli, S.Chand & Co. (P) Ltd.
- PhysicalChemistry, Vol. I &II, S.Pahari, New Central Book Agency (P) Ltd.
- PhysicalChemistry, Vol. I, II & III, KL Kapoor, MacMillan
- PhysicalChemistry, S Ameta, Himanshu Publication (Hindi)
- PhysicalChemistry, PD Sharma, Ramesh Book Depot

Semester-III

BSCH 321: Practical - Chemistry Lab-III	**45 Hrs**

- **A. INORGANIC CHEMISTRY**

  Qualitative Analysis

  Qualitative estimation of the inorganic mixture for five radicals including interfering acid radicals, their combinations and insoluble oxides, sulphates and halides.

- **B. PHYSICAL CHEMISTRY**

  a) Chemical Kinetics

  i. To determine the order of acid hydrolysis of ester and its rate constant using integrated rate law method and graphical method.

  ii. Determine the rate constant and order of base hydrolysis of ester.

  - To study the kinetics of acetone iodine reaction and determine the order with respect to 1. Iodine 2.Acetone

  b) Distribution Law

  i. To determine the distribution coefficient of I_2 between CCl_4 and water.

  ii. To study the distribution of benzoic acid between benzene and water and hence show that benzoic acid dimerises in benzene.

RECOMMENDED READINGS

-

Semester-IV		
BSCH 411: Inorganic Chemistry-III		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	**QUANTITATIVE ANALYSIS AND ERRORS IN ANALYSIS** **GravimetricAnalysis**: Precipitation: Concept of common ion effect and solubility product and conditions of precipitation (no mathematical treatment), Co-precipitation and Post precipitation. **Volumetric analysis:** basic requirement of titration reaction, standard solutions, primary standards, expressing concentration of standard solution, cautions in volumetric analysis and correction of unavoidable errors. **Errors in chemical analysis:**Types of error and their minimization; Accuracy, Precision, calculation of absolute and relative error and Standard Deviation.	09
II	**CHEMISTRY OF TRANSITION METALS** General Characteristics and Periodicity in properties with emphasis on their 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 (Gauy's and Faraday's method).	09
III	**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 in respect to ionic radii, oxidation states, Magnetic behavior and spectral properties.	09
IV	**CHEMISTRY OF REDOX REACTION** Oxidation and Reduction, application of electrochemical series – oxidising and reducing property of sustances in aqueous solution, reactivity of metals & non-metals, spontaneity of redox reactions & disproportionation reaction. Diagramaticreprsentation of potential data: Latimer, Frost &Ellinghem diagrams and their use in extraction of metals.	09
V	**CONCEPTS OF ACIDS AND BASES** Arrhenius, Bronsted-Lowry, Lewis and Usanovich concept. Acid base titrations, Redox titrations and theory of indicators. **Non aqueous solvents:** Physical properties of solvent, types of solvents and their general characteristics. Reactions in non aqueous solvents with reference to liquid NH_3 and SO_2.	09

RECOMMENDED 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.
- Inorganic Chemistry, vol II by Ameta, Daga, Sharma and Mehta. , Himanshu publication (Hindi)
- Inorganic Chemistry, vol II by Ojha ,Chaturvedi, Ramesh book depot (Hindi & English)

