SCHEME & SYLLABUS

For

B.Sc. Chemistry (Hons.)

(Semester I-VI)

Session: 2024-25

BADDI UNIVERSITY OF EMERGING SCIENCES & TECHNOLOGY

B.Sc. (Honors) Chemistry (Semester System)

(Under Credit Based Continuous Evaluation Grading System)

Scheme for B.Sc. (Honors chemistry) – I, II & III Year (i.e. from Semester – I to VI)

SEMESTER- First

Course Code	Course Name	L (hrs)	P (hrs)	Credits
USCH-101	Inorganic Chemistry-I	4	2	4 + 1
USCH-102	Organic Chemistry-I	4	2	4 + 1
USCH-103	Physical Chemistry-I	4	2	4 + 1
USCH-104 or USCH-105	Mathematics-I Biology	4 4	0 0	4 4
USCH-106	Physics-I	4	2	4 + 1
		Total Credits		24

SEMESTER- Second

Course Code	Course Name	L (hrs)	P (hrs)	Credits
USCH-151	Inorganic Chemistry-II	4	2	4 + 1
USCH-152	Organic Chemistry-II	4	2	4 + 1
USCH-153	Physical Chemistry-II	4	2	4 + 1
USCH-154	Physics-II	4	2	4 + 1
USCH-155	Mathematics-II	4	0	4
USCH-156	Fundamentals of Computers	1	2	1 + 1
		Total Credit		26

SEMESTER- Third

Course Code	Course Name	L (hrs)	P (hrs)	Credits
USCH-201	Inorganic Chemistry-III	4	2	4 + 1
USCH-202	Organic Chemistry-III	4	2	4 + 1
USCH-203	Physical Chemistry-III	4	2	4 + 1
USCH-204	Analytical Chemistry	4	0	4
USCH-205	Communication Skills	2	0	2
USCH-206	Human Values and Ethics	2	0	2
		Total Credit		25

SEMESTER – Fourth

Course Code	Course Name	L (hrs)	P (hrs)	Credits
USCH-251	Inorganic Chemistry-IV	4	2	4 + 1
USCH-252	Organic Chemistry-IV	4	2	4 + 1
USCH-253	Physical Chemistry-IV	4	2	4 + 1
USCH-254	Green Chemistry	4	0	4
USCH-255	Environmental Science	2	0	2
USCH-256	Contemporary Awareness and Insights	2	0	2
		Total Credit		23

SEMESTER – Fifth

Course Code	Course Name	L (hrs)	P (hrs)	Credits
USCH-301	Inorganic Chemistry-V	4	2	4 +1
USCH-302	Inorganic Chemistry-VI	4	0	4
USCH-303	Organic Chemistry-V	4	2	4 + 1
USCH-304	Organic Chemistry-VI	4	0	4
USCH-305	Physical Chemistry-V	4	2	4 + 1
USCH-306	Physical Chemistry-VI	4	0	4
		Total Credits		27

SEMESTER – Sixth

Course Code	Course Name	L (hrs)	P (hrs)	Credits
USCH-351	Inorganic Chemistry-VII	4	2	4 +1
USCH-352	Inorganic Chemistry-VIII	4	0	4
USCH-353	Organic Chemistry-VII	4	2	4 + 1
USCH-354	Organic Chemistry-VIII	4	0	4
USCH-355	Physical Chemistry-VII	4	2	4 + 1
USCH-356	Physical Chemistry-VIII	4	0	4
		Total Credits		27

(SEMESTER-I)

Course Code	Course Title	L	T	P	Credit
USCH-101	Inorganic Chemistry-I	4	0	0	4

Prerequisites: Nil

Course Objectives:

1. To understand the complete knowledge of atom structure, the Schrödinger wave equation, some principles and shapes of orbitals.
2. the bonding fundamentals for both ionic and covalent compounds, including electro negativities, bond distances, and bond energies using MO diagrams

a. predicting geometries of simple molecules

3. To understand the periodic table and periodic properties in detail.

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Atomic Structure

Atomic number, atomic weight, calculation of empirical formula and molecular formula from molecular weight, historical development of the subject, Bohr's theory and its limitations, idea of de-Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of ψ and ψ^2, quantum numbers, normal and orthogonal wave functions, radial and angular wave functions and probability distribution curves, shapes of s, p, d and f orbitals, Aufbau and Pauli exclusion principle, Hund's multiplicity rule electronic configurations of the elements, effective nuclear charge.

Unit-II

Covalent Bonding

Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridisation and shapes of simple Inorganic molecules and ions. VSEPR Theory of NH_3 , H_3O^+, SF_4 , ClF_3, ICl_2 and H_2O. MO theory: homonuclear and heteronuclear (CO and NO) diatomic molecules, multi centre bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

Weak Interactions:

Hydrogen bonding: Types, theory and consequences of Hydrogen Bonding, Van der Waal's forces.

Unit-III

The Periodic Table and Chemical Periodicity Nomenclature of Inorganic compounds:

The relationship between chemical periodicity and electronic structure of the atom. The long form of the periodic Table – Classification of elements in s, p, d and f block of elements. Periodicity in oxidation state of valence, metallic/non-metallic character, oxidizing or reducing behaviour; acidic and basic character of oxides; Anomalous behaviour of elements of 2nd short period (Li to F) compared to other members in the same groups of s & p block elements. Effect of lanthanide contraction on the elements following lanthanides. The diagonal behavior between elements. The inert pair effect; variability of oxidation states of transition elements, colour, magnetic properties and other characteristics of transition elements.

Unit-IV

Ionic Solids

Ionic structures, types of ions and packing of ions in crystals size effects, radius ratio effects and co-ordination numbers, limitation of radius ratio rules, lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions fajan's rule.

Metallic Bond: Free electron, valence bond and band theories (Alloys excluded)

Course Outcomes:

CO1 To study the various atom models, to understand the important features of quantum mechanical model of atom

CO2 To study the periodic properties of elements, to explain the formation of different types of bonds, to predict the geometry of simple molecules, to explain the different types of hybridisation and draw shapes of simple covalent molecules, to understand basics of ionic solids.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

- D.F.C. Shriver, P.W. Atkins and C.H. Langford, Inorganic Chemistry, ELBS Oxford, 1991.
- 2. J.E. Huheey, E.A. Keiter, R.L. Keiter, Inorganic Chemistry, 4th Ed, Pearson Education,
  Singapore, 1999.
- J.D.Lee, Concise Inorganic Chemistry, ELBS, Oxford 1994.

Web Resources:

Course Code	**Course Title**	**L**	**T**	**P**	**Credit**
USCH-101	**Inorganic Chemistry Lab-I**	**0**	**0**	**2**	**1**

Prerequisites: Nil

Perform any 8 experiments.

1. **Qualitative Analysis**:

Qualitative analysis of inorganic mixtures containing not more than six radicals

2. **Quantitative Analysis:**

Volumetric Methods

(a) Acid-base titrations – Preparation of standard hydrochloric acid and sodium hydroxide solution. Preparation of some buffers and measuring their pH value, pH titration of unknown soda ash.

Reference text:

1. Vogel, A.I. *A Textbook of Quantitative Inorganic Analysis*, ELBS.

Assessment and Evaluation:

(a)Lab work:10 marks
(b) Record:10 marks
(c) Viva-voice:10 marks
Total Assessment: Average of best seven practicals out of all the weekly practicals (30 Marks)

Course Code	Course Title	L	T	P	Credit
USCH-102	**Organic Chemistry-I**	**4**	**0**	**0**	**4**

Prerequisites: Nil

Course Objectives:

1. To understand the structure and bonding of organic compounds.
2. To understand complete knowledge of stereochemistry of organic compounds.
3. To understand chemistry of alkanes and cycloalkanes.

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Structure and Bonding

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, van der Waal's interactions, inclusion compounds, clatherates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

Unit-II

Mechanism of Organic Reactions

Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles. Types of organic reactions. Energy considerations.

Reactive intermediates - carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species.

Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

Unit-III

Stereochemistry of Organic Compounds

Concept of isomerism. Types of isomerism. Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeric centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization.

Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

Geometric isomerism – determination of configuration of geometric isomers. E & Z system of nomenclature..

Conformational isomerism – conformational analysis of ethane and n-butane;

Unit-IV

Alkanes and Cycloalkanes

IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes.

Cycloalkanes - nomenclature, methods of formationseme, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings.

Books Suggested:

1. Organic Chemsitry, Morrison and Boyd, Prentice- Hall.
2. Fundamentals of Organic Chemistry, Solomons, John Wiley.
3. Organic Chemistry. F.A. Carey, McGraw Hill, Inc.
4. Organic Chemistry, L.G. Wade Jr. Prentice Hall.
5. Organic ChemistryVol. I, II & III, S.M. Mukherji, S.P. Singh and R.P.Kapoor, Wiley Eastern Ltd (New Age International).
6. Introduction to organic chemistry, Stritwieser, Heathcock and Kosover, Macmilan.

Course Outcomes:

CO1 the hybridization and geometry of atoms and the three-dimensional structure of organic molecules, the reactivity and stability of an organic molecule based on structure, including conformation and stereochemistry.

CO2 an understanding of nucleophiles, electrophiles, electronegativity, and resonance, the prediction of mechanisms for organic reactions, how to use their understanding of organic mechanisms to predict the outcome of reactions, how to design syntheses of organic molecules

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

- 1.Organic Chemsitry, Morrison and Boyd, Prentice- Hall.
- 2. Fundamentals of Organic Chemistry, Solomons, John Wiley.
- 3. Organic Chemistry. F.A. Carey, McGraw Hill, Inc.
- 4. Organic Chemistry, L.G. Wade Jr. Prentice Hall.
- 5. Organic ChemistryVol. I, II & III, S.M. Mukherji, S.P. Singh and R.P.Kapoor, Wiley
- Eastern Ltd (New Age International).
- Introduction to organic chemistry, Stritwieser, Heathcock and Kosover, Macmilan.

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-102	**Organic Chemistry Lab-I**	**0**	**0**	**2**	**1**

Prerequisites: Nil

Perform any 8 experiments.

1. Preparation and purification through crystallization or distillation and ascertaining their purity through melting point or boiling point

(i) Iodoform from ethanol (or acetone)

(ii) *m*-Dinitrobenzne from nitrobenzene (use 1:2 conc. HNO_3 - H_2SO_4 mixture if fuming HNO_3 is not available)

iii) p-Bromoacetanilide from acetanilide

iv) Dibenzalacetone from acetone and benzaldehyde

v) Aspirin from salicylic acid

2. Determination of melting point Naphthalene 80-82^o, Benzoic acid 121.5-122^o

urea, 132.5-133^o, Succinic acid 184-185^o Cinnamic acid 132.5-133^o, Salicylic acid 157-5-158^o Acetanilide 113-5-114^o, m-Dinitrobenzene 90^o p-Dichlorobenzene 52^o. Aspirin 135^o.

3. Determination of boiling points Ethanol 78^o, Cyclohexane 81.4^o, Toluene 110.6^o, Benzne 80^o.

4. Distillation Simple distillation of ethanol-water mixture using water Condenser Distillation of nitrobenzene and aniline using air condenser.

Reference text:

1. Vogel, A.I. *A Textbook of Quantitative Inorganic Analysis*, ELBS.

Assessment and Evaluation:

(a)Lab work:10 marks
(b) Record:10 marks
(c) Viva-voice:10 marks

Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

Course Code	Course Title	L	T	P	Credit
USCH-103	**Physical Chemistry-I**	**4**	**0**	**0**	**4**

Prerequisites: Nil

Course Objectives:

1. To study the gases, liquids and solid state in detail, to understand the dynamics of the molecules in the gases and liquids
2. To study adsorption and surface chemistry.

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Gaseous State-I

Elementary treatment of gas laws, Real and ideal gases, Boyle's temperature, gas constant R and its numerical values critical constants and their determination. Kinetic gas equation and its derivation, cause of deviation of gases from ideal behaviour, Van der waal's equation and its deviation under different pv isotherms of real gases, isotherms of carbon dioxide, continuity of states. Relationship between critical constants and van der waal's constants, law of corresponding states. Reduced equation of state, liquification of gases (based on Joule - Thomson effect.) degree of freedom of motion and principle of equipartition of energy.

Unit-II

Gaseous State-II

Maxwell's distribution law of velocities and energies. Root mean square velocity, average velocity and most probable velocity and their relationship. Mean free path and its derivation. Collision diameter. Collision number and collision frequency, viscosity of gases. Relationship between mean free path and coefficient of viscosity, calculation of molecular diameter from coefficient of viscosity.

Surface Chemistry and Colloidal States

Adsorption, Absorption. Types of adsorption, difference between them, adsorption isotherms and adsorption isobars. Langmuir adsorptions isotherms and freundlieh adsorption isotherms different isotherms, elementary idea of BET equation and its application.

Unit-III

Surface Chemistry

Gibb's adsorption equation and its application. Enzyme catalysis and mechanism of enzyme catalysis, Micharlis- Menton equation application of adsorption.

Solid state.

Crystalline and amorphous solids. Type of unit cells. Laws of crystallography law of constancy of interfaial angeles, law of rational indices, law of symmetry. Symmetry of elements in crystalls. Seven crystal system, Bravis Lattice Bragg's equation and its determination X-ray diffraction of crystals. Determination of crystal structure of NaCl, KCl, CsCl by law's and panders method.

Unit-IV

Liquid State

Intermolecular forces, structure of liquids (qualitative description, structural differences between solids, liquids and gases, Liquid crystals. Differences between liquid, crystal solid and liquid, classification structure of nematic and chalastric phases, thermography and seven segment of cell, vapour pressure of liquids. Theory of liquids and entropy of vaporization, viscosity and surface tension of liquids.

Course Outcomes:

CO1 To study the gases, liquids and solid state in detail, to understand the dynamics of the molecules in the gases and liquids

CO2 To study adsorption and surface chemistry.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

- **Preferred Reading:**
- Physical Methods in Inorganic Chemistry" by R S Drago.
- "Fundamentals of Molecular Spectroscopy" by C N Banwell*Quantum Mechanics*" by E Merzbacher.
- 2. "A Text *book* of *Quantum Mechanics*" by P M Mathews and K Venkatesan.
- . "Quantum *Mechanics*" by A Messiah.
- 4. "Quantum *Mechanics*" by L Landau and E Lifshitz. 5. "Introduction to *Quantum Mechanics*" by J Griffiths David.
- "Introduction to Molecular Structure and Spectroscopy" by W A Gullory.
- "Basic Principles of Spectroscopy" by R Chang.
- "Molecular Structure and Spectroscopy" by Arulhas

Web Resource

Course Code	**Course Title**	**L**	**T**	**P**	**Credit**
USCH-103	**Physical Chemistry Lab-I**	**0**	**0**	**2**	**1**
Prerequisites: Nil					
Perform atleast 8 experiments.					

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To determine the surface tension of a given liquid by drop number method.
3. To determine the viscosity of a given liquid**.**
4. To determine the specific refractivity of a given liquid
5. To determine the solubility of benzoic acid at various temperatures and to determine the ▲H of the dissolution process
6. To determine the enthalpy of solution of solid calcium chloride.
7. To study the kinetics of hydrolysis of methyl acetate in the presence of hydrochloric acid.
8. To study the effect of ionic strength (primary salt effect) on the kinetics of a reduction of toluidine blue with sodium sulfite.
9. To determine the molecular weight of a non-volatile substances by a cryoscopic method.
10. Determination of pK_a values of indicator using spectrophotometry.
11. Sponification of ethyl Acetate.

Reference text:

1. Vogel, A.I. *A Textbook of Quantitative Inorganic Analysis*, ELBS.

Assessment and Evaluation:

(a)Lab work:10 marks
(b) Record:10 marks
(c) Viva-voice:10 marks
Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

Course Code	Course Title	L	T	P	Credit
USCH-104	**Mathematics I**	**4**	**0**	**0**	**4**

Prerequisites: Nil

Course Objectives:

1. To apply the knowledge of Mathematics in bachelors of chemistry
2. To use concepts of mathematics for various types of problems

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Probability

Introduction : theory of probability , probability concept , random experiment and events, mathematical notion , probability function ,laws of addition of probability ,extension of general law of addition of probability ,multiplication law of probability and conditional probability ,extension of multiplication law of probability , independent events ,bayes theorem

Unit-II

Determinants and Matrices

Introduction to various terms Matrix, row, column, diagonal, unit. Sub, square, equal matrices, null, symmetric, order of matrix, character of matrix, transpose of matrix, Adjoint of matrix, inverse of matrix. Addition multiplication, Cayley Hamilton theorem(without proof).. Definition and properties of determinants, product of two determinants.

Unit-III

Differential Calculus

Differentiation of standard functions, theorems relating to the derivative of the sum, difference, product and quotient of functions, derivative of trigonometric functions, inverse trigonometric functions, logarithmic functions and exponential functions, differentiation of implicit functions, logarithmic function, composite function .

Unit-IV

Integral Calculus

Integration as an inverse of differentiation , indefinite integrals of standard forms, method of substitution, method of partial fractions, integration by parts, definite integrals, definite integrals of limit of a sum and geometrical interpretation.

Course Outcomes:

CO1 Able to solve the problems of differentiation of functions of one/two variables and know about the maximization and minimization of functions and also familiarize with the concept of analytic function, C-R equations and its uses.

CO2: Come to know the applications of double and triple integration in finding the area and volume and also Know about qualitative applications of Gauss , Stoke's and Green's theorem.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

1.Shanti Narayan – Differential Calculus.
2.Shanti Narayan - Integral Calculus.
3.B.S. Grewal – Higher Engineering Mathematics**.**

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Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-105	Biology	4	0	0	4

Prerequisites: Nil

Objective:

1. To give basic knowledge of organization of life, tissues, genetics.
2. To give an idea about diversity of life.

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

UNIT-I

The Organisation of Life

Biologically important molecules: Carbohydrates, lipids, proteins and nucleic acids. The life of cells – The Cell Theory, general characteristics of cells, difference between prokaryotic and eukaryotic cells, difference between plant and animal cells, cell organelles.

UNIT-II

Tissues

Tissues, organs and organ systems: Animal tissues; epithelial tissues, connective tissues, muscle tissue, nervous tissue and plant tissue: meristematic tissue, permanent tissues**.**

UNIT-III

Genetics

The basic principle of heredity: Mendel's law, monohybrid cross, dihybrid cross.
DNA – Double helix structure and replication.
Genes expression: Transcription and translation, genetic code.

UNIT-IV

The Diversity of Life

The classification of Living things – Criteria of classification, Whittaker's systems of classification, their characteristics with are example of each.
Viruses, structure of Viruses.

Course Outcomes:

CO1 Cell theory, membrane structures, transport mechanisms across membranes, carbohydrates nucleic acid, DNA replication – steps in synthesis of new DNA from template, regulation of pathways and mechanisms of action for DNA replication enzymes, gene transcription.
CO2 to understand Tissues in detail, genetics and diversity of life.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

Cord Biology - South Western Educational Publications, Texas, 2000.

Web Recourses:

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Course Code	Course Title	L	T	P	Credit
USCH-106	Physics-I	4	0	0	4

Prerequisites: Nil

Objective:

1. Understand the fundamental concepts of electromagnetism, including Gauss's law, Faraday's law, Ampere's circuital law, and Maxwell's equations.
2. Introduce the principles of quantum mechanics and its application to understand the behavior of matter waves, as demonstrated in the Davisson-Germer experiment.
3. Explore the principles of laser operation, including spontaneous and stimulated emission, population inversion, and various types of lasers, along with the basics of optical fiber communication.
4. Study the properties and applications of magnetic materials, including hard and soft magnetic materials, ferrites, and the phenomenon of superconductivity.
5. Gain insights into the applications of electromagnetic theory, quantum mechanics, lasers, optical fibers, and superconductivity in various technological fields.

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

UNIT – I

Electromagnetic fields and em wave: Gradient of a scalar, divergence and cul of a vector, Gauss's law (integral and differential form) and its applications, Electric potential and electric field (in vector form), Dieletrics, Polarization, Electric displacement, Susceptibility and permittivity, Lorentz foce law, Magnetic field of a steady current (Biot-Savart's law), Faraday's law, Ampere's circuital law and its applications, Maxwell's equations a dn their significance, Electromagnetic Spectrum (basic idea of different regions).

UNIT – II

Quantum Theory: Need of Quantum Mechanics, Davisson-Germer Experiment and Matter waves, Group and Phase velocities. Uncertainity Principle and its applications, Time-independent and Time-Dependent Schrödinger Wave equation, Eigen values and Eigen Functions, Applications of Schrödinger Wave equation to Particle in a box (one dimensional).

UNIT – III

Lasers and Optical Fibers: Spontaneous and Stimulated Emission, Einstein's coefficients, Population Inversion and Optical Pumping, Three-level and Four-level Lasers, Ruby, He-Ne, CO_2, Semiconductor Lasers, Application of lasers, Basic theory of fiber optics, accepatance angle, numerical aperture, modes of propagation, material and pulse dispersion, application of optical fibers.

UNIT – IV

Magnetic materials and Superconductivity: Hard and soft magnetic materials and their applications, Ferrites and their applications, Phenomenon of superconductivity, Magnetic properties of superconductors (Meissner effect), Type-I and Type-II Superconductors, Applications of Superconductivity.

Course Outcomes:

Course Outcomes:

CO1. Ability to apply mathematical tools such as gradient, divergence, curl, and vector calculus in analyzing electromagnetic fields and waves.
CO2. Understanding of the principles of quantum mechanics and its relevance in explaining phenomena like uncertainty principle and matter waves.
CO3. Familiarity with the operation and applications of lasers, including different types of lasers and their practical uses.
CO4. Knowledge of optical fiber communication principles, including acceptance angle, numerical aperture, modes of propagation, and dispersion effects.
CO5. Proficiency in analyzing magnetic materials and their applications, as well as understanding the principles and applications of superconductivity.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

- Introduction to special theory of Relativity by Robert Resnick (Wiley)
- Quantum mechanics by Schiff.
- Quantum mechanics by Pauling & Wilson.
- Principle of Optics by B.K. Mathur.
- Optics by A.G. Ghatak 3rd edition (Tata McGrow Hill – 2005)
- Optics by Brijlal and Subramaniam (S. Chand)

Web Recourses:

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Course Code	Course Title	L	T	P	Credit
USCH-106	**Physics lab-I**	**0**	**0**	**2**	**1**

Prerequisites: Nil

Perform at least 8 practicals.

1.Self-inductance by Anderson's bridge.
2.Capacitance by de Sauty method.
3.Verification of laws of electromagnetic induction.
4.Conversion of galvanometer into ammeter. and voltmeter.
5.Study of C.R.O. as display and measuring device, Study of Sine-wave, square wave signals (half wave and full wave rectification)
6.Study of B-H curves of various materials using C.R.O, and determination of various parameters.
7.Determination of coefficient of viscosity by Stoke's method.
8.Determination of ‘e’ or ‘(e/m)’of an electron.
9.Study of Solar-Cell characterstics
10.Determination of Planck's constant using photocell.

11.Determination of velocity of ultrasonic waves in a given liquid
12. Low resistance by carey foster bridge.

Assessment and Evaluation:

(a)Lab work:10 marks
(b) Record:10 marks
(c) Viva-voice:10 marks
Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

SEMESTER–II

Course Code	Course Title	L	T	P	Credit
USCH-151	**Inorganic Chemistry-II**	**4**	**0**	**0**	**4**

Prerequisites: Nil

Course Objectives:

1. To understand the general characteristics of the s and p block elements
2. To understand in detail qualitative and quantitative analysis.
3. To understand the chemistry of noble gaseous**.**

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

s-Block Elements

Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.

Theory of Precipitation: theory, purification of precipitates, co-precipitation and post precipitation.

Unit-II

Theory of Qualitative and Quantitative Inorganic Analysis

Chemistry of analysis of various groups of basic and acidic radicals, chemistry of identification of acid radicals in typical combinations. Chemistry of interferences of acid radicals including their removal in the analysis of basic radicals.

Unit-III

p-Block Elements

Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-16, hydrides of boron - diborane and higher boranes, borazine, borohydrides.

Chemistry of fullerenes, carbides, fluorocarbons, silicates (structural principle) tetrasulphur tetra nitride, basic properties of halogens, interhalogens and polyamides.

Chemistry of Noble Gases

Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

UNIT-IV

Coal, petroleum and petrochemicals

Coal tar distillation and coal tar chemicals, petroleum origin, fractionation cracking**,** reforming and aromatisation, petrochemicals, synthetic fuels, octane and cetane numbers, antiknock additives.

Course Outcomes:

CO1 To study the various properties of s and p block elements. Purification of inorganic compounds.

CO2 To study the analyse various acidic and basic radical in qualitative and quantitative inorganic chemistry**.**

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

- D.F.C. Shriver, P.W. Atkins and C.H. Langford, Inorganic Chemistry, ELBS Oxford, 1991.
- 2. J.E. Huheey, E.A. Keiter, R.L. Keiter, Inorganic Chemistry, 4th Ed, Pearson Education,
  Singapore, 1999.
- J.D.Lee, Concise Inorganic Chemistry, ELBS, Oxford 1994.

Web Resources:

Course Code	**Course Title**	**L**	**T**	**P**	**Credit**
USCH-151	**Inorganic Chemistry Lab-II**	**0**	**0**	**2**	**1**

Prerequisites: Nil

Attempt atleat 8 Experiments:

1. **Gravimetric Analysis**
   Quantitative estimations of, Cu^{2+} as copper thiocyanate and Ni^{2+} as Ni– dimethylglyoxime.
2. **Redox titrations**: Determination of Fe^{2+}, $C_2O_4^{2-}$ (using $KMnO_4$, $K_2Cr_2O_7$)
3. **Iodometic titrations:** Determination of Cu^{2+} (using standard hypo solution).
4. **Complexometric titrations:** Determination of Mg^{2+}, Zn^{2+} by EDTA.
5. Preparation of SnI_4 and its complex with pyridine
6. Preparation of $Pb(OOCCH_3)_4$ and its complex $(C_5H_5NH_2)$ $PbCl_6$ Thermal analysis of $Pb(OOCCH_3)_4$
7. **Volumetric Analysis**
   a) Acid base titrations (combinations o f s strong and weak acids and Bases)
   b) Oxidation reduction titrations (using $KMnO_4$ and $K_2Cr_2O_7$)

Assessment and Evaluation:

(a)Lab work:10 marks
(b) Record:10 marks

(c) Viva-voice:10 marks
Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

Course Code	Course Title	L	T	P	Credit
USCH-152	**Organic Chemistry-II**	**4**	**0**	**0**	**4**

Prerequisites: Nil

Course Objectives:

1. To understand the complete knowledge of alkenes and various rule of organic chemistry and some idea about peterochemicals.
2. To understand the complete knowledge ofcyclo alkenes, dienes and alkynes.

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

1. Alkenes

Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes.

Chemical reactions of alkenes mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration–oxidation, oxymercuration reduction

Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$, polymerization of alkenes, substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.

Unit-II

Cycloalkenes, Dienes and Alkynes

Methods of formation, conformation and chemical reactions of cycloalkenes.

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

Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization.

Unit-III

Arenes and Aromaticity

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

Aromaticity: the Huckel rule, aromatic ions, annulenes up to 10 carbon atoms, aromatic, anti - aromatic and non – aromatic compounds. 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/para ratio. Side chain reactions of benzene derivatives, Birch reduction. Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyl.

Unit-IV

Alky l and Aryl Halides

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms and stereochemistry of nucleophilic substitution reactions of alkyl halides, S_N2 and S_N1 reactions with energy profile diagrams. Study of elimination reactions in alkyl halides, E_1. and E_2 mechanism, substitution vs. elimination, factors affecting substitution/elimination**.** Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions.

Relative reactiviteis of alkyl halides vs. allyl, vinyl and aryl halides.

Course Outcomes:

CO1 to study the chemistry of some selected functional groups, to develop proper aptitude towards the study of organic compounds and their reactions

CO2 To learn the chemistry of alkene, cycloalkenes, alkynes and polyhalogen compounds, to understand and study Organic reaction mechanisms.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

- Organic Chemsitry, Morrison and Boyd, Prentice- Hall.
- 2. Fundamentals of Organic Chemistry, Solomons, John Wiley.
- 3. Organic Chemistry. F.A. Carey, McGraw Hill, Inc.
- 4. Organic Chemistry, L.G. Wade Jr. Prentice Hall.
- 5. Organic ChemistryVol. I, II & III, S.M. Mukherji, S.P. Singh and R.P.Kapoor, Wiley
- Eastern Ltd (New Age International).
- Introduction to organic chemistry, Stritwieser, Heathcock and Kosover, Macmilan**.**

Web Resources:

Course Code	Course Title	L	T	P	Credit

USCH-152	Organic Chemistry Lab-II	0	0	2	1

Prerequisites: Nil

Attempt atleast 8 Experiments:

1. To study the process of) sublimation of camphor and phthalic acid,

2. Systematic identification (detection of extra elements, functional groups, determination of melting point or boiling point and preparation of at least one pure solid derivative) of the following simple mono and bifunctional organic compounds: Naphthalene, anthracene, naphthene, benzyl chloride, *p*-dichlorobenzene, *m*-dinitrobenzene , *p*-nitrotoluene, resorcinol , hydroquinone, Ethyl methyl ketone, benzaldehyde, vanillin, oxalic acid, succinic acid, benzoic acid, salicyclic acid, aspirin, phthalic acid, cinnamic acid, benzamide, urea, acetanilide, benzanilide, aniline hydrochloride, p-toluidine, phenyl salicylate (salol), glucose, fructose, sucrose, *o*-, *m*-, *p*nitroanilines, thiourea

Assessment and Evaluation:

(a)Lab work:10 marks
(b) Record:10 marks
(c) Viva-voice:10 marks
Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

Course Code	Course Title	L	T	P	Credit
USCH-153	Physical Chemistry-II	4	0	0	4

Prerequisites: Nil

Course Objectives:

1. To understand the concepts of thermodynamics chemical kinetics and electrochemistry**.**

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Chemical Kinetics

Chemical kinetics and its scope, Rate of reaction, factors influencing the rate of reaction. Concentration, temperature, pressure, solvent, light, catalyst, concentration dependence of rates. Mathematical characteristics of simple chemical reactions, molecularity and order of reaction. Zero order, Ist order ,second order, third order reactions and their mathematical derivations for their rate constants. Half life period, average life period, determination of order reaction. Differential method, method of integration. Method of half life period and isolation method. Pseudo unimolecular reactions.