Semester-IV		
BSCH 412: Organic Chemistry-III		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	**SPECTROSCOPY I** **Ultraviolet (UV) absorption spectroscopy**: Absorption laws (Beer-Lambertlaw), presentation and analysis of UV spectra, 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**: Molecular vibrations, Hook's law, selection rules, intensity and position of IR bands of various functional groups, fingerprint region, functional groups and interpretation of IR spectra of simple organic compounds.	09
II	**SPECTROSCOPY II** **NMR: PROTON MAGNETIC RESONANCE SPECTROSCOPY** Nuclear shielding and de shielding, chemical shift, spin spincoupling, coupling constant, area of signals. Interpretation of PMR spectra of ethyl bromide, acetaldehyde, 1,1,2-tribromoethane , ethylacetate, toluene and acetophenone. Problem pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR.	09
III	**CHEMISTRY OF CARBONYL COMPOUNDS** Nomenclature and structure and physical properities of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acidchlorides, synthesis of aldehydes and ketones using 1,3-dithianes and synthesis of ketones from nitriles and from carboxylicacids. Enolisation of carbonyl compounds, protecting groups. Mechanism of nucleophilic additions tocarbonyl group with particular emphasis on benzoin, aldol,Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives.Wittig reaction.Mannich reaction, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner, LiAIH4 and NaBH4 reduction.	09
IV	**CHEMISTRY OF CARBOXYLICACIDS** Nomenclature, structure and bonding.Pysical 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). Methods of formation and chemical reactions of haloacids and hydroxyacids and action of heat on them. **Reactive methylene compounds:** Malonic ester and acetoacetic ester preparation and synthetic applications.	09
V	**FAT, OILS, DETERGENT AND POLYMERS** Common fatty acids, hydrogenation of unsaturated oils, saponification value, iodine value, cleaning action of soaps and detergents. **Polymer:**Addition or chain growth polymerization, free radical vinyl polymerization, ionic vinyl polymerization, zeigler-natta polymerization. Condensation or step growth polymerizations.Concept of dendrimers.Polyesters, polyamides, phenol-formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes.	09

RECOMMENDED READINGS

- Organic Spectroscopy, YR Sharma, S Chand Publication.
- Organic Chemistry, Solomon and Fryhle, Wiley
- Organic Chemistry, Louden, Roberts and Company Publishers.
- Organic chemistry, M.Mukherji, P. Singh and P. Kapoor, New age international (p) limited
- Organic chemistry Vol II & III by M.K Jain and S.C Sharma, Shobanlal & Co educational publisher
- Organic chemistry Vol II & III, Dr.Jagdamba Singh and L.D.S Yadav, Pragatiprakashan
- Organic chemistry by Morrison & Boyd, Pearson

- Organic chemistry Vol II& III by Singh, Pardasani and Pathak, Ramesh book depot (hindi&english)
- Organic chemistry Vol II& III by Ameta, Sharma, Punjabi and Sharma, Himanshu publication
- Understanding Organic Chemistry by Brown, Foote, Iverson &Anslyn, Cenage learning

Semester-IV	
BSCH 421: Practical - Chemistry Lab-IV	**45 Hrs**

- **A. Inorganic Chemistry**
  - **Gravimetric estimation**
    - **i.** Barium as barium sulphate.
    - **ii.** Zinc as zinc oxide
    - **iii.** 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).**

RECOMMENDED READINGS

Semester-V		
BSCH 511: Organic Chemistry-IV		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	**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. Condensed heterocycles: Preparation of Indole, Quinoline, Isoquinoline with special reference to Fischer indole synthesis, Skraup synthesis and Bischler-napieralski synthesis and chemical reactions.	09
II	**CHEMISTRY OF CARBOHYDRATES** Classification and nomenclature, oxidation and reduction reactions of carbohydrates.mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldose. Configuration of monasccharides.Erythro and threodiastereomers.Conversion of glucose into mannose. Formation of glycosides,ethers and esters. Cyclic structure D glucose.Mechanism of mutarotation.Structure of ribose and deoxyribose. An introduction to dissacharides (maltose,sucrose and lactose) and polysaccharides : starch and cellulose without involving structure determination.	09
III	**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 media. Picric acid. Structure and nomenclature of amines, physical properties.Stereochemistry of amines. Structural features affecting basic nature of amines. Preparation of alkyl and aryl amines (reduction of nitro compounds, Nitriles, reductive amination of aldehydic and ketonic compounds).Gabriel – phthalimidereaction.Hoffmannbromamidereaction.Reaction of amines (alkylation, reaction with acid chlorides, nitrous acid, phenyl isocyanate). Synthetic transformations of aryl diazonium salts, azocopupling. Amine salts as phase – transfer catalysts.	09
IV	**EPOXIDES, ORGANO MAGNESIUM 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, sulphonic acids, suluphonamides and sulphaguanide and mode of action of sulpha drugs. Grignard reagent: preparation and reactions.	09
V	**CHEMISTRY OF BIOMOLECULE: AMINO ACIDS AND PEPTIDES** Classification, structure and stereochemistry of amino acids, acid-base behaviour, isoelectric point.preparation and reactions of amino acids. Structure and nomenclature of peptides.group Determination of peptide structure (hydrolysis, sequencial degradation and specific cleavage). Classical and solid phase peptide synthesis. Electrophoresis.	09