Unit-II

Electrochemistry-I

Electrical transport conduction in metal and in electrolyte solutions, specific conductance and equivalent conductance. Measurement of equivalent conductance. Variation of equivalent conductance and specfic conductance with dilution, migration of ions, Kohlrausch's law,

Arhenious theory of electrolyte dissolution and its limitations. Weak and strong electrolytes. Ostwold's dilution law and its uses and limitation.

Unit-III

Electrochemistry-II

Debye-Huckel onsager equation for strong electrolytes (elementary treatment only),transport number and its determination by Hittorf and moving boundary method. Application of conductivity measurements, determination of solubility product of spraningly soluble salts. Determination of degree of dissolution ,Ka for weak acids.

Unit-IV

Theromchemistry and chemical energaties

Definition of important terms used in thermochemistry. Energy changes during chemical reactions.. Derivation of Ist law of thermodynamus. Heat of reaction, enthalpy and enthalpy change. Enthalpy of formation, combustion, neutralisation, solution, vaporisation, sublimation hydration and fusion, calorfic value of foods. Bond energy and its calculation. Hess's law of heat summation and its application for the calculation of various enthalpies of reaction. Kirchhoff's equation, Spontaneous processes. Criteria of spontaneity., entropy and free energy. Why crisis of energy if conserved in nature.

Course Outcomes:

CO1 concepts in thermodynamics, different thermodynamic quantities such as heat and work and how they are measured, related or transformed from one to the other states of matter and how they depend on temperature and pressure as well as how they co-exist in phase equilibria chemical equilibrium and its relationship with themodynamic quantities

CO2 chemical kinetics; how reaction rates are measured and represented in rate laws, and applications of chemical kinetics in studying enzyme mechanisms and electrochemistry

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

- Physical Methods in Inorganic Chemistry" by R S Drago.
- "Fundamentals of Molecular Spectroscopy" by C N Banwell*Quantum Mechanics*" by E Merzbacher.
- 2. "A Text *book* of *Quantum Mechanics*" by P M Mathews and K Venkatesan.
- . "Quantum *Mechanics*" by A Messiah.
- 4. "Quantum *Mechanics*" by L Landau and E Lifshitz. 5. "Introduction to *Quantum Mechanics*" by J Griffiths David.
- "Introduction to Molecular Structure and Spectroscopy" by W A Gullory.
- "Basic Principles of Spectroscopy" by R Chang**.**
- "Molecular Structure and Spectroscopy" by Arulhas

Web Resource

Course Code	Course Title	L	T	P	Credit
USCH-153	Physical Chemistry Lab-II	0	0	2	1

Prerequisites: Nil

Perform atleast 8 experiments.

1. To determine the enthalpy of neutralisation of a weak acid/weak base vs. strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.

2. Determination of critical solution temperature for phenol-water system and study effect of impurities.

Potentiometry

1. Potentiometric titration of monobasic acids (HC & CH_3COOH) with NaOH.

2. Determination of mean ionic activity co-efficients of hydrochloric acid at different concentrations.

3. To study the effect of ionic strength on mean ionic activity coefficient of hydrochloric acid in a given solution and verify Debye-Huckel limiting law.

Thermo Chemistry

1. To determine heat capacity of a calorimeter and heat of solution of a given solid compound.
2. To determine heat of solution of Solid calcium chloride and calculate lattice energy of calcium chloride using Born-Haber cycle.
3. To determine heat of hydration of copper sulphate

Any other experiment carried out in the class.

Assessment and Evaluation:

(a)Lab work:10 marks
(b) Record:10 marks
(c) Viva-voice:10 marks
Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

Course Code	Course Title	L	T	P	Credit
USCH-154	Physics-II	4	0	0	4

Prerequisites:Nil

Course Objective:

1. Understand the fundamental principles governing the structure of crystalline solids, including crystal systems, lattice parameters, and atomic packing.

2. Explore the behavior of electrons in solids through classical and quantum theories, emphasizing Fermi level, density of states, and Fermi-Dirac distribution function.

3. Investigate optical phenomena such as interference, diffraction, and polarization, and their applications in understanding light behavior and material properties.

Course Outcomes:

1. Ability to analyze crystal structures, calculate inter-planar spacing, and determine crystallographic parameters for various materials.

2. Proficiency in explaining the behavior of electrons in solids using band theory, distinguishing between different types of materials based on their electronic properties.

3. Competence in applying principles of interference, diffraction, and polarization to interpret experimental observations and solve problems related to optics and material science.

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

UNIT – I

CRYSTAL STRUCTURE: Space lattice, Bravais lattice - unit cell, primitive cell. Lattice parameters. Crystal systems. Direction and planes in a crystal. Miller indices. Expression for inter-planar spacing. Co-ordination number. Atomic packing factor. Bragg's Law.Determination of crystal structure by Bragg's x-ray spectrometer. Crystal structures of NaCl, and diamond.

FREE ELECTRON THEORY: Elements of classical free electron theory and its limitations. Quantum theory of free electrons, Fermi level, density of states, Fermi-dirac distribution function, Thermionic emission, Richardson's equation.

UNIT – II

BAND THEORY OF SOLIDS: Origin of energy bands, Periodic Potential in a crystal, Wave function in a periodic potential, kronig, Penney Model (qualitative), E-K diagrams, Brillouin Zones, Effective mass of electron, Concept of negative effective mass and holes, Classification into metals, semiconductors and insulators, fermi energy and its variation with temperature.

UNIT – III

INTERFERENCE: Coherent Sources, Two Beam Interference by Division of Wavefront- Fresnel Biprism Interference by Division of Amplitude - Newton's Rings, Michelson Interferometer.

DIFFRACTION: Fraunhoffer Diffraction, Diffraction through Single Slit, Plane Transmission Grating, Fresnel Diffraction, Fresnel Half Period Zone, The Zone Plate.

POLARIZATION: Production of Polarized Light, Malus's Law, Double Refraction, and Interference of polarized light: Quarter Wave Plate And Half Wave Plate.

UNIT – IV

NUCLEAR PHYSICS: Natural radioactivity, successive radioactive transformations, radioactive equilibrium, radioactive series, radiometric dating.

Course Outcomes:

CO1. Ability to analyze crystal structures, calculate inter-planar spacing, and determine crystallographic parameters for various materials.

CO2. Proficiency in explaining the behavior of electrons in solids using band theory, distinguishing between different types of materials based on their electronic properties.

CO3. Competence in applying principles of interference, diffraction, and polarization to interpret experimental observations and solve problems related to optics and material science.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

1. Lasers and Non-linear Optics: B.B. Laud. (Wiley Eastern).

2. Principles of Lasers: O. Svelto (Plenum Press).

3. An Introduction to Lasers and their applications: D.C.O'Shea, W. Russell and W.T. Rhodes (Addition –Wesley).

4. Laser Theory and Applications : Thyagarajan and A. Ghatak (MacMillan)

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-154	**Physics Lab- II**	**0**	**0**	**2**	**1**

Attempt atleast 8 Experiments:

1. Determination of the wave-length of sodium light using Newton's Rings Method.
2. Determination of refractive index of prism for different wave lengths using spectrometer
3. To determine the Dispersive & Resolving Power of the Material of a given Prism using Mercury lamp.
4. To determination Wavelength of Sodium Light using Michelson's Interferometer.
5. To determine the wavelength of (1) Sodium and (2) Mercury Light using Plane Diffraction Grating.
6. To study attenuation loss in a single mode optical fibre.
7. To determine laser parameters: i) power distribution within the laser ii)beam spot size iii)wavelength
8. To study the characteristics of laser (by diode laser) i.e. monochroaticity, divergence, directionality etc
9. Study of diffraction using laser beam and thus to determine the grating element.
10. To verify the Law of Malus for Plane Polarized Light.

Assessment Model:

(a)Lab work:10 marks
(b) Record:10 marks
(c) Viva-voice:10 marks
Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

Course Code	Course Title	L	T	P	Credit
USCH-155	**Mathematics-II**	**4**	**0**	**0**	**4**

Prerequisites: Nil

Course Objectives:

1. Understand and apply fundamental principles of numerical methods for solving mathematical problems encountered in engineering and scientific contexts.
2. Develop proficiency in utilizing iterative methods, interpolation techniques, and numerical differentiation and integration for accurate computation and analysis.
3. Gain insights into the implications of numerical errors and the significance of choosing appropriate algorithms for efficient problem-solving.

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

UNIT-I

Computer Arithmetic: Floating-point representation of numbers, arithmetic operations with normalized floating-point numbers and their consequences, significant figures. Error in number representation-inherent error, truncation, absolute, relative, percentage and round-off error. Iterative Methods: Bisection, False position, Newton-Raphson method. Iteration method, discussion of convergence, Bairstow's method.

UNIT-II

Solution of simultaneous linear equations and ordinary differential equations: Gauss-Elimination methods, pivoting, Ill-conditioned equations, refinement of solution. Gauss-Seidal iterative method, Euler method, Euler modified method, Taylor-series method, Runge-Kutta methods, Predictor-Corrector methods.

UNIT-III

Interpolation and Approximation: Polynomial interpolation: Newton, Lagranges, Difference tables, Approximation of functions by Taylor Series.
Chebyshev polynomial: First kind, Second kind and their relations, Orthogonal properties.

UNIT-IV

Numerical Differentiation and integration: Differentiation formulae based on polynomial fit, pitfalls in differentiation, Trapezoidal & Simpson Rules, Gaussian Quadrature.

Course Outcomes:

CO1. Demonstrate the ability to employ various numerical techniques, such as floating-point arithmetic, iterative methods, and polynomial interpolation, to solve mathematical problems encountered in engineering applications.

CO2. Apply numerical methods effectively to solve simultaneous linear equations, ordinary differential equations, and problems requiring interpolation and approximation, with an understanding of their limitations and convergence properties.

CO3. Utilize numerical differentiation and integration techniques, including Gaussian quadrature and Simpson's rule, to accurately evaluate derivatives and integrals, and assess the associated errors to ensure reliable computational results.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

1.Shanti Narayan – Differential Calculus.
2.Shanti Narayan - Integral Calculus.
3.B.S. Grewal – Higher Engineering Mathematics**.**

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-156	FUNDAMENTALS OF COMPUTERS	1	0	0	1

Prerequisites: Nil

Course Objectives:

- To gain knowledge about computers
- To effectively use MS office for creating their documents
- To learn the use of computers for basic statistics using excel
- To learn the use of internet services for research and documentation
- To learn about the various applications of computers in medical sciences

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

UNIT 1:

Computer Fundamentals: Block structure of computer, Characteristics of computers, Problem solving with computers, Generation of computers, Classification of computers.

Memory: Computer memory, Types of memory, Memory hierarchy. Overview of Secondary storage devices.

UNIT 2:

Computer languages: machine language, assembly language, high level language. Compiler, Interpreter, Assembler. System software, Application software.

Introduction to MS Office: MS word, MS excel, MS Access, MS PowerPoint**.**

UNIT 3:

Operating system: Types of operating systems, Functions of an operating system. Introduction to WWW and Web Browsers.

Basic of Computer networks: LAN, MAN, WAN. Data network and communication: Network types, Transmission mode. Concept of Internet: Applications of Internet, ISP. Search Engines, Understanding URL, IP Address**.**

UNIT 4:

Basics of electronic mail (E-mail). ICT. Web technologies: Introduction to HTML, XML and Programming languages.
Applications of Computers in different fields of medical sciences.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

1. Computer fundamentals: P. K. Sinha, BPB
2. Teach yourself all about computers: Barry Press and Marcia Press, IDG Books India

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-156	**FUNDAMENTALS OF COMPUTERS LAB**	**0**	**0**	**2**	**1**

Prerequisites: Nil

Perform any 8 experiments.

List of Practical:

1. Study of the various components of computers.
2. Internal and External DOS commands.
3. Studying the windows operating system.
4. Exploring MS Office suite.
5. Create a document using MS word and its features.
6. Create a spreadsheet using MS excel and its features.
7. Create a presentation using MS PowerPoint and its features**.**
8. Web browser and Email features.
9. Study of different HTML tags.
10. Create a HTML web page to show personal information.
11. Create HTML web pages using hyperlinks.
12. Create a database in MS Access to store information with the required field.

Assessment and Evaluation:

(a)Lab work:10 marks
(b) Record:10 marks
(c) Viva-voice:10 marks
Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

SEMESTER-III

Course Code	Course Title	L	T	P	Credit
USCH-201	**Inorganic Chemistry-III**	**4**	**0**	**0**	**4**

Prerequisites:Nil

Course Objective: 1. To study about the Chemistry of d-Block Elements

2. To know about Coordination Compounds

3. To study Oxidation and reduction reactions

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Co-ordination Compounds

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds isomerism in coordination compounds, valence bond theory of transition metal complexes.

Unit-II

Oxidation and Reduction

Use of redox potential data - analysis of redox cycle, redox stability in water - Frost, Latinmer and Pourbaix diagrams, Principles involved in the extraction of elements.
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 liquid SO_2.

Unit-III

Chemistry of Elements of First Transition Series-I

Definition, characteristic properties of d-block elements. Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

Unit-IV

Chemistry of Elements of First Transition Series-II

Chemistry of Ti, V, Cr, Mn, Fe and Co in various oxidation states.
Titanium – oxides, oxyions, peroxides and halides
Vanadium – halides, oxides, vanadates and vanadyl compounds
Chromium – halides, oxides, chromates & oxyhalides
Manganese – oxides, permanganates, halides & acetates
Iron – oxides and iron compounds
Cobalt – oxides, sulphates, halides and Co(III) complexes.

Course Outcomes: :

CO1. You will have a broad knowledge of the principles and concepts of contemporary inorganic chemistry.

CO2.you can discuss and define the chemical properties of main group compounds.
CO3.you can elucidate the electronic structure of a variety of d-metal complexes.
CO4.you can describe the structure and properties of different classes of transition metal oxides
CO5.you can explain the occurrence of superconductivity and magnetic order in solids
CO6.you understand the applications of battery materials and supercapacitors

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading: 1. Cotton F.A., Wilkinson G.W. and Gaus P.L., Basic Inorganic Chemistry, Pubs: John Wiley & Sons ,1987.

2. Lee J.D., Concise Inorganic Chemistry, 4th edition, Pubs:

ELBS,1991.

3. Huheey J.E., Keiter E.A., Keiter R.L., Inorganic Chemistry : Principles of Structures and Reactivity; 4th Edition, Pubs: Harper Collins, 1993.

4. Greenwood N.N. and Earnshaw A., Chemistry of the Elements, 2nd edition., Pubs: Butterworth/Heinemann, 1997.

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-201	**Inorganic Chemistry Lab-III**	**0**	**0**	**2**	**1**

Prerequisites: Nil

Attempt atleast 8 experiments:

1. Preparation of any two of the following complexes and measurement of their conductivity:

(i) tetraamminecarbonatocobalt (III) nitrate

(ii) tetraamminecopper (II) sulphate

(iii) potassium trioxalatoferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, $MgCl_2$ and $LiCl_3$.

2. Analysis of $CaC_2O_4.H_2O$ by using thermogravimetry.

3. Complexometric titrations involving EDTA for quantitative determination of individual cation/mixture of cations.

Assessment and Evaluation:

(a)Lab work:10 marks

(b) Record:10 marks

(c) Viva-voice:10 marks

Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

Course Code	Course Title	L	T	P	Credit
USCH-202	**Organic Chemistry-III**	**4**	**0**	**0**	**4**

Prerequisites:Nil

Course Objectives:

1. To study about Alcohols and Phenols

2. To know about Epoxides

3. To study Ultraviolet (UV) absorption spectroscopy

4. To promote interest in Carboxylic Acids &Acid Derivatives

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit–I

Alcohols

Classification and Nomenclature.

Monohydric alcohols -nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols. Industrial manufacture of methanol (from CO and H_2) and ethanol (flow sheet diagram).

Dihydric alcohols — nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement.

Trihydric alcohols -nomenclature and methods of formation, chemical reactions of glycerol.

Unit–II

1. Phenols

Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols — electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Reimer- Tiemann reaction.

Unit-III

Carboxylic Acids& Derivatives

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids. Hydroxy acids: malic, tartaric and citric acids. Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis (acidic and basic).

Unit-IV

Ultraviolet (UV) absorption spectroscopy

Ultraviolet (UV) absorption spectroscopy -absorption laws(Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. Woodward-Fieser rules, calculation of λ_{max} of simple conjugated dienes and α ,β-unsaturated ketones. UV spectra of conjugated enes, enones, dienones, α ,β-unsaturated acids, unsaturated esters, lactones, α ,β-unsaturated amides and lactams.

Course Outcomes:

CO1:Be able to explain structure, reactivity and synthesis of the important classes of organic compounds

CO2:Understand and be able to explain detailed reaction mechanisms for the important reactions in organic chemistry, including pericyclic reactions and be able to predict the chemo-, regio- and stereoselective outcome of such reactions.

CO3:Have the basic knowledge of the organic chemistry related to biomolecules**.**

CO4:Be able to plan and independently conduct modern organic chemistry laboratory work; mostly organic synthesis including working under inert atmosphere and at low temperatures.

CO5:Be able to use flash chromatography for purification of compounds and employ chromatographic techniques (GC, TLC) to follow reactions and to determine the purity of isolated compounds.

CO6:Be able to record NMR and IR spectra and employ NMR, IR, MS and UV spectra in the structure elucidation and purity determination of organic compounds. Be able to determine % ee for optically active compounds.
CO7:Be able to write a detailed laboratory journal for organic chemistry experiments and conduct the necessary safety evaluations (SJA) prior to the experiments

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

1. Morrison R.T. and Boyd P.S., Organic Chemistry, 5th Edn., Pubs: Allyn and Bacon Inc., Boston ,1992.

2. Mukerji S. M., Singh S. P. and Kapoor R. P., Organic Chemistry Vol. I/II, Pubs: Wiley Eastern Ltd., New Delhi, 1985.

3. Wade L.G.Jr., Organic Chemistry, Pubs: Prentice-Hall, 1990.

4. Solomons G., Fundamentals of Organic Chemistry, Pubs: John Wiley, 2002.

5. Carey F.A., Organic Chemistry, Pubs: McGraw-Hill, Inc, 2003.

6. Streitwisser A., Jr. and Heathcock C.H., Introduction to Organic

Course Code	Course Title	L	T	P	Credit
USCH-202	**Organic Chemistry Lab-III**	**0**	**0**	**2**	**1**

Prerequisites: Nil

Attempt atleast 8 experiments:

1. **A. Crystallization**

Concept of induction of crystallization Phthalic acid from hot water (using fluted filter paper and stemless funnel) Acetanilide from boiling water Naphthalene from ethanol Benzoic acid from water.

B. Qualitative Analysis

To perform qualitative analysis of single organic compound (hydrocarbons, aldehydes, ketones, phenols, carboxylic acids/(derivative), amines, amides, nitro compounds and carbohydrates).
I. Test for elements (other than C, H, O).
II. Functional group determination
III. Melting point, derivative preparation and Rf value determination.

C. Synthesis of organic compounds

I. Acetylation/benzolyation of salicylic acid, aniline, hydroquinone and glucose.
II. Preparation of *m*-dinitrobenzene from nitrobenzene.

Assessment and Evaluation:

(a)Lab work:10 marks

(b) Record:10 marks

(c) Viva-voice:10 marks

Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

Course Code	Course Title	L	T	P	Credit
USCH-203	Physical Chemistry-III	4	0	0	4

Prerequisites:Nil

Course Objective:

1. To study about the Thermodynamics

2. To know about Chemical Equilibrium.

3. To study Distributioln Law

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Thermodynamics-I

Important terms used in thermodynamic system, surrounding, type of system intensive and extensive property, state and path function and their differentials, thermodynamic equilibrium thermodynamic process, concept of heat and work, first law of thermodynamics, (statement and derivation). Internal energy and enthalpy, internal energy and enthalpy change and their realtion. Heat capacity. Heat capacity at constant volume and pressure and their relationship. Joule- Thomson effect and inversion temperature, calculation of W, Q, dv and the expansion of ideal gas under isothermal and adiabatic conditions for reversible processes.

Unit-II

Chemical Equilibrium

Types of Reactions (Reversible and irreversible) Equilibrium state. Le-chatelier principle. Law of mass action and its application to derive the law of chemical equilibrium. Thermodynomical derivation of law of chemical equilibrium. Equilibrium constant and free energy function, isotherms and reaction isochore, Classius - Claperon equation and its application**.**

Unit-III

Colloidal States

Colloids, classification of colloids, solids in liquids (sols) properties: Kinetic, optical and

electrical; stability of colloids, protective colloids Hardy-schulze Rule, gold number, Emulsion types of emulsion and their preparation, Emulsifier.
Gels(liquid in solids)
Classification and properties, inhibition and general application of colloids

Unit-IV

Distribution Law

Nernst distribution law, Thermodynamic derivation of Nernst distribution law. Conditions for the validity of Nernst distribution law. Derivation of molecular complexity from distribution law. Application of distribution law i.e. calculation of solubility of solute in solvent ,determination of extent of association and dissociation of solute in the solvent, distribution indicator, process of extraction and determination of degree of hydrolysis and study of complex ion formation**.**

Course Outcomes:

CO1:The student shall acquire increased knowledge of central fields in physical chemistry and be able to use this in practical work with chemical systems.
CO2:Demonstrate an understanding of gas behavior using the kinetic molecular model and different equations of state**.**

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

referred reading:

1. Physical Chemistry by P.W. Atkins, 8th Ed., Oxford University Press, 2006 (Indian Print).

2. Physical Chemistry by T. Engel & P. Reid, 1st ed., Pearson Education, 2006.

3. Physical Chemistry by Castellan, 3rd Ed., Addison Wisley/Narosa, 1985 (Indian Print)

4. Physical Chemistry by G. M. Barrow, 6th Ed., New York, McGraw Hill, 1996.

5. Physical Chemistry by R. J. Silbey, R. A. Albert & Moungi G. Bawendi, 4th Ed., New York: John Wiley, 2005.

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-203	**Physical Chemistry Lab-III**	**0**	**0**	**2**	**1**

Prerequisites: Nil

Perform atleast 8 Experiments:

I. Conductometry

1. To study the effect of concentration of electrolyte on specific and molar conductance of a strong and weak electrolyte.

2. Determination of degree of dissociation and dissociation constant of weak acid.

3. Conductometeric titration of a strong acid, a weak acid, mixture of a strong and weak acid and a dibasic acid with alkali.

4. To compare the relative strengths of weak acids like acetic acid and monochloroacetic acid by conductivity measurements.

5. To verify Debye-Huckel Onsager equation

II. Polarimetry

1. To determine the specific and molecular rotations of an optically active substance.
2. To determine the composition of an unknown solution with a polarimeter.

III. Dipole-Metry

1. To determine the dielectric constant of an unknown liquid.
2. To determine the dipole moment of a polar substance in solution.

Any other experiment carried out in the class.

Assessment and Evaluation:

(a)Lab work:10 marks

(b) Record:10 marks

(c) Viva-voice:10 marks

Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

COURSE CODE	COURSE TITLE	L	T	P	Credit
USCH-204	Analytical Chemistry	4	0	0	4

Prerequisites: Nil

Objective:

1. Understand and apply fundamental principles of analytical chemistry, including qualitative and quantitative analysis techniques, spectral analysis, thermal analysis, and electroanalytical methods.

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit I

Qualitative and Quantitative aspects of analysis:

Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution if indeterminate errors, statistical test of data; F, Q, and

T test, rejection of data, and confidence intervals. Titration and their classification in detail.

Unit II

Optical methods of analysis:

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. *UV-Visible Spectrometry:* Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument;

Infrared Spectrometry: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques.

Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromator, detector, Choice of flame and Burner designs. Techniques of atomization and sample introduction;

Unit III

Thermal method of analysis:

Theory of thermogravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

Unit IV

Electro analytical methods:

Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence point.

Course Outcome:

CO1. Demonstrate proficiency in sampling, evaluating analytical data, and assessing errors with precision, utilizing statistical tests such as F, Q, and T tests, and confidence intervals.

CO2. Apply optical methods of analysis, including UV-Visible, Infrared, and Flame Atomic Absorption and Emission Spectrometry, to analyze and interpret spectra, understand instrumentation principles, and utilize appropriate sampling techniques.

CO3. Utilize thermal analysis techniques such as thermogravimetry for quantitative estimation of specific compounds and understand the theory and techniques involved in electroanalytical methods, including pH metric, potentiometric, and conductometric titrations for determination of equivalence points

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

- Engineering Chemistry: By P.C.Jain& Monika Jain, Dhanpat Rai and Sons.
- A Text Book of Engineering Chemistry: By Shashi Chawla, Dhanpat Rai & Sons.
- Physical Chemistry: By R.P.Verma, Pardeep Publishers, Jallandhar.
- Industrial Chemistry by B.K. Sharma
- Chemistry in Engineering & Technology, Vol.I&Vol.II, Rajaram, Kuriacose (TMH).
- Physical Chemistry, P.W.Atkin (ELBS, Oxford Press)
- Chemistry of Natural products by OP Aggarwal.

- Engineering Chemistry- by A.K. Tripath,i Satya Prakashan, New Delhi.
- Stereo Chemistry of Organic Compounds by P.S. Kalsi.
- Environmental Chemistry by A.K. De , New Age International Publishers

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-205	**Communication Skills**	**2**	**0**	**0**	**2**

Prerequisites: Nil

Course Objective:

To enhance and brushing up the basic communication skills of the pupils along with their personality development**.**

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Communication Skills: Introduction, Definition, The importance of communication, the Communication Process- Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context.

Barriers to Communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional Barriers, 7 C's of Effective Communication.

Elements of Communication: Introduction, Face to Face Communication- tone of voice, Body Language (Non-Verbal Communication), Verbal communication, Physical communication.

Unit-II

Grammar and Reading skills: Parts of speech, Idioms and Phrases, one word substitution, Vocabulary building: Antonyms and Synonyms, Sentence formation: Simple sentences of all six types, Clauses, Simple, Compound and Complex sentences, Tenses, Voice, Narration, Reading Comprehension, Newspaper Reading.

Unit-III

Listening and Speaking skills: Familiarization with listening skills, Phonetics: Consonants and vowel sounds, Transcriptions, Syllables, Presentation skills, Paper reading, Extempore, Self introduction, Dialogues, Debates, Role play, Group discussion, Interview skills, Public speaking.

Unit-IV

Writing Skills: Letter writing: Personal, Official, Business and Cover letters, Good news letters and Bad news letters, Resume writing, Essay writing, Report writing, Story Writing, Précis Writing.

Course Outcomes:

CO1:Students get acquainted with the functional aspects of communication skillswith a thorough persona transformation.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

1.An Exordium by Zeenat Khan and AkankshaVashisht.
2.English Grammar and Composition by Prof. M. Krishna swami
3.High School English Grammar and Composition by Wren and Martin.
4.English Grammar and Composition by Prof. M. Krishna swami.
5.Patterns of English structures by A.S. Hornby. (Macmillian publications recommended)
6.McGraw, SJ;Basic Managerial Skills for All, Prentice Hall of India, New Delhi 1991
7.Handbook of Practical Communication Skills by Chrissie Wright
8.Business Communication by K.K.Sinha
9.The Functional Aspects of Communication Skills by Dr. P Prashad.

Web Resoursces:

Course Code	Course Title	L	T	P	Credit
USCH-206	**Human Values and Ethics**	**2**	**0**	**0**	**2**

Prerequisites: Nil

Course Objective: Equip students with skills to analyze ethical dilemmas, understand values, and apply ethics in various contexts.

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit 1:

Introduction to Human Values

1. **Definition and Importance of Human Values:**
- Understanding values and their significance in personal and professional life.
- The role of values in shaping behavior and decision-making.
2. **Types of Values**
- Personal values, social values, cultural values, and professional values.
- Examples and case studies.
3. **Value Crisis in the Contemporary World**
- Causes and consequences of value crisis.
- Ways to address and resolve value conflicts.

Unit 2:

Ethical Theories and Approaches

1. **Introduction to Ethics**
    - Definition and scope of ethics.
    - Differences between ethics, morals, and laws.
2. **Major Ethical Theories**
    - Utilitarianism, Deontology, Virtue Ethics, and Care Ethics.
    - Comparative analysis of different ethical theories.
3. **Applied Ethics**
    - Introduction to applied ethics.
    - Ethical dilemmas in various fields (business, medicine, technology, environment).

Unit 3:

Professional Ethics

1. **Definition and Scope of Professional Ethics**
    - Importance of ethics in professional life.
    - Ethical codes and standards in various professions.
2. **Professional Integrity and Accountability**
    - Concepts of integrity, honesty, and accountability.
    - Case studies and real-world examples.
3. **Ethical Issues in the Workplace**
    - Common ethical issues in the workplace (discrimination, harassment, conflicts of interest).
    - Strategies to promote ethical behavior in the workplace.