RECOMMENDED READINGS

- Organic Chemistry, Solomon and Fryhle, Wiley
- Organic Chemistry, Louden, Roberts and Company Publishers.
- Organic ChemistryVOL. II, IL Finar, Pearson.
- Organic chemistry, M. Mukherji, P. Singh and P. Kapoor, New age international (p) limited
- Organic chemistry Vol II & III by M.K Jain and S.C Sharma, Shobanlal& Co educational publisher
- Organic chemistry Vol II & III, Dr. Jagdamba Singh and L.D.S Yadav, Pragatiprakashan
- Organic chemistry by Morrison & Boyd, Pearson

- Organic chemistry Vol II & III by Singh, Pardasaniand Pathak, Ramesh book depot (Hindi& English)
- Organic chemistry Vol II & III by Ameta, Sharma, Punjabi and Sharma, Himanshu publication
- Understanding Organic Chemistry by Brown, Foote, Iverson &Anslyn, Cenage learning

Semester-V		
BSCH 512: Physical Chemistry-III		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	**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 coefficient 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.	09
II	**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. Third Law of thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data.	09
III	**THERMODYNAMICS-III** Criteria for reversible and irreversible process Gibbs and Helmholtz functions; 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 isochor - Clapeyron equation and Clausius - Clapeyron equation and its applications.	09
IV	**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 method and moving boundary method. Applications of conductivity measurements : determination of degree of dissociation, determinationofKa of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.	09
V	**ELECTROCHEMISTRY-II** Types of reversible electrodes: gas metal ion, metal-metal ion, metal-insoluble salt-anion and redox electrodes, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes-standard electrode potential, sign conventions, 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. Defination of PH, determination of PH using hydrogen, quinhydrone and glass electrode, potentiometric tration, Concentration cell with and without transference.	09

RECOMMENDED READINGS

- PhysicalChemistry,G.M. barrow,InternationalStudent Edition, McGrawHill.
- PhysicalChemistry,R.A.Alberty, WileyEasternLtd.
- TheElementsofPhysicalChemistry, P.W.Atkins, Oxford.
- PhysicalChemistryThroughproblems, S.K.Dogra and S.Dogra, WileyEasternLtd.
- PrinciplesofPhysicalchemistry, B.R.Puri, L.R.Sharma and M.S. Pathania, ShobhanLalNaginchand& Co.
- Physical Chemistry, BahlandTuli, S.Chand& Co. (P) Ltd.

- PhysicalChemistry, Vol. I &II, S.Pahari, New Central Book Agency (P) Ltd.
- PhysicalChemistry, Vol. I, II & III, KL Kapoor, MacMillan
- PhysicalChemistry, S Ameta, Himanshu Publication (Hindi)
- PhysicalChemistry, PD Sharma, Ramesh Book Depot

Semester-V

BSCH 521: Practical - Chemistry Lab-V	**45 Hrs**

- **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.

RECOMMENDED READINGS

•

Semester-VI		
BSCH 611: Inorganic Chemistry-IV		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	**COORDINATION CHEMISTRY** Werner's coordination theory and its experimental verification, different types of ligands including chelates and pi accepter ligands, nomenclature and formulation of coordination compounds, effective atomic number, stereoisomerism in complexes of oordination number 4 and 6. Complexometric titrations and theory of metallochrome indicators.	09
II	**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, Jahn Teller effect.	09
III	**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, colour of transition metal complexes, experimental determination of stability constant and composition of complex (Job's Method and Bjerrum's Method).	09
IV	**HARD AND SOFT ACID & BASES CONCEPT (HSAB)** Classification of acid and base as hard and soft, Pearson's HSAB concept and its applications.Symbiosis, theoritical basis of hardness and softness, electronegetivity, hardness and softness and limitation of HSAB principle. **Bioinorganic Chemistry** Essential and trace elements in biological processes, Biological role of alkali (Na, K, Li) and alkaline earth (Mg, Ca) metals.	09
V	**ORGANOMETALLIC CHEMISTRY** Defination, nomenclature and classification of organometallic compounds, bonding, preparation, properties and application of organometallic compounds of Li, Al, Hg and Sn (alkyls and aryl).	09