Unit 4:

Values and Ethics in Society

Role of Values and Ethics in Society

- Influence of values and ethics on social behavior and community life.
- The role of education and media in promoting ethical values.

Human Rights and Social Justice

- Understanding human rights and social justice.
- Ethical issues related to human rights and social justice.

Global Ethics and Sustainability

- Ethical considerations in global issues (poverty, inequality, environmental sustainability).
- The role of ethics in promoting sustainable development.

Course Outcomes:

CO1: Enhanced Ethical Decision-Making Skills**:** Students will critically analyze ethical dilemmas and make informed decisions using ethical theories and principles.

CO1: Informed Understanding of Professional and Social Values**:** Students will understand personal, social, cultural, and professional values and navigate conflicts effectively.

CO3: Practical Application of Ethics in Real-World Contexts**:** Students will apply ethical theories to real-world issues, resolving dilemmas and promoting ethical practices.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

Suggested Readings:

1. "Ethics: Theory and Contemporary Issues" by Barbara Mackinnon.
2. "The Fundamentals of Ethics" by Russ Shafer-Landau.
3. "Professional Ethics" by R. Subramanian.
4. "Human Values and Professional Ethics" by Rishabh Anand.

Web Resoursces:

SEMESTER-IV

Course Code	Course Title	L	T	P	Credit
USCH-251	Inorganic Chemistry-IV	4	0	0	4

Prerequisites:Nil

Course Objectives:

1. To study about the Chemistry of d-Block Elements

2. To know about metallurgy

3. To study acids and bases

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Chemistry of Elements of Second and Third Transition Series

General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry. Chemistry of Mo and W in different oxidation states.

Unit-II

Isopolyacids of Mo and W: aqueous chemistry of Mo and W(VI), isopoly molybedates and isopolytungustates.

Acids and Bases:

Arrhenius, Bronsted- Lowry, the Lux- Flood, solvent system and Lewis concepts of acids and bases relative strength of acids and bases, the levelling effect.

Unit-III

General Principles of Metallurgy

General principles of metallurgy, occurrence of metals with special emphasis on mineral wealth of India, calcinations roasting, smelting, bessimerization, various methods of concentration, purification and refining (such as parting process, zone refining, oxidation refining, electrolytic refining and solvent extraction) metallurgy of important metals like Ag, Au, Zn, Cu, Ni.

Unit-IV

Chemistry of Lanthanide Elements:

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

Chemistry of Actinides:

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides.

Course Outcomes:

CO1. Students will have a broad knowledge of the principles and concepts of contemporary inorganic chemistry.

CO2.you can discuss and define the chemical properties of main group compounds.

CO3.you can elucidate the electronic structure of a variety of d-metal complexes.

CO4.you can describe the structure and properties of different classes of transition metal oxides

CO5.you can explain the occurrence of superconductivity and magnetic order in solids.

CO6.you understand the applications of battery materials and supercapacitors

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

1. Cotton F.A., Wilkinson G.W. and Gaus P.L., Basic Inorganic Chemistry, Pubs: John Wiley & Sons ,1987.

2. Lee J.D., Concise Inorganic Chemistry, 4th edition, Pubs: ELBS,1991.

3. Huheey J.E., Keiter E.A., Keiter R.L., Inorganic Chemistry : Principles of Structures and Reactivity; 4th Edition, Pubs: Harper Collins, 1993.

4. Greenwood N.N. and Earnshaw A., Chemistry of the Elements, 2nd edition., Pubs: Butterworth/Heinemann, 1997.

5. Cotton F.A. and Wilkinson G., Murillo C.A., Bochmann M., Advanced Inorg. Chemistry, 6th Edition, Pubs: John Wiley & Sons. Inc., 1999.

6. Shriver D.F., Atkins F.W. and Langford C.M., Inorganic Chemistry; 3rd Edition, Pubs: Oxford University Press, 1999.

7. Douglas B., Daniel D. Mc and Alexander J., Concepts of Models of Inorganic Chemistry, Pubs: John Wiley,1987.

8. Gray H.B., Electrons and Chemical Bonding, Pubs: W.A., J Benjamin Inc., 1965

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-251	**Inorganic Chemistry Lab-IV**	**0**	**0**	**2**	**1**

Perform atleast 8 experiments.

Inorganic Chemistry

Indicators- selection of indicators, types

1.Acid-base titrations - Determination of the pH of household substances

2.Redox titrations - Determination of iron content in a sample using $KMnO_4$,

3. Complexometric titrations using disodium salt of EDTA

4. Estimation of Zn^{2+} using EBT / Xylenol orange as indicator

5. Estimation of Mg^{2+}

6. Estimation of Ca^{2+} by substitution method

7. To estimate the concentration of Ca in commercially available medicines.

8. To estimate the Mg present in multivitamins.

Assessment and Evaluation:

(a)Lab work:10 marks
(b) Record:10 marks
(c) Viva-voice:10 marks
Total Assessment: Average of best seven practicals out of all the weekly practicals (30 Marks)

Course Code	Course Title	L	T	P	Credit
USCH-252	**Organic Chemistry-IV**	**4**	**0**	**0**	**4**

Prerequisites:Nil

Course Objectives:

1. To study about Aldheydes and ketones

2. To know about Diazonium salts

3. To study Infrared (IR) absorption spectroscopy

4. To promote interest in nitro compounds

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Infrared (IR) absorption spectroscopy

molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.

Hydrocarbons (saturated and unsaturated), hydroxy compounds, aldehydes, ketones, eseters, anhydrides, amides, amines and nitrocompounds. Applications of IR spectroscopy in structure

elucidation of organic compounds.

Unit-II

Amines

Structure and nomenclature of amines, physical properties. Stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Amine salts as phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles, reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide reaction. Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid.

Unit–III

Diazonium Salts:

Mechanism of diazotisation, structure of benzene diazonium chloride, Replacement of diazo group by H, OH, F, Cl, Br, I, NO_2 and CN groups, reduction of diazonium salts to hydrazines, coupling reaction and its synthetic application. Preparation and reactions of cyanides, and isocyanides, urea and diazomethane.

Nitro Compounds

Preparation of nitroalkanes and nitroarenes.and their chemical reactions. Mechanisms of electrophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid. Halonitroarenes: reactivity.

Unit–IV

Aldehydes and Ketones

Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, advantage of oxidation of alcohols with chromium trioxide (Sarett reagent) pyridinium chlorochromate (PCC) and pyridinium dichromate. synthesis of aldehydes and ketones using 1,3-dithianes,Gatterman aldehyde synthesis , Gatterman Koch reaction, synthesis of ketones from nitriles and from carboxylic acids. Physical properties. Comparison of reactivities of aldehydes and ketones. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, Aldol, Perkin and Knoevenagel condensations . Condensation with ammonia and its derivatives. Wittig reaction. Mannich Reaction, Michael reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyer–Villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions. Halogenation of enolizable ketones. An introduction to α ,β- unsaturated aldehydes and ketones.

Course Outcomes: :

CO1:Be able to explain structure, reactivity and synthesis of the important classes of organic compounds

CO2:Understand and be able to explain detailed reaction mechanisms for the important reactions in organic chemistry, including pericyclic reactions and be able to predict the chemo-, regio- and stereoselective outcome of such reactions.

CO3:Have the basic knowledge of the organic chemistry related to biomolecules.

CO4:Be able to plan and independently conduct modern organic chemistry laboratory work; mostly organic synthesis including working under inert atmosphere and at low temperatures.

CO5:Be able to use flash chromatography for purification of compounds and employ chromatographic techniques (GC, TLC) to follow reactions and to determine the purity of isolated compounds.

CO6:Be able to record NMR and IR spectra and employ NMR, IR, MS and UV spectra in the structure elucidation and purity determination of organic compounds. Be able to determine % ee for optically active compounds.

CO7:Be able to write a detailed laboratory journal for organic chemistry experiments and conduct the necessary safety evaluations (SJA) prior to the experiments.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

1. Morrison R.T. and Boyd P.S., Organic Chemistry, 5th Edn., Pubs: Allyn and Bacon Inc., Boston ,1992.

2. Mukerji S. M., Singh S. P. and Kapoor R. P., Organic Chemistry Vol. I/II, Pubs: Wiley Eastern Ltd., New Delhi, 1985.

3. Wade L.G.Jr., Organic Chemistry, Pubs:Prentice-Hall,1990.

4. Solomons G., Fundamentals of Organic Chemistry, Pubs: John Wiley,2002.

5. Carey F.A., Organic Chemistry, Pubs: McGraw-Hill, Inc, 2003.

6. Streitwisser A., Jr. and Heathcock C.H., Introduction to Organic

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-252	**Organic Chemistry Lab-IV**	**0**	**0**	**2**	**1**

Perform atleast 8 experiments.

Organic Chemistry

1. Systematic identification (detection of extra elements, functional groups, determination of melting point or boiling point and preparation of at least one pure solid derivative) of the following simple mono and bifunctional organic compounds:
ethyl-methyl ketone, benzaldehyde, vanillin, oxalic acid, succinic acid, benzoic acid, salicyclic acid, aspirin, phthalic acid, cinnamic acid, benzamide, urea, acetanilide,benzamide, aniline hydrochloride, p-toluidine, phenyl salicylate (salol), glucose, fructose, sucrose, o-,m-, p-nitroanilines, thiourea.
2. Equivalent weight of acid (neutralization and silver salt method).
3. Estimation of phenol (bromide- bromate method) and aniline (bromide - bromate and acetylation method).

Assessment and Evaluation:

(a)Lab work:10 marks
(b) Record:10 marks
(c) Viva-voice:10 marks

Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

Course Code	Course Title	L	T	P	Credit
USCH-253	**Physical Chemistry-IV**	**4**	**0**	**0**	**4**

Prerequisites:Nil

Course Objectives:

1. To study about the Thermodynamics

2. To know about Chemical Equilibrium.

3.To study about the corrosion**.**

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Thermodynamics – II

Second law of thermodynamics. Need of the law, different definitions of the law, Carnot Cycle and its efficiency. Carnot theorem. Thermodynamic scale of temperature.
Concept of entropy, entropy as a state function of V and T, entropy as a function of P and T. Entropy change in physical processes. Clausius inequility. Entropy as criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases, work function, Gibb,s free energy function. Gibbs function (G) and Helmholtz function (A) as thermodynamic function. Criteria of spontaneity of reversible processes in terms of enthalpy change, entropy change, work function and free energy function. Variation of G and A with P,V and T.

Unit-II

Thermodynamics – III

Gibb Helmholtz equation and its application ,clausius- clapeyron equation
Nernst heat theorem. Third law of thermodynamics and its applications. Partial molar quantities. Chemical potential. Gibb's Duhem equation. Gibb,s adsorption equation and its application, variation of chemical potential with temperature and pressure

Unit-III

Electrochemistry-II

Redox reactions, electrolytic and galvanic cells. Reversible and irreversible cells reversible electrodes, types of reversible electrodes, metal electrodes, gas metal electrode, metal insoluble salt on ions and redox electrodes, electrode reactions, cell voltage ,function of salt bridge, electrode potential and its determination. Standard hydrogen electrode, reference electrode, standard cell, sign convention. Electrochemical series and its significance.
Nernst equation for a reversible electrode and cell. Calculation of thermodynamic

quantities of a cell reaction ΔG, ΔH and K. Polarisation over potential and hydrogen over voltage.

Unit-IV

Chemical Kinetics

Experimental methods of chemical kinetics: conductometric , potentiometric , optical method ,polarimetery and spectrophotometer. Theories of reaction rates, effect of temperature on rate of reaction. Simple collision theory based upon transition state, hard sphere model theory (equilibrium hypothesis). Expression for the rate constants based on equilibrium constant their thermodynamic aspect

Electrochemistry-III

Definition of pH. Determination of pH using hydrogen, quinhydron and glass electrode by potentiometric method. Buffers solution, Buffer action, Henderson - Hazel equation. Hydrolysis of salts, corrosion, types, theories and methods of controlling it.

Course Outcomes:

CO1:The student shall acquire increased knowledge of central fields in physical chemistry and be able to use this in practical work with chemical systems.

CO2:Demonstrate an understanding of gas behavior using the kinetic molecular model and different equations of state

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

1. Physical Chemistry by P.W. Atkins, 8th Ed., Oxford University Press, 2006 (Indian Print).

2. Physical Chemistry by T. Engel & P. Reid, 1st ed., Pearson Education, 2006.

3. Physical Chemistry by Castellan, 3rd Ed., Addison Wisley/Narosa, 1985 (Indian Print)

4. Physical Chemistry by G. M. Barrow, 6th Ed., New York, McGraw Hill, 1996.

5. Physical Chemistry by R. J. Silbey, R. A. Albert & Moungi G. Bawendi, 4th Ed., New York: John Wiley, 2005

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-253	**Physical Chemistry Lab-IV**	**0**	**0**	**2**	**1**

Perform any 8 experiments.

Inorganic Chemistry

Physical Chemistry

Conductance

1. Determination of cell constant.
2. Determination of equivalent conductance, degree of dissociation, and dissociation constant of a weak acid.
3. Perform the following conductometric titrations:

a) Strong acid vs strong base

b) Weak acid vs strong base**.**

Potentiometry

Perform the potentiometric titrations of (i) Strong acid vs strong base, (ii) Weak acid vs strong base and (iii) Mohr's salt vs $KMnO_4$.

Assessment and Evaluation:

(a)Lab work:10 marks

(b) Record:10 marks

(c) Viva-voice:10 marks

Total Assessment: Average of best seven practicals out of all the weekly practicals (30 Marks)

Course Code	Course Title	L	T	P	Credit
USCH-254	**Green Chemistry**	**4**	**0**	**0**	**4**

Prerequisites:Nil

Course Objectives:

1. Understand the principles and concepts of Green Chemistry and its significance in mitigating chemical waste production.
2. Explore various green processes and solvents used in chemical synthesis for sustainability and environmental friendliness.
3. Learn strategies for designing greener processes and implementing them through industrial case studies, focusing on efficiency and reduced environmental impact

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

UNIT-I

Green Chemistry- Concepts and principles, production of chemical waste, problems associatedwith it and its prevention. Green process metrics. Green Catalysis –heterogeneous, homogeneous, phase transfer, Biocatalysis, and photocatalysis**.**

UNIT-II

Green solvents – Supercritical fluids (carbon dioxide and water), water, ionic liquids and fluorous biphasic solvents.Design forefficiency – photochemical reactions, Microwaves, sonochemistry and electrochemical synthesis.

UNIT-III

Designing Greener processes – Reactors, inherent safer design, process intensification and inprocessmonitoring.Industrial case studies – greening of acetic acid manufacture, EPDM rubbers, Vitamin C, improvement in Dyeing, polyethene and eco-friendly pesticides, COFIRM, MACH 2 and INTREPID insecticides.