RECOMMENDED READINGS

- Principles of Inorganic Chemistry by B.R.Puri, L.R.Sharma and Kalia.
- Advanced Inorganic Chemistry, vol II, 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 III by Ameta, Daga, Sharma and Mehta. , Himanshu publication (Hindi)
- Inorganic Chemistry, vol III by Ojha ,Chaturvedi, Ramesh book depot (Hindi & English)

Semester-VI		
BSCH 612: Physical Chemistry-IV		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	**QUANTUM MECHANICS** Black-body radiation, Planck's radiation law, photoelectric effect, Bohr's model of hydrogen atom and its defects. Compton effect. De Brogile hypothesis, Heisenberg's uncertainty principle. Operators Schrodinger wave equation and its importancephysical interpretation of the wave function, postulates of quantum mechanics. particle in a one dimensional box & its importance .	09
II	**SPECTROSCOPY-I** Introduction : electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom. **Rotational Spectrum:**Diatomic molecules. Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using populationdistribution (Maxwell-Bo!tzmann 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, idea of vibrational frequencies of different functional groups.	09
III	**SPECTROSEOPY-III** **Raman spectrum:** Concept of polarizability, pure rotational and pure vibrational Raman spectra of Diatomic molecules and selection rules. **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 a σ, π and n MO, their energy levels and the respective transitions.	09
IV	**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 photosensitized reactions-energy transfer processes (simple examples).	09
V	**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.	09

RECOMMENDED READINGS

- PhysicalChemistry,G.M. barrow,InternationalStudent Edition, McGrawHill.
- PhysicalChemistry,R.A.Alberty, WileyEasternLtd.
- TheElementsofPhysicalChemistry, P.W.Atkins, Oxford.
- PhysicalChemistryThroughproblems, S.K.Dogra and S.Dogra, WileyEasternLtd.
- PrinciplesofPhysicalchemistry, B.R.Puri, L.R.Sharma and M.S. Pathania, Shobhan LalNagin chand& Co.
- Physical Chemistry, BahlandTuli, S.Chand& Co. (P) Ltd.
- PhysicalChemistry, Vol. I &II, S.Pahari, New Central Book Agency (P) Ltd.
- PhysicalChemistry, Vol. I, II & III, KL Kapoor, MacMillan
- PhysicalChemistry, S Ameta, Himanshu Publication (Hindi)
- PhysicalChemistry, PD Sharma, Ramesh Book Depot

Semester-VI

BSCH 621: Practical - Chemistry Lab-VI **45 Hrs**

- **A. Inorganic Chemistry**
  - **a. Inorganic preparations**
  - **i.** FAS
  - **ii.** Potash alum
  - **iii.** Microcosmic salt
  - **iv.** Tetraamminecoppersulphate
  - **v.** Hexathiourealead(II) nitrate
  - **vi.** Cis & trans potassium diaquodioxalatochromate(III)

- **B. Water & Soil Analysis**
  - I. Determine the permanent, temporary and total hardness of the given water sample using complexometric titration method.
  - II. Determine the permanent, temporary and total hardness of the given water sample using Clark's method.
  - III. Determine the COD of the given water sample.
  - IV. Determine the available carbon in the given soil sample.

- **C. Physical Chemistry**
  - I. To verify the Lambert-Beer's law and determine the concentration of given solution ($CoCl_2$& $NiSO_4$).
    Jobs method for composition of Fe(III) and SCN- complex

RECOMMENDED READINGS