UNIT-IV

Green polymers - Polyaspartic acid.

Concept of atom-economy: Synthesis of ibuprofen, microbes in synthesis of adipic acid and catechol, activators for hydrogen peroxide oxidation processes. Green reactions – Strecker reaction, halide free synthesis of aromatic amines, selective methylation using dimethylcarbonate.

Course Outcomes:

CO1. Ability to identify and evaluate different green catalysis methods and solvents for chemical synthesis.
CO2. Proficiency in designing and optimizing greener processes using reactors, process intensification techniques, and in-process monitoring.
CO3. Knowledge and application of green reactions and polymers in sustainable chemical synthesis, alongside understanding atom-economy principles and eco-friendly synthesis pathways.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

- Green Chemistry: Theory and Practice" by Paul T. Anastas and John C. Warner.
- Introduction to Green Chemistry" by Albert Matlack.
- Green Chemistry: An Introductory Text" by Mike Lancaster.
- "Green Chemistry and Engineering: A Practical Design Approach" by Concepción Jiménez-González, Paul T. Anastas, et al.
- "Green Solvents: Properties and Applications in Chemistry" edited by William M. Nelson.
- "Industrial Green Chemistry: Volume 1: Introduction" edited by V. K. Ahluwalia, Dev Raj Ahuja, and Muthanna Al-Dahhan.
- "Green Techniques for Organic Synthesis and Medicinal Chemistry" edited by Wei Zhang.

- "Green Synthetic Approaches for Biologically Relevant Heterocycles" edited by Sławomir Jarosz.

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-255	**Environmental Science**	**2**	**0**	**0**	**2**

Prerequisites: It prepares students for immediate employment and graduate studies in the analysis and mitigation of environmental problems. The program focuses on science methodology and applied analysis, applying state-of-the-art field methods to the study of the natural and human environment from an interdisciplinary systems perspective.

Course Objective:

1.Very much an 'interdisciplinary' subject, environmental science degrees challenge students to combine skills and knowledge from a variety of different fields.

2.This could mean exploring aspects of biology, chemistry, physics, geography, Earth and marine sciences, and also social sciences. The idea is to combine multiple perspectives and data sources, to build up a fuller understanding of natural and human environments **.**

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

The Multidisciplinary nature of environmental studies. Scope, importance & Need for public awareness.
Natural Resources-Renewable & Non Renewable resources, Forest resources, Water Resources, Mineral Resources, Land resources- their use & over-exploitation. Food Resources- world food problems, effects of modern agriculture & overgrazing, fertilizer & pesticide problems. Soil erosion & desertification.

Unit-II

Ecosystems-Natural Ecosystems- Concept, Structure & Function, Flow of energy in Ecosystem. Biodiversity-Concept, Different levels of Biodiversity, Uses of Biodiversity, Biodiversity conservation**.**

Unit-III

Environmental Pollution- Definition, Causes Effects & Control Measures of Air, Water, Soil & noise pollution. Solid Waste Management**.**

Unit-IV

Human Population & Environment-Population growth, Population Explosion, Environment & Human Health, water conservation, Rain Water harvesting, watershed management, Environmental Ethics- Issues & possible solutions,

Course Outcomes:

CO1.Apply mathematical concepts, including statistical methods, to field and laboratory data to study scientific phenomena.

CO2.Understand the complex relationships between natural and human systems.

CO3.Design and execute a scientific project**.**

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

1.Environment Chemistry(7th Edition) A.K. De New Age International Publications.
2.Environment Chemistry by Dr. J.P. Sharma, Laxmi Publications.
3.Environment Chemistry by Dr. Suresh K. Dhameja, S.K Kataria & Sons

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-256	**Contemporary Awareness and Insights**	**2**	**0**	**0**	**2**

Prerequisites:

Course Objectives: Develop a thorough understanding of global and national geography, current events, and international organizations to analyze and address complex issues.

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

UNIT I

Current Events of National and International Importance-

Current social events
International events
Environmental events
Sports events

UNIT II

General and World Geography

Natural Resources of the world:
Landforms – Continents and oceans, mountains, plateaus and plains
Soils (introduction, classification, characteristics, Natural vegetation, Agriculture
Industry, Transport and communication

UNIT III

International Organizations

United Nations Organizations
UNESCO, UNICEF, WHO
SAARC
ASEAN

UNIT IV

Indian Geography

Natural Resources of India
Animal Husbandry and fishing.
The people, settlements and migration

Course Outcomes:

CO1: Students will analyze and interpret current global and national events, applying geographical knowledge to address real-world issues effectively.

CO2: Students will understand and evaluate the roles of international organizations and geographic factors in shaping global and national dynamics.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

Current Affairs Yearly" by Disha Experts
"Geography of the World" by McKnight's
"Indian Geography" by Majid Husain

Web Resources:

(SEMESTER-V)

Course Code	Course Title	L	T	P	Credit
USCH-301	**Inorganic Chemistry-V**	**4**	**0**	**0**	**4**

Prerequisites: Nil

Course Objectives:

1.To Know the concept of atomic structure and covalent bond

2.To understand the importance of periodic table and periodic properties

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit - I

Metal - ligand Bonding in Transition Metal Complexes:

Limitation of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the Crystal-field parameters.

Unit - II

Magnetic Properties of Transition Metal complexes:

Types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μs and μeff values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.

Thermodynamic and Kinetic Aspects of Metal Complexes:

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

Unit-III

Electron Spectra of Transition Metal Complexes:

Types of electronic transitions, selection rules of d-d transitions, spectroscopic ground states, spectrochemical series, Orgel - energy level diagram for d1 and d9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

Hard and Soft Acids and Bases (HSAB)

Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

Unit-IV

Silicon's, Phosphagens and S - N compounds:

Synthesis, properties nature of bonding, structures and applications.

Course Outcomes:

CO1: The goal of the course to know the limitation of VBT and CFT a model for bonding interaction between transition metals and ligands and also know the thermodynamic stability of the metal complexes and factor effecting the stability.

CO2: Student will study Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, LS coupling,

CO3: To know the application of magnetic moment data for 3d-metal complexes and also Types of electronic transitions, selection rules for d-d transitions,

CO4:To know theproperties and nature of bonding of phosphagens and S-N Compounds

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

- G.L.Miessler,D.A.Tarr,InorganicChemistry,3rd edition,PearsonEducation.
- B.N.Figgis,IntroductiontoLigandField,WileyEastern.A.Earnshaw,
- IntroductiontoMagnetochemistry,AcademicPress.
- J.E.Huheey,InorganicChemistryPrinciplesofStructureandReactivity,Harper

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-301	**Inorganic Chemistry Lab-V**	**0**	**0**	**2**	**1**

Perform at least 8 practicals.

1. Inorganic Synthesis:
(a)Preparation of sodium trioxalate ferrate (III) , $[Na_3[Fe(C_2O_4)_3]$ and determination of its composition by permaganatometry.
(b) Preparation of copper tetra ammine complex $[Cu\ (NH_3)_4]\ SO_4$
(c) Preparation of cis and trans- bisoxalato diaqua chromate (III) ion.
(d) Mercuric tetrathiocyanato cobaltate (II) , $Hg\ [Co(SCN)_4]$
2 (a Colorimetry: To verify Beer-Lambert law for $KMnO_4/K_2Cr_2O_7$ and determine the concentration of the given $KMnO_4/\ K_2Cr_2O_7$ solution.
(b) Solvent extraction
Separation and estimation of Fe (II) (estimation by calorimetrically)
3 Analysis of insoluble:
Only one to be given ($PbSO_4$, AgCl, AgBr., AgI, $BaSO_4$, $SrSO_4$, $CaSO_4$, CaF_2, SiO_2 and Al_2O_3)

Assessment and Evaluation:

(a)Lab work:10 marks
(b) Record:10 marks
(c) Viva-voice:10 marks
Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

Course Code	Course Title	L	T	P	Credit
USCH-302	**Inorganic chemistry-VI**	**4**	**0**	**0**	**4**

Prerequisites: Nil

Objective:
1.To introduce the basic organometallic concepts.
2.To understand the formation of Essential and Trace elements in biological processes, Haemoglobin and myoglobin, vitamin B_{12}

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit – I

Organometallic Chemistry-I
Definition, Nature of Metal Carbon bond, classification of organometallic compounds by bond types viz. I) covalent ii) Ionic iii) Electron deficient iv) cluster compounds v) □bond compounds including sand witch derivatives. Structure and bonding in, metal-ethylenic, metal-acetylenic complexes,

Unit – II

Organometallic Chemistry-II
Structure and bonding in Metal carbonyls, cyclopentadienyl derivative, Applications of organometallic compounds as homogeneous catalysts in hydrogenation,hydroformylation, polymerization, oligomerization and metathesis reactions of alkenes and alkynes (Ziegler - Natta polymerization of ethylene and propylene.)

Unit –III

Bio- Inorganic Chemistry:
Essential and Trace elements in biological processes, bioinorganic chemistry of Haemoglobin and myoglobin, vitamin B_{12}, carboxypeptidase A and chlorophyll, Biological role of alkali and alkaline earth metal ions with nitrogen fixation (special Reference to Ca^{2+}.

Unit-IV

Medicinal Chemistry:
Medicinal aspects of some metal complexes - platinum metal complexes as anticancer agents and their probable mechanism, anticancer activity of cu, Co and Au complexes.Antibacterial and antiviral activity of metal complexes.

Corrosion and Passivity:

Theories of corrosion, prevention of corrosion of metals, passivity.

Course Outcomes:

CO1:To understand the nature of metal carbon bond . structure and bonding in metal-ethylenic complexes
CO2:To know the concept of structure and bonding in metal carbonyls and application of metal carbonyl
CO3: Student will know the importance of bio inorganic chemistry
CO4: To know the concept of medicinal chemistry and theories of corrosion

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

- G.L.Miessler,D.A.Tarr,InorganicChemistry,3rd edition,PearsonEducation.
- B.N.Figgis,IntroductiontoLigandField,WileyEastern.A.Earnshaw,
- IntroductiontoMagnetochemistry,AcademicPress.
- J.E.Huheey,InorganicChemistryPrinciplesofStructureandReactivity,Harper
-

Web Recourses:

- **www.chemistryclassroom.com**

COURSE CODE	COURSE TITLE	L	T	P	CREDIT
USCH-303	Organic chemistry-V	4	0	0	4

Prerequisites: Nil

Objective:
1.To know the various spectroscopy techniques.
2.To know the concept of organosulfur and carbohydrates

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit–I

NMR Spectroscopy:
Principle of nuclear magnetic resonance, the PMR spectrum, number of signals, peak areas, equivalent and nonequivalent protons positions of signals and chemical shift, shielding and deshielding of protons, proton counting, splitting of signals and coupling constants, magnetic equivalence of protons. Discussion of PMR spectra of the molecules: ethyl bromide, n-propyl bromide, isopropyl bromide, 1,1-dibromoethane, 1,1,2-tribromoethane, ethanol, acetaldehyde,

ethyl acetate, toluene, benzaldehyde, acetophenone, *p*-anisidine and *p*-nitrotoluene .Simple problems on PMR spectroscopy for structure determination of organic compounds.

Unit–II

Mass Spectroscopy:

Introduction, Basic theory, Mass Spectrum, Base peak, Molecular ion and parent ion, Mass to charge ratio, Relative intensity, Fragmentation of ions, Meta stable ions, Even electron rule, Nitrogen rule, McLafferty rearrangement and ortho effect. General modes of fragmentation of simple molecules, homolytic cleavage , heterolytic cleavage, β- Cleavage, allyllic cleavage, benzyllic cleavage, Retro Diels - Alder Reaction and simple characteristic features of fragmentation in acetone, anisole, benzaldehyde, ethyl acetate, ethyl amine, ethyl bromide, toluene and isopropyl benzene.

Organosulphur Compounds

Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine. Synthetic detergents alkyl and aryl sulphonates.

Unit –III

Carbohydrates

Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and throes diastereomers. Conversion of glucose into mannose. Formation of glycols ides, ethers and esters. Determination of ring size of glucose and fructose. Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism ofmutarotation. Structures of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and Polysaccharides (starch and cellulose) without involving structure determination.

Unit – IV

Organometallic Compounds

Organ magnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions. Organ lead compounds: formation and chemical reactions. Organo cadmium compounds: formation and chemical reactions. Organo copper compounds: formation and chemical reactions.

Course Outcomes:

CO1: Students will know the various spectroscopy techniques like NMR AND PMR
CO2:Students will know various organ sulphur compounds
CO3:They will know about the carbohydrates and its types, erythro and throes diastereomers
CO4: Students will know about the various organometallic compound.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

- Total Assessment (Out of 100 Marks)
-

Preferred Reading:

- Reaction Mechanism in Organic Chemistry, S. M. Mukherjee and S. P. Singh, McMillan Publication.
- Stereochemistry-Eliel
- AdvancedOrganicChemistry–JerryMarch.
- AdvancedOrganicChemistry,F.A.Carey,R.J.Sundberg,VolumeIandII
- HighlightsofOrganicChemistry,W.J.L.Nobel;AnAdvancedTextBook.
- StereochemistryconformationandMechanism–P.S.Kalsi

Web Recourses:

Course Code	Course Title	L	T	P	Credit
USCH-303	**Organic Chemistry Lab-V**	**0**	**0**	**2**	**1**

Perform at least 8 practical.

1. Laboratory Techniques

(a) Steam distillation

Naphthalene from its suspension in water

Separation of o-and p-nitrophenols

(b) Column chromatography

Separation of fluorescein and methylene blue

Separation of leaf pigments from spinach leaves

2. Thin Layer Chromatography

Determination of Rf values and identification of organic compounds.

(a) Separation of green leaf pigments (spinach leaves may be used)

(b) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5: 1.5)

3. Paper Chromatography

Determination of Rf values and identification of organic compounds

(a) Separation of a mixture of phenylalanine and glycine. Alanine and aspartic acid. Leucine and glutamic acid . Spray reagent-ninhydrin.

(b) Separation of mixture of D, L-alanine, glycine and L-leucine using n-butanol: acetic acid water (4:1:5). Spray reagent-ninhydrin.

4. Synthesis of the following organic compounds:

(a) p-Nitro acetanilide from acetanilide and its hydrolysis to p-nitroaniline.

(b) 1,3,5-Tribromobenzene from aniline.

(c) Qhthalimide from phthalic anhydride and its rearrangement to anthranilic acid.

(d) Benzanilide from benzophenone.

5. Determination of:

(a) Acid value: Resin, Plasticizers

(b) Iodine number: Linseed oil, Castrol oil

(c) Saponification value: coconut oil, polyester

Assessment and Evaluation:

(a)Lab work:10 marks
(b) Record:10 marks
(c) Viva-voice:10 marks
Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

COURSE CODE	COURSE TITLE	L	T	P	CREDIT
USCH-304	**Organic chemistry-VI**	**4**	**0**	**0**	**4**

Prerequisites: Nil

Objective:

1.To know the various heterocyclic compounds

2.To learn about organic synthesis

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit–I

Heterocyclic Compounds

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five and six- membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline

Unit–II

1.Organo Phosphorus Compounds:

Nomenclature, Trivalent phosphorus compounds - trialkyl and triaryl phosphine (method of formation and reactions), pentavalent phosphorus compounds, organic phosphoranes, phosphorus ylides, wittig reaction. Biological role of phosphorus.

2. Polymers:

Brief history of macromolecular Science, Natural polymers: Starch, cellulose silk res in. Classification, types of polymerization: Addition, condensation and their mechanisms (free radical, ionic and coordination - Ziegler Natta Catalyst), methods of polymerization – bulk suspension, emulsion and solution.

Detailed study of following polymers with respect to synthesis, properties and applications.

(I) Phenol formaldehydes resins.

(II) Urea formaldehydes resins.

(III) Polyesters

(IV) Polyamides.

(V) Natural and synthetic rubbers.

Unit – III

1.Organic Synthesis *via* Enolates

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

2.Synthetic Dyes

Colour and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and Indigo

Unit – IV

Amino Acids, Peptides, Proteins and Nucleic Acids

Classification, structure and stereochemistry of amino acids. Acid base behavior, isoelectric point and electrophoresis. Preparation and reactions of □-amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid– phase peptide synthesis. Structures of peptides and proteins. Levels of protein structure. Protein denaturation/renaturation. Purines and pyrimidines: Introduction to purines and pyrimidines, preparation and reactions of adenine, guanine, cytosine, uracil, thymine, tautomerism in purines and pyrimidines. Nucleic acids: introduction. Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

Course Outcomes:

CO1: Students will know the aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions

CO2: Students will know various organophosphorus compounds and polymers in details

CO3:They will know organic synthesis via enolates and synthetic dyes

CO3: Students will know about the various amino acids, peptides, proteins and nucleic acids and their preparations.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

- Reaction Mechanism in Organic Chemistry, S. M. Mukherjee and S. P. Singh, McMillan Publication.
- Stereochemistry-Eliel
- AdvancedOrganicChemistry–JerryMarch.
- AdvancedOrganicChemistry,F.A.Carey,R.J.Sundberg,VolumeIandII
- HighlightsofOrganicChemistry,W.J.L.Nobel;AnAdvancedTextBook.
- StereochemistryconformationandMechanism–P.S.Kalsi

Web Recourses:

Course Code	Course Title	L	T	P	Credit
USCH-305	Physical chemistry-V	4	0	0	4

Prerequisites: Nil

Objective:

1:To know solution and collective-properties and rotational spectroscopy.

2: To learn about phase equilibrium and photochemistry.

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Solution and collective – properties

Ideal and Non-ideal solution. Methods of expressing concentrations of solution, activity and activity coefficient. Dilute solution. Colligative properties, Raoults law. Relative lowering of vapour pressure. Molecular weight determination, osmotic law of osmotic pressure and its measurements. Determination of molecular weight by osmotic pressure method. Elevation of boiling point and depression in freezing point. Thermodynamic derivation of relation between molecular weighty and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass. Degree of dissociation and association of solutes.

Unit-II

Rotational Spectroscopy

Introduction of electromagnetic radiations, regions of the spectrum, basic features of different spectrometers. Statement of the Born-Openheimer approximation, degree of freedom. of diatomic molecule. Energy level of a rigid rotor (semiclassical principle) selection rule, spectral intensity. Distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of nonrigid rotator. Isotopic effect

Unit –III

Phase equilibrium

Statement and meaning of the terms phase, component and degree of freedom. Phase rule and its thermodynamic derivation, phase equilibria of one component system, water and sulfur system, phase equilibria of two component system, solid-liquid equilibria, simple eutectic (Bi-Cd; Pb-silver system), De-solverisation of lead. Solid solution: Compound formation with congruent melting point (Mg-Cu) and incongruent melting point (NaCl-Cu) ($FeCl_3$ and $CuSO_4$ - H_2O) system freezing mixture, acetone, dry ice

Unit –IV

Photo Chemistry:

Interaction of radiation with matter. Photo chemical reactions and their difference with thermal reaction law of photo chemistry. Grothus, Drapper law Stark Einstein law, Lambert law, Beer's law. Jablonski diagram depicting various processes occurring in the excited state qualitative description of Fluorescence, phosphorescence non-radiation processes (internal conversion, inter system crossing) quantum yield photosensitized reactions energy transfer processes (some simple examples).

Course Outcomes:

CO1:Will be able to know methods of expressing concentrations of solutions, activity and activity coefficient. Dilute solution, Colligative properties, Raolut's law
CO2: will able to know rotational spectra of the molecules, determination of the bond length, isotopic effect
CO3:Further students know statement and meaning of the terms phase, component and degree of freedom
CO4: will able to know photochemical reaction and their difference

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

- IFNash:Elementsofclassicalandstatisticalthermodynamics
- Pitts: photochemistry
- IPrigogine:Introductiontothermodynamicsofirreversibleprocesses
- TLHill:Introductionto spectroscopy

Web Recourses:

Course Code	Course Title	L	T	P	Credit
USCH-305	**Physical Chemistry Lab-V**	**0**	**0**	**2**	**1**

Perform at least 8 practicals.

Distribution Law
i) To study the distribution of Iodine between H_2O and CCl_4
ii) To study distribution of benzoic acid in benzene and water. To study the equilibrium constant of complex reach e.g. $I^- + I_2 - I_3^-$
Buffer Solution:
Preparation of buffer solution.
(NH_4Cl, NH_4OH) CH_3CooH and CH_3 COONa and determination of pH of buffer solution.
Phase equilibrium:
To study the effect of solute (NaCl, succinic Acid) on the critical solution temperature of two partially miscible liquid (e.g. water -phenol) and to determine the concentration of that solute in the given water -phenol system.
Conductometric Titration:
(1) Determine of cell constant of the conductivity cell.
(2) Determination of solubility and solubility product of the given sparingly soluble salt.
(3) Determination of molar conductance of the salt by conductometric method.
(4) Conductometric titrations of strong acid vs strong base.
Potentiometric Titration:

(i) Potentiometric titration of strong/weak and against weak/strong base.
(ii) To titrate the given $FeSO_4$ $NH_2(SO_4)_2$ $6H_2O$ solution using $KMnO_4$/ $K_2Cr_2O_7$ as titrant and calculate redox potential of $Fe^{2+/}$ Fe^{3+} system on the hydrogen scale.
Specific Rotation (Polarimetery)
To determine the specific rotation of the given optically active compound.
Colorimetry:
(i) To verify the Lembert Beer's Law using $KMnO_4$/ $K_2Cr_2O_7$ solution.
(ii) Determination of concentration of unknown solution of substance.

Assessment and Evaluation:

(a)Lab work:10 marks
(b) Record:10 marks
(c) Viva-voice:10 marks
Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

Course Code	Course Title	L	T	P	Credit
USCH-306	Physical chemistry-VI	4	0	0	4

Prerequisites: Nil

Objective:
1.To learn the basic concept statistical thermodynamics. And nuclear chemistry.
2.To study concept of polymer chemistry.

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Statistical Thermodynamics
Need for statistical thermodynamics, thermodynamic probability, maxwell boltmann distribution statistics, Born oppenheiner approximation, partition function, and its physical significance, factorization of partition functions.
Bose Einstein and Fermi Dirac Statistics:, Fermi-Dirac statistics. Comparison of M-B, B-E, F-D statistics.

Unit-II

Nuclear Chemistry and Radioactivity:
Nature of radiation from radioactive substances nuclear structure and nuclear properties. Nuclear reaction, radioactive disintegration series, kinetics of radioactive disintegration. Artificial transmutation of elements. Nuclear fission and nuclear fusion. Radio-carbon dating, synthetic elements. Composition of nuclei forces operating within the nucleus, nuclear stability and mass energy. Types of nuclear reaction. The compound nuclear theory, scintillation counters. Activation analysis. Isotopic dilution and radioactive titration. Application

Unit-III

Polymers Chemistry
Polymerization, classification of polymers, natural and synthetic polymers. General methods of preparation. addition and condensation polymers. Number average molecular weight, Weight average molecular weight. Determination of molecular weight by

osmotic, pressure method, viscosity method, light scattering method, kinetics of condensation polymerization, kinetics of chain polymerization, kinetics of cationic, anionic and condensation polymerization. Copolymerization

Unit-IV

Physical properties and Molecular structure
Optical activity, polarization, clausius- mossotti equation, orientation of dipoles in electric field. Dipole moment, induced dipole moment, measurement of dipole moment by temperature methods and refractivity method. Dipole moment and chemical constitution, magnetic properties - paramagnetic diamagnetic ferro dynamic.

Course Outcomes:
CO1:Will have basic understanding of Statistical thermodynamics of Maxwell Boltzmann distribution law.
CO2*:* will able to knownature of radiation from radioactive substances nuclear structure and nuclear property
CO3: will know theclassification of polymers, natural and synthetic polymers. kinetics of cationic,anionic and condensation polymerization. Copolymerization
CO4: Optical activity, polarization, clausius- mossotti equation, orientation of dipoles in electric field. Dipole moment, induced dipole moment

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

- IFNash:Elementsofclassicalandstatisticalthermodynamics
- Pitts:Nonequilibriumthermodynamics
- IPrigogine:Introductiontothermodynamicsofirreversibleprocesses
- TLHill:Introductiontostatisticalthermodynamics.
- D.R. Crow Principles and Applications of Electrochemistry, 4th edition, Chapman and Hall, London, 1994.
- Bockris, Reddy, K.N.AmulyaModern Electro-Chemistry, 2nd edition, Plenum Press, New York, 1998.
- Arthur W. Adamson, Physical Chemistry of Surfaces, 4th edition, A Wiley-Interscience Publication, 1982.
- P.W. Atkins, Physical Chemistry, 3rd edition, ELBS, 1987.

Web Recourses:

- **www.physicalclassroom.com**

(SEMESTER-VI)

COURSE CODE	COURSE TITLE	L	T	P	Credit
USCH-351	Inorganic Chemistry-VII	4	0	0	4

Prerequisites: Nil

Objective:

1.To provide the knowledge of organic reagents in inorganic analysis and analytical chemistry

2.To provide concepts of solvent extraction and Ion-exchange.

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Organic Reagents in Inorganic Analysis:

Criteria for choice of organic reagents, use of following reagents in inorganic analysis:DMG, cupferron, 8-hydroxyquinoline, Nitroso β- naphthol, EDTA, Acetylacetone, dithiozone, dithiocarbamate. Advantages and disadvantages of organic reagents in inorganic analysis.

Unit – II

Introductory Analytical Chemistry: ***Data Analysis:***

Sources of errors in chemical analysis, classification of errors, precision, accuracy, statistical evaluation and interpretation of results in analytical chemistry (with numerical).

Inorganic Polymers:

General chemical aspects (synthesis, properties and structure) of phosphazenes, borazines, silicones, and condensed phosphates.

Unit - III

Solvent Extraction:

Basic principles of solvent extraction, classification and mechanism of extraction, extraction equilibria, techniques of extraction and applications in analytical chemistry**.**

Ion - Exchange:

Characteristics of ion-exchangers, mechanism of ion-exchange, ion-exchange equilibra, plate theory for ion-exchange, techniques of ion-exchange and applications of ion exchange for separations.

Unit - IV

Chromatography:

Classification of chromatographic methods, chromatographic terminology - Rf value, partition co-efficient, dynamics of chromatography, basic principles of adsorption and partition chromatography, applications**.**

Course Outcome:

CO1:Will be able to knoworganic reagents, use of following reagents in inorganic analysis:DMG, cupferron, 8-hydroxyquinoline, Nitroso β- naphthol, EDTA

CO2:Will have knowledge to sources of errors in chemical analysis, classification of errors

CO3::Able to knowbasic principles of solvent extraction, classification and mechanism of extraction

CO4:Able to knowChromatography, Classification of chromatographic methods, chromatographic terminology.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading

- A text book of macro and semi micro quantitative analysis, A.I.Vogel,
- A vogel's Text Book of Quantitive Inorganic Analysis, J. Bassett, R.C. Denney, G.B. Jaffrey and J. Menaham, Longman , London
- Synthesis and Characterisation of Inorganic compounds, W.B.Jolly, Prentice Hall, Englewood
- Synthesis and Physical studies of inorganic compounds, C.F. Bell, Pergamon Press
- Inorganic Preparations, W.G. Palmer

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-351	**Inorganic Chemistry Lab-VI**	**0**	**0**	**2**	**1**

Perform at least 8 practicals.

1. Inorganic Synthesis:
(a) Preparation of sodium trioxalate ferrate (III), $[Na_3[Fe(C_2O_4)_3]$ and determination of its composition by permaganatometry.
(b) Preparation of copper tetraamine complex $[Cu(NH_3)_4]SO_4$.
(c) Preparation of cis and trans- bisoxalato diaqua chromate (III) ion.
(d) Mercuric tetrathiocyanato cobaltate (II), $Hg[Co(SCN)_4]$.
2 (a)Colorimetry: To verify Beer-Lambert law for $KMnO_4/K_2Cr_2O_7$ and determine the concentration of the given $KMnO_4/K_2Cr_2O_7$ solution.
(b) Solvent extraction
Separation and estimation of Fe (II) (estimation by calorimetrically)
3 Analysis of insoluble:
Only one to be given ($PbSO_4$, AgCl, AgBr. AgI, $BaSO_4$, $SrSO_4$, $CaSO_4$, CaF_2, SiO_2 and Al_2O_3)

Assessment and Evaluation:

(a)Lab work:10 marks
(b) Record:10 marks
(c) Viva-voice:10 marks
Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

COURSE CODE	COURSE TITLE	L	T	P	Credit
UBCH-352	Inorganic chemistry-VIII	4	0	0	4

Prerequisites:

Objective:

After course completion the learners will be able:

1. To learn about air pollution
2. water pollution

3 Industrial Wastes and treatment processes and Nuclear and Radio- Chemistry

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Metal π Complexes:

Preparation, reactions, structures and bonding in carbonyl, nitrosyl, phosphine and related complexes, structural evidences from vibrational spectra, bonding and important reactions of metal carbonyls. Structure and bonding in metal cyanides, stabilization of unusual oxidation states of transition metals**.**

Unit-II

Photoelectron Spectroscopy: Basic principle, photoionization process, ionization energies, Koopman's theorem, ESCA, photoelectron spectra of simple molecules, (N_2, O_2 and F_2) Photoelectron spectra for the isoelectronic sequence Ne, HF, H_2O, NH_3 and CH_4, chemical information from ESCA, Auger electron spectroscopy – basic idea.

Unit-III

Nuclear and Radio- Chemistry

Composition of Nuclei, structure of nucleus, forces operative within nucleus, nuclear stability and mass energy equivalence (binding energy). Nuclear reactions: Types of nuclear reactions, the compound nucleus theories, thermonuclear reactions including fusion and fission reactions, radiation detection and measurement: gaseous ion collection methods (G.M., ionization and proportional counters) scintillation counter, semi -conductor's detectors. Tracers in Chemistry Activation analysis, isotopic dilution analysis and radiometric titrations.

Unit-IV

Non Aqueous solvents:

Introduction to non aqueous solvents. Effect of the physical properties of the solvent on the role of solvent in chemical reaction. Solvent system concept of acids and base. Elementary study of ammonia and sulphur dioxide as non aqueous solvent.

Crystal Structure:

Structures of binary compounds such as zinc blende, wurtzite, NiAs, CsCl, CaF_2, rutile, β-Crystobalite, CdI_2, BiI_3, ReO_3, corundum and Mn_2O_3, factors affecting crystal structures.

Course Outcomes: After the end of course, the student will able to:

CO1: know about Primary and secondary pollutants, sources, pollution effects and control of the following: gaseous hydrocarbons

CO2: learn characteristics of industrial wastes, types of industrial wastes

CO3: understand Nuclear reactions: Types of nuclear reactions, the compound nucleus theories.

CO4: learnTracers in ChemistryActivation analysis and Structures of binary compounds

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks

Total Assessment (Out of 100 Marks)

Preferred Reading:

- Hacking the Atom. Explorations in Nuclear Research,
- Vol. Radiochemistry and Nuclear Chemistry.
- Gregory Choppin, Jan-Olov Liljenzin, JAN RYDBERG, Christian Ekberg.
- Nuclear Magnetic Resonance. Peter Hore. Crucibles.
- Modern Nuclear Chemistry.

Web Recourses:

- Wolfram.com

Course Code	Course Title	L	T	P	Cr.
USCH-353	**Organic chemistry-VII**	**4**	**0**	**0**	**4**

Prerequisites: Nil

Course Objectives:

1.Learn biological chemistry

2. study general method of preparation of drugs

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Topics in Biological Chemistry:

Introduction to enzymes, nomenclature, characteristics, general picture of mechanism of enzymes action, co-enzymes: co-enzymes derived from niacin and thiamine, lipoic acid, co-enzyme- A, energy production in biological system, glycolysis, and tricarboxylic acid cycle.

Unit-II

Fermentation

Anaerobic and aerobic fermentation, production of alcohol, citric acid and lactic acid

Fats, Oil and Detergents:
Occurrence, chemical composition and importance, hydrogenated oils, Rancidity, acid value, sponification and iodine numbers, difference between toilet and washing soaps, comparison of soap and detergents, classification and principle of cleansing action of detergents.

Unit -III

Drugs-I
Introduction, relation of chemical structure and physiological activity with suitable examples, mechanism of chemotherapeutic action. Nomenclature of organic chemical systems, stereochemical notations. General aspects, preparation and uses of the following drugs:
(i) Analgesics and antipyretics: paracetamol, Aspirin
(i) Anti-inflammatory: Ibuprofen
(iii) Antiseptics and disinfectants Chloro cresol, povidone – Iodine

Unit –IV

Drugs-II
General aspects, preparation and uses of the following drugs:
(i) Sulpha :Su phenetamine
(ii) Local anaesthetics : Benzocaine
(iii) Anti amoebic: Metronidazole
(iv) Antimale rials: Chloroquinine
(v) Antihistamines: Chlorpheniramine Maleate
(vi) Antifungal : Undecylenic acid
(vii) Insect repellants: Dibutyl phthalate
(viii) Antibiotics Chloramphenicol
, lipoic acid, co-enzyme- A, energy production in biological system, glycolysis, and tricarboxylic acid cycle.

Course Outcomes:

CO1: Students will learn, nomenclature, characteristics, general picture of mechanism of enzymes action, co-enzymes: co-enzymes derived from niacin and thiamine.

CO2:, production of alcohol, citric acid and lactic acid. Occurrence, chemical composition and important

CO3:: Students will learn general preparation of drugs

CO4:Students will learn general preparation of drugs

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

- Human Anatomy and Physiology. Basic *Books* –
- Pharmacognosy.
- B.D. Chaurasia's Human Anatomy 4

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-353	**Organic Chemistry Lab-VI**	**0**	**0**	**2**	**1**

Perform at least 8 practicals.

1. Laboratory Techniques
(a) Steam distillation
Naphthalene from its suspension in water
Separation of o-and p-nitrophenols
(b) Column chromatography
Separation of fluorescein and methylene blue
Separation of leaf pigments from spinach leaves
2. Thin Layer Chromatography
Determination of Rf values and identification of organic compounds.
(a) Separation of green leaf pigments (spinach leaves may be used)
(b) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5: 1.5)
3. Paper Chromatography
Determination of Rf values and identification of organic compounds
(a) Separation of a mixture of phenylalanine and glycine. Alanine and aspartic acid. Leucine and glutamic acid. Spray reagent-ninhydrin.
(b) Separation of mixture of D, L-alanine, glycine and L-leucine using n-butanol: acetic acid water (4:1:5). Spray reagent-ninhydrin.
4. Synthesis of the following organic compounds:
(a) p-Nitro acetanilide from acetanilide and its hydrolysis to p-nitroaniline.
(b) 1,3,5-Tribromobenzene from aniline.
(c) Qhthalimide from phthalic anhydride and its rearrangement to anthranilic acid.
(d) Benzanilide from benzophenone.
5. Determination of:
(a) Acid value: Resin, Plasticizers
(b) Iodine number: Linseed oil, Castrol oil
(c) Saponification value: coconut oil, polyester

Assessment and Evaluation:

(a)Lab work:10 marks
(b) Record:10 marks
(c) Viva-voice:10 marks
Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

Course Code	Course Title	L	T	P	Credit
USCH-354	**Organic chemistry-VIII**	**4**	**0**	**0**	**4**

Prerequisites: Nil

Course Objective:

1. Learn aboutTerpenoids, Terpenoids
2. Study of pesticides, vitamins, hormones

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory..

Unit – I

Terpenoids :

Introduction, essential oils, classification of terpenes, isolation, isoprene rule, isolation, structure elucidation and synthesis of citral and geraniol.

Unit - II

Alkaloids

Introduction, c, general methods of determining structures, Hofman's exhaustive methylation, isolation, structure
elucidation and synthesis are of nicotine, cocaine, coniine and piperine.

Unit-III

Pesticides:

Classification, Natural pesticides: Nicotidines, Pyrethroids, Rotenoids, Sabodilia, Ryania, Synthetic pesticides: Nitrophenols , Halogens derivatives of aromatic hydrocarbons and alicyclic hydrocarbons, organo phosphorus pesticides. Preparation, reactions and uses of DDT, BHC, Malathion and Parathion.

Unit-IV

1.Vitamins

Introduction, classification, pro vitamins, occurrence, structure and deficiency diseases of vitamins A, B complex (B_1, B_2, B_6 and B_{12}), C, D, E, H and K

2.Harmones:

Introduction, functions, difference between hormones and vitamins, classification and study of Thyroxine, Adrenalin, Insulin, Testosterone, Progesterone, Estrogens, Cortisone (structure, secreting gland and functions).

Course Outcome:

CO1: Student has better idea aboutessential oils, classification of terpenes, isolation, isoprene rule.

CO2: classification, extraction, physiological action in alkaloids, general characteristics.

CO3:Student has idea ofClassification, Natural pesticides: Nicotidines, Pyrethroids, Rotenoids.

CO4: Student has better idea aboutclassification, pro vitamins, occurrence, structure and deficiency diseases of vitamins A, B complex.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks

- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

- Alkaloids. Chemistry, Biology, Ecology, and Applications. Book • Second Edition • 2015. Authors: Tadeusz
- References ... Biosynthesis of Terpenoids The Oldest Natural Products. 317. Monoterpenoids C10. 345.Sesquiterpenoids C15. 403.
- Pilocarpine and IsopilocarpinelHistidineDerived Imidazole Alkaloids. 793.

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-355	**Physical chemistry-VII**	**4**	**0**	**0**	**4**

Prerequisites: Nil

Objective:

1.To learn all spectroscopy techniques.

2.study of quantum mechanics.

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Vibrational Spectroscopy

Infrared spectrum: energy levels of simple harmonic oscillator. Selection rule. Pure vibration spectrum. Intensity determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motions and isotope on the spectrum. Idea of vibrational frequencies of different functional group, rotational - vibration spectrum. Calculation of energy of levels and selection rule

Unit-II

Raman Spectroscopy

Quantum theory of Raman effect. Classical theory of Raman effect. Pure rotational Raman spectra. Raman activity of vibration. Vibration Raman spectra. Rotation - vibration Raman spectrum. Polarization of light and Raman effect. Experimental technique. Application of Raman effect. Elementary idea of nuclear magnetic resonance. Coupling constant. Chemical shift.

Unit-III

Electronic Spectra

Concepts of potential energy curves for bonding and antibonding molecular orbitals.

Qualitative description of selection rule. Franck-Condon principle. Qualitative description of ,πand δ orbitals and their energy level and their respective transition. Elementary idea of electron spin resonance spectroscopy. Application ESR spectroscopy

Unit-IV

Quantum Mechanics:

Dual nature of matter and light. Photoelectric effect, De-Broglie equation. Heisenberg's uncertainty principle, Schrodinger wave equation and its significance. Physical interpretation of the wave function. Postulates of quantum mechanics. Particle in one and three-dimensional box.

Course Outcome:

1.Students will study : vibration spectrumenergy levels of simple harmonic oscillator. Selection rule. Pure

2.They will learn Quantum theory of Raman effect. Classical theory of Raman effect. Pure rotational

3. students will learn Electronic spectra.

4. they will study basic concept of quantum mechanics

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Readings:

- Physical Methods in Inorganic Chemistry" by R S Drago.
- "Fundamentals of Molecular Spectroscopy" by C N Banwell*Quantum Mechanics*" by E Merzbacher.
- 2. "A Text *book* of *Quantum Mechanics*" by P M Mathews and K Venkatesan.
- . "Quantum *Mechanics*" by A Messiah.
- 4. "Quantum *Mechanics*" by L Landau and E Lifshitz. 5. "Introduction to *Quantum Mechanics*" by J Griffiths David.
- "Introduction to Molecular Structure and Spectroscopy" by W A Gullory.
- "Basic Principles of Spectroscopy" by R Chang.
- "Molecular Structure and Spectroscopy" by Arulhas

Web Resources:

Course Code	Course Title	L	T	P	Credit
USCH-355	**Physical Chemistry Lab-VI**	**0**	**0**	**2**	**1**

Perform at least 8 practicals.

Distribution Law

i) To study the distribution of Iodine between H_2O and CCl_4

ii) To study distribution of benzoic acid in benzene and water. To study the equilibrium constant of complex reaches e.g. $I^- + I_2 - I_3^-$

Buffer Solution:

Preparation of buffer solution.

(NH_4Cl, NH_4OH) CH_3CooH and CH_3 COONa and determination of pH of buffer solution.

Phase equilibrium:

To study the effect of solute (NaCl, succinic Acid) on the critical solution temperature of two partially miscible liquid (e.g., water -phenol) and to determine the concentration of that solute in the given water -phenol system.

Conductometric Titration:

(1) Determine of cell constant of the conductivity cell.

(2) Determination of solubility and solubility product of the given sparingly soluble salt.

(3) Determination of molar conductance of the salt by conductometric method.

(4) Conductometric titrations of strong acid vs strong base.

Potentiometric Titration:

(i) Potentiometric titration of strong/weak and against weak/strong base.

(ii) To titrate the given $FeSO_4$ $NH_2(SO_4)_2$ $6H_2O$ solution using $KMnO_4$/ $K_2Cr_2O_7$ as titrant and calculate redox potential of $Fe^{2+/}$ Fe^{3+} system on the hydrogen scale.

Specific Rotation (Polarimeter)

To determine the specific rotation of the given optically active compound.

Colorimetry:

(i) To verify the Lambert Beer's Law using $KMnO_4$/ $K_2Cr_2O_7$ solution.

(ii) Determination of concentration of unknown solution of substance.

Assessment and Evaluation:

(a)Lab work:10 marks

(b) Record:10 marks

(c) Viva-voice:10 marks

Total Assessment: Average of best seven practical's out of all the weekly practical's(30 Marks)

Course Code	Course Title	L	T	P	Credit
USCH-356	**Physical chemistry-VIII**	**4**	**0**	**0**	**4**

Prerequisites: Nil

Objective:

1.To study theBlack Body Radiation and Molecular orbitals theory

2.To study about the catalysis and chromatography

The question paper will consist of 5 questions in all. The student has to attempt all, selecting one question each from the sections A, B, C, and D. Section E is compulsory.

Unit-I

Black Body Radiation and Molecular orbitals theory-I

Planck's law, heat capacity of solids, Bohr's model of hydrogen atom (derivation excluded) and its defects. Compton effect, molecular orbital theory, basic idea, criteria for forming molecular orbital from atomic orbitals. Construction of molecular orbital by linear combination of atomic orbital, -H_2 ion.

Unit-II

Molecular orbitals theory-II

Calculation of energy levels from wave function, physical picture of bonding and antibonding wave function. Concept of π, π^* orbitals and their characteristics. Hybrid orbital (Sp. Sp^2 and Sp^3.). Calculation of co-efficient of atomic orbitals used in these hybrid orbitals. Introduction of valence bond model of H_2, comparison of molecular orbital. and valence bond. model

Unit-III

Catalysis

Homogeneous and Heterogeneous catalysis, Enzyme catalysis. Theory of catalysis - Intermediate compound formation theory, adsorption theory, general characteristics of catalysis, positive catalysis, negative catalysis, autocatalysis, shape selective catalysis.

Unit-IV

Chromatography

Classification of chromatographic methods, principle of differential migration, nature of differential migration. Adsorption phenomenon, nature of adsorbent, solvent system. Rf-values, application basic principle of partition, paper, column, thin layer liquid-liquid partition and high performance. Liquid chromatography, paper & column, thin layer liquid-liquid partition and high-performance liquid chromatography

Course Outcome:

CO1: Students will be study of Black Body Radiation and Molecular orbitals theory

CO2: Students will become able to Calculate of energy levels from wave function, physical picture of bonding andantibonding wave function

CO3:student will understand the concept of catalysis

CO4:they will able to classify of chromatographic methods.

Assessment Model:

- Average of best four out of six Quizzes (25 Marks)-25 Marks
- Average of Two Mid-Terms (50 Marks) –20 Marks
- Attendance Marks(05 Marks)-05 Marks
- End-Term (100 Marks) – 50 marks
- Total Assessment (Out of 100 Marks)

Preferred Reading:

- Physical Chemistry" by P Atkins and J de Paula. ...
- "Physical Chemistry" by I N Levine.
- "Physical Chemistry – A Molecular Approach" by D A McQuarrie and J D Simon. ...

- “Physical Chemistry” by David Warren Ball. ...
- “Physical Chemistry” by Peter Atkins and Julio De Paula.

Web Resources: