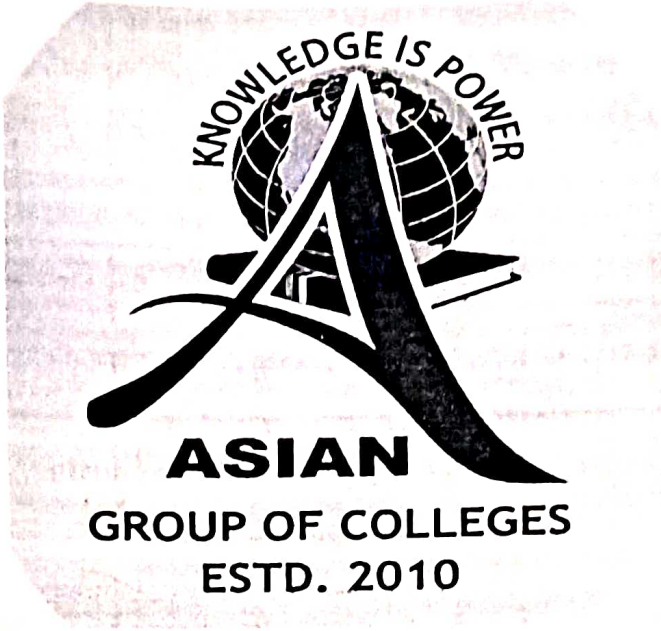
Asian Educational Institute, Patiala
(An Autonomous Body)
School of Science and Mathematics



SYLLABUS

M.Sc. (CHEMISTRY) Part-I
(Semester- I, II)
Session: 2024-25

M.Sc. (Chemistry) Part-I

Session: 2024-2025

Semester-I

Course code	Title of the paper	Hours per week			Total Credits	University Exams (hrs.)	Maximum marks		
		L	T	P			IA	SE	Total
Core Subjects									
MCHEM 1101T	Inorganic Chemistry	5	0	0	5	3	30	70	100
MCHEM 1102T	Organic Chemistry	5	0	0	5	3	30	70	100
MCHEM 1103T	Physical Chemistry	5	0	0	5	3	30	70	100
Elective Subjects									
MCHEM 1104 T	Mathematics for Chemists **or** Biology for Chemists	5	0	0	5	3	30	70	100
Practical Subjects									
MCHEM1105L	Inorganic Chemistry Lab-I	0	0	6	3.75	6	30	70	100
MCHEM1106L	Analytical Chemistry Lab	0	0	6	3.75	6	30	70	100

Note: B.Sc. (NM) students will take Biology for Chemist and B.Sc. (M) will take Mathematics for Chemist as elective subject.

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SEMESTER-I
MCHEM 1101T
Inorganic Chemistry

Max Marks: 100
Semester paper 70
Internal Assessments 30
Pass Marks: 35%

65 hours
Time allowed- 3hrs
5 period/week
Credit: 05

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions from the respective sections of the syllabus and will carry 12 marks each. Section C will consist of 11 short-answer questions from the entire syllabus and will carry 2 marks each.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions selecting two questions from each of Section A & B and Section C will be compulsory.

Course Outcomes (C.O.):

1. To have a quantum mechanical treatment of chemical bonding.
2. To study the important aspects of bioinorganic chemistry.
3. To gain an insight of the spectral and magnetic properties of metal complexes.

Section – A

Chemical Bonding: The ionic bond, covalent bond, the variation method, ground state energy of hydrogen atom, the secular equations, the molecular orbital theory, electron distribution in hydrogen molecule ion, symmetric and antisymmetric energy states, the classical interaction energy, resonance, contribution of ionic terms, sp3 hybridization, three centered bond, Linnetts doublet - quartet approach, the Pauli's exclusion principle.

Pi Bonding Ligand Complexes: Pi Acid Ligands: CO as prototype, other pi acid ligands- isocyanide ligands, dinitrogen, the CS ligands, the NO ligands, pi acid ligands: Trivalent phosphorus compound, multiple bonds from ligands to metal, pi complexes of unsaturated organic molecules: alkene & alkyne, enyl ligands, aromatic ring systems.

Chemical Bonding and structure:

i. **Ionic bonding:** Size effects, radius ratio rules and their limitations. Packing of ions in crystals, lattice energy, Born-Lande equation and its applications, Born-Haber cycle and its applications. Solvation energy, polarizing power and polarizability, ionic potential, Fazan's rules. Defects in solids. Covalent bonding: Lewis structures, formal charge. Valence Bond Theory, Molecular orbital Theory, hybridizations, VSEPR theory. Partial ionic Character of covalent bonds, bond moment, dipole moment and electro negativity differences. Concept of resonance, resonance energy, resonance structures. Schrodinger equation for the H-atom.

ii. **Coordinate bonding:** Werner theory of coordination compounds, double salts and complex salts, Lewis acid-base. Ambidentate and polydentate ligands, chelate complexes. IUPAC nomenclature of coordination compounds. Coordination numbers, Geometrical isomerism. Stereoisomerism in square planar and octahedral complexes. Hydrogen bonding. Metallic bonding: qualitative idea of band theory, conducting, semi

conducting and insulating properties.

Section – B

Chemistry of coordination compounds:

Isomerism, reactivity and stability: Determination of configuration of cis- and trans- isomers by chemical methods. Labile and inert complexes, substitution reaction on square planer complexes, trans effect. Stability constants of coordination compounds and their importance in inorganic analysis.

Elementary Crystal Field Theory: splitting of d^n configurations in octahedral, square planar and tetrahedral fields, crystal field stabilization energy; pairing energy. Jahn - Teller distortion. Metal-ligand bonding, sigma and pi bonding in octahedral complexes and their effects on the oxidation states of transitional metals.

Spectra and magnetism: Electronics spectra of complexes, Tanabe-Sugano diagrams tetragonal distortions from octahedral symmetry, charge transfer spectra, magnetic properties of complexes. Orbital and spin magnetic moments, spin only moments of and their correlation with effective magnetic moments, d-d transitions; L-S coupling, spectroscopic ground states, selection rules for electronic spectral transitions; spectro-chemical series of ligands.

Bioinorganic Chemistry: Introduction, the biochemistry of Iron: iron storage and transport ferritin, transferrin, bacterial iron transport, hemoglobin and myoglobin, nature of the heme-dioxygen binding, cooperativity in hemoglobin cytochromes, other iron-porphyrin bimolecule peroxidases & catalases, cytochrome P_{450} enzymes, other natural oxygen carriers-hemerythrins, iron-sulfur proteins. The biochemistryof other metals: zinc (carboxypetidase-A, carbonic anhydrase, metallothioneins), copper superoxide dismutase (CuZn SOD), hemocyanins, oxidases), cobalt (cyanocobalamin), molybdenum (nitrogenases) and tungsten other miscellaneous metals such as Platinum, Vanadium, Nickel, chromium. Chelates in chemotherapy, synthetic metal chelates as antimicrobial agents, lithium and mental -health, gold and its compounds, metal complexes as antitumour agents - cis platin (mechanism of action).

Recommended Books:

1. Advanced Inorganic Chemistry - Cotton and Wilkinson (3rd, 4th and 5th Ed.),1930
2. Theoretical Inorganic Chemistry - Day and Selbin, 1962.
3. Inorganic Chemistry - Shriver, Atkins and Lang Ford, 7th edition, 2010.
4. Inorganic Chemistry of Biological Processes – M.N. Hughes, 2nd edition, 1981
5. Bio-Inorganic Chemistry - R.W. Hay (John Wiley and Sons), 1984.
6. Inorganic chemistry: Principles of Structure and reactivity by James E. Huheey, E.A. Keiter, R.L.Keite,1973.

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SEMESTER-I
MCHEM 1102T
Organic Chemistry

Max Marks: 100
Semester paper 70
Internal Assessments 30
Pass Marks: 35%

65 hours
Time allowed- 3hrs
5 period/week
Credit: 05

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions from the respective sections of the syllabus and will carry 12 marks each. Section C will consist of 11 short-answer questions from the entire syllabus and will carry 2 marks each.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions selecting two questions from each of Section A and B and Section C will be compulsory.

Course Outcomes (C.O.):

1. To understand the basic concepts and mechanism in organic chemistry.
2. To have a basic idea of Aromaticity, non-aromaticity and anti-aromaticity in carbocyclic and heterocyclic compounds.
3. Students will acquire knowledge about various reactive intermediates and their participation in reactions.
4. The students will acquire knowledge of mechanistic aspects in nucleophilic substitution.
5. The students will get knowledge of mechanisms of addition reactions of C=C and C=O bonds and elimination reactions.
6. To study the molecular orbital symmetry elements and possibility of thermally and photo-chemically allowed pericyclic reactions.
7. To get an idea about the various kinetic and thermodynamic factors which control the organic reactions.

Section – A

Nature of Bonding in Organic Molecules

Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternanthydrocarbons, Huckel's Rule, anti-aromaticity, homo-aromaticity.
Introduction to fullernes

Reactive Intermediate

i. **Carbocations:** Generation, Structure, Stability, Application of NMR spectroscopy in the detection of carbocation, allylic and benzyllic carbocations. Stereochemistry and reactions.
ii. **Nonclassical carbocations:** Phenonium ion, norbornyl system, explaination based on rearrangement.
iii. **Carbanions:** Generation, Structure, stability, stereochemistry, Tautomerism, Prototropy and general reactions.
iv. **Carbenes and Nitrenes:** Formation, Structure, Singlet & Triplet carbene, Stereochemsitryand reactions.
v. **Arynes:** Formation, Structure and reactions.

vi. **Free radicals:** Formation, Structure, Stability, Stereo-chemistry and reactions.

Reactions of Free Radicals

a. Polymerisation
b. Halogenation: Chlorination, bromination, Bromination by NBS, Iodination, Fluorination, Polareffects in halogenation.
c. Addition Reactions: Free radical addition of HBr, HCl, HI thiols and halogens.(d). Auto-oxidation
d. Rearrangements

Chemistry of non-covalent interactions: Crown ethers, Cryptands, Rotaxans, Catanes

Methods used for determination of reaction mechanism
(Non-Kinetic method)
Use of optical, Stereochemical and isotopic techniques. Reaction studies from identification of products. Trapping of intermediate, crossover experiments, use of catalyst, use of isotopes in reaction mechanism studies in case of Benzyne, Claisen's and Favorskii's reactions.

Section – B

Pericyclic Reactions: Molecular Orbital symmetry, Frontier Orbitals of ethylene, 1, 3- butadiene, 1, 3, 5- hexatrience and allylsystem. Classification of Pericyclic reactions. Woodward-Hoffman rule, correlation diagrams. FMO andPMO approach.

Electrocyclic reactions: conrotatory and disrotatory motions 4n, 4n+2 and allyl systems.

Cycloadditions: Antarafacial and Suprafacial additions, 4S+2S systems and 2S+2S additions of alkene.

Sigmatropic rearrangement - Suprafacial and Antarafacial shift involving hydrogen carbon moieties. [1,3], [1,5], [1,7] [3,3] and [5,5]-sigmatropic rearrangement, Claisen and Cope rearrangement reactions.

Elimination reactions: E1, E2 and E1CB mechanism, Stereochemistry product ratio, orientation of double bond, Hofman's Rule, Saytzeff's Rule, Factors governing E1 and E2 mechanism.

Cyclic Elimination: Amine oxide, Esters, Xanthate, and Free elimination reactions, Dehalogenation by Zinc. Triple bond by elimination. Elimination versus substitution. Effect of solvent, temperature. Nature of base and structure of reactants.
Aromatic Elimination: Benzyne, Nucleophillic aromatic substitution, addition elimination.

Recommended Books

1. Modern Organic Reactions, H.C. House, Benjamin, 1972.
2. Advanced Organic Chemistry by Carey Sundberg. (Volume I and II), 2007
3. Advanced Organic Chemistry by Jerry March, 2006.
4. Pericyclic Reactions, S.M. Mukherji, Macmillan, India, 3rd edition, 2008.
5. Pericyclic Reactions by Ian Fleming (Oxford University, Press), 2015
6. Reaction Mechanism in Organic Chemistry, S.M. Mukherjii and S.P. Singh, Macmillan, 2021.

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SEMESTER-I

MCHEM 1103T

Physical Chemistry

Max Marks: 100
Semester paper 70
Internal Assessments 30
Pass Marks: 35%

65 hours
Time allowed- 3hrs
5 period/week
Credit: 05

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions from the respective sections of the syllabus and will carry 12 marks each. Section C will consist of 11 short-answer questions from the entire syllabus and will carry 2 marks each.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions selecting two questions from each of Section A & B and Section C will be compulsory.

Course Outcomes (C.O.):

1. To study advanced idea of thermodynamics.
2. To learn thermodynamic phenomenon of coupled biological reactions.
3. To provide an insight into the characteristics of different types of solutions and electrochemical phenomena.
4. To learn ionic equilibria and electrical properties of ions in solution.

Section – A

Thermodynamics

Recall: Concepts involved in first and second law of thermodynamics, Entropy, free energy and chemical equilibrium. Thermodynamic equation of state. Maxwell relations.

Non-ideal systems: Excess functions for non-ideal systems. Activity and activity coefficients and their determination. Concept of fugacity and its experimental determination. Partial molal properties and their determination.

Third law of the thermodynamics: Indentification of statistical and thermodynamic entropy.Nernst postulate, Plank's contribution. Alternate formulation of third law. Cooling by adiabatic anddemagnetisation. Evaluation of absolute entropy.

Thermodynamic and living systems: Simultaneous or coupled reactions. Coupled reactionsand metabolism. Free energy utilisation in metabolism. Terminal oxidation chain. Overall metabolicplan. General thermodynamic consideration of living systems.

Statistical Thermodynamics

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Basic introduction to statistical thermodynamics

Partition function and Thermodynamic properties: Partition function and its factorization. Translational, rotational, vibrational; electronic and nuclear partition functions. Expressions for internal energy, entropy, Helmholtz function, Gibb's function, pressure, work and heat in terms of partition function. Thermodynamic properties of ideal gases. Vibrational, rotational, electronic and nuclear contributions to the thermodynamic properties.

Section – B

Electrochemistry

Ion-solvent interactions: Born model of ion-solvent interactions, Structural models of ion - solvent interations. Experimental determination of salt-solvent interactions. Relative heat of solvation of ions in the hydrogen scale. Evaluation of ion-solvent interactions from experimental data of salt-solvent interactions.

Ion-ion interactions: Debye - Huckel theory of ion - ion interactions. Verification of Debye - Huckel limiting law. Activity, coefficients at moderate concentrations and higher concentrations. Activity coefficients as a function of ion-ion and ion-solvent interactions. Mean activity coefficients and their experimental determination.

Conductance and Ionic mobilities: Conductance of electrolytic solution. Variation of equivalent conductance with concentration. Debye - Huckel - Onsager theory. Modification of Debye - Huckel - Onsager equation. Ionic conductances. Ion-association and ion-pair formation. Ion-triplets in electrolyte solutions. Ion-triplets and conductance.

Applied Electrochemistry

Electrical Double layer: Electrokinetic phenomenon. Null point and its determination. Structure of electrical double layer, parallel plate condenser theory, diffuse layer theory and adsorption theory of double layer.

Electrocatalysis: A chemical catalyst and an electrochemical catalyst, Electrocatalysis in redox reactions. Electrocatalysis in reactions involving adsorbed species. Some specific feature of electrocatalysis.

Corrosion of Metals: Classification of corrosion processes, theories of corrosion processes, passivation of metals. Corrosion monitoring and methods of corrosion prevention.

Recommended Books

1. Bockris and Reddy, Modern Electrochemistry, Vol. I & II, 2nd edition, 1999.
2. Antropov, Theoretical Electrochemisty, 2nd edition, 1987.
3. Glasstone, Electrochemistry, 2011.
4. Aston and Fritz, Thermodynamic and Statistical Thermodynamics, 1959.
5. Lee, Seers and Turcotte; Statistical Thermodynamics, 1973.
6. Dickerson, Molecular Thermodynamics, 1970.
7. Glasstone, Thermodynamics for Chemists, 2008.

SEMESTER-I
MCHEM 1104T
Mathematics for Chemist
(For Students without Mathematics in B.Sc.)

Max Marks: 100
Semester paper 70
Internal Assessments 30
Pass Marks: 35%

65 hours
Time allowed- 3hrs
5 period/week
Credit: 05

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions from the respective sections of the syllabus and will carry 12 marks each. Section C will consist of 11 short-answer questions from the entire syllabus and will carry 2 marks each.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions selecting two questions from each of Section A and B and Section C will be compulsory.

Course Outcomes (C.O.)

After completion of this course, the students will be able to

1. Understand the topics matrices, differentiation and integration.
2. Evaluate problems of differential equation and partial differentiation.
3. Analyse basic concepts related to trigonometric functions and straight line.
4. This knowledge helps them to become expertise in all subjects of chemistry and apply them to practicalexamples.

Section – A

Matrix Algebra and Coordinate Geometry

Addition and Multiplication of Matrices, determinants (up to 3rd order), inverse, adjoint and transpose of matrices. Cartesian system of co-ordinates in the plane, slope of a line, parallel and perpendicular lines. Various forms of equations of a line: parallel to axis, slope intercept form, the point slope form, two-point form, interceptform.

Trigonometry

Degree, gradient and radian measure of positive and negative angles, relation between degree, gradient and radian, definition of trigonometric functions with the help of unit circle, Periodic functions, Concept of periodicityof trigonometric functions.

Section – B

Calculus

Differential Calculus: Functions, limit, continuity and differentiability, rules for differentiation, applications of differential calculus including maxima and minima. Partial differentiation, Euler's theorem.
Integral calculus: Basic rules for integration, integration by parts, partial fraction and substitution definite

integrals. Reduction formulae.
Elementary Differential Equations
Method of Variables - separable and exact differential equation, first order differential equations. Homogeneousand linear equations. Applications to chemical kinetics, secular equilibria, quantum chemistry etc. Solutions of differential equations by the power series method, Fourier series, solutions of harmonic oscillator and Legendre equation, spherical harmonics.

Recommended Books

1. The Chemistry Mathematics Book, E. Steiner, Oxford University Press, 1996.
2. Mathematics for Chemistry, Doggett and Sucliffe, Longman, 1995.
3. Mathematical Preparation for Physical Chemistry, F. Daniels, McGraw Hill, 1928.
4. Chemical Mathematics, D.M. Hirst, Longman, 2011.
5. Applied Mathematics for Physical Chemistry, J.R. Barrante, Prentice Hall, 2011.
6. Basic Mathematics for Chemists, Tebbutt Wiley, 1998.
7. Plane trigonometry, S.L.Loney, 2005.
8. Co-ordinate geometry, S.L.Loney, 1895.

SEMESTER-I
MCHEM 1104T
Biology for Chemist
(For Students with Mathematics in B.Sc.)

Max Marks: 100
Semester paper 70
Internal Assessments 30
Pass Marks: 35%

65 hours
Time allowed- 3hrs
5 period/week
Credit: 05

INSTRUCTIONS FOR THE PAPER SETTER
The question paper will consist of three sections: A, B, and C. Sections A and B will have four questions from the respective sections of the syllabus and will carry 12 marks each. Section C will consist of 11 short-answer questions from the entire syllabus and will carry 2 marks each.

INSTRUCTIONS FOR THE CANDIDATES
Candidates are required to attempt five questions selecting two questions from each of Section A and B and Section C will be compulsory.

Course Outcomes (C.O.):

1. The students understand the core principles & topics of Biochemistry and to enable students to acquire knowledge ofbiomolecules in biology that are based upon chemistry.
2. To increase the knowledge and understanding of principles that governs the structures of macromolecules and theirinteractions.
3. To enable students to understand function of Nucleic acids & proteins and functioning of these molecules which interact within the cell to promote proper growth, division and development.
4. To make the students understand the metabolic pathway of different biomolecules.

Section – A

Biomolecules: Introduction of biomolecules, building blocks of biomolecules.

Cell Structure & Functions:
Structure of prokaryotic & eukaryotic cells, Intracellular organelles and their functions, Comparison of plant and animal cells. Overview of metabolic process - catabolism and Anabolism. ATP - the Biological energy currency.

Cell Division: Cell division stages of mitosis & meiosis. Significance of cell division and fertilization.

Carbohydrates:
Conformation of monosaccharides, structure & functions of important derivatives of monosaccharides like glycosides, deoxy sugars, myoinositol, amino sugars, N-acetyl muramic acid, Sialic acid, disaccharide & Polysaccharides. Structural polysaccharides – cellulose, pectin and chitin. Storage Polysaccharides - starch

and glycogen.
Carbohydrates of glycoproteins and glycolipids, Ascorbic acid.
Carbohydrate metabolism - Kreb's Cycle, glycolysis, glycogenesis and glycogenolysis, gluconeogenesis, Pentose phosphate Pathway.

Lipids:
Fatty acids, essential fatty acids, structure and function of triglycerols glycerophospholipids, Sphingolipids, cholesterol, Bile acids, prostaglandins, Lipoproteins - composition and function role in atherosclerosis. Properties of lipid aggregates - micelles, bilayers, liposomes and their possible biological functions. Biological membranes. Fluid mosaic model of membrane structure.

Section – B

Structure of Proteins:
Chemical and enzymatic hydrolysis of Proteins to peptides, amino acid sequencing. Secondary structure of proteins, forces responsible for holding of secondary structure, a. triple helix, b. sheets, super secondary structure, triple helix structure of collagen/Tertiary structure of protein — folding and domain structure. Quaternary structure.

Enzymes and Hormones:
Enzymes as biological catalyst and mode of their action. Michaelis-mention equations. Enzymes classification, Allosteric enzymes, Zymogens.
Chemistry of oxytocin and tryptophan releasing harmone (TRH).

Structure of Nucleic Acids:
Purines and Pyrimidine bases of nucleic acids, base pairing via H-bonding. Structure of ribonuclic acids (RNA) and deoxyribonucleic acids (DNA), double helix model of DNA and forces responsible for holding' it Chemical and enzymatic hydrolysis of Nucleic acids.

Replication of DNA:
The chemical basis of heredity and overview of replication of DNA.

Protein synthesis & Genetic Code:
Transcription, translation and genetic code

Recommended Books

1. Principles of Biochetnistry, A.L. Lehninger, Worth Publishers, 7th Ed., 2017.
2. Biochemistry, L. Stryer, W.H. Freeman, 2015.
3. Biochemistry, J. David Rawn, Neil Patterson.
4. Biochemistry, Voet and Voet, John Wiley.
5. Outlines of Biochemistry, E.E. Conn and P.K. Stumpf, John Wiley.
   Fundamentals of Biochemistry, JL Jain, S Jain, N Jain, S. Chand.

SEMESTER-I
MCHEM 1105L
Practical Inorganic Chemistry-I

Max Marks: 100
Semester paper 70
Internal Assessments 30
Pass Marks: 35%

65 hours
Time allowed- 06hrs
7. 5 period/week
Credit: 02

Course Outcomes (C.O.):

1. Students are able to estimate metal ions and ligands in prepared complexes using titrationmethod.
2. To make the students expertize in preparation of metal complexes.
3. Students gain the knowledge about IR studies of prepared complexes.
4. Students are able to analyze total dissolved solids and chlorides in water using appropriatemethods.

PREPARATION AND ESTIMATIONS

1. Preparation of tris-thioureacuprous chloride.
2. Preparation of hexathioureaplumbousnitrate $[Pb(CH_4N_2S)_6](NO_3)_2$ and IR studies of these samples.
3. Estimation of lead.
4. Preparation of K_3 $[Fe(C_2O_4)_3]$.
5. Preparation of Hg $[Co(NCS)_4]$
6. Preparation of $(NH_3)_2HgCl_2$.
7. Estimation of Hg.
8. Mercuration of phenol and separation of the compound into o and p isomers and IR studies of these samples.
9. Preparation of $K_3[Cr(C_2O_4)_3]$
10. Estimation of oxalate.
11. Preparation of Cu_2 $[HgI_4]$.
12. Estimation of cobalt.

Water Analysis:

1. Determination of the amount of bleaching powder required to disinfect a water sample by Horrock's test.
2. Determination of chemical oxygen demand of a wastewater sample.
3. Determination of total dissolved solids dried at 103-105° C.
4. Determination of chloride content of water sample by Mohr's method or Vohlard's method

Recommended Books

1. Advanced Practical Inorganic Chemistry, Gurdeep Raj, Krishna Prakashan Media (P)Ltd.,Meerut.
2. Vogel's Qualitative Inorganic Analysis Paperback – 2012 by Svehla / Sivasankar.
3. Advanced Practical Chemistry, Jagdamba singh, LDS Yadav, Pragati Prakashan.

SEMESTER-I
MCHEM 11061,
Analytical Chemistry Practical-I

Max Marks: 100
Semester paper 70
Internal Assessments 30
Pass Marks: 35%

65 hours
Time allowed- 06hrs
7, 5 period/week
Credit: 02

Course Outcomes (C.O.):

1. Students are able to learn the principle and working of pH meter.
2. Students are able to learn the principle and working of conductometer.
3. Students are able to find the percentage purity and strength of different solutions using different methods.
4. Students are able to learn the principle and working of potentiometer and colorimeter.

SECTION-A

1. To determine the percentage purity of given sample of $ZnSO_4.7H_2O$ by complexo-metrictitration.
2. Determine the percentage purity of the given sample of $NiSO_4.7H_2O$ by complexometric titration using Eriochrome black-T.
3. To determine the composition of Calcium and Magnesium in the mixture of the given solution.
4. To find the strength of ascorbic acid in the given solution of Vitamin C tablet by titrating against
   (I) Standard I_2 solution
   (II) (II) Standard Sodium thiosulphate solution.
5. To determine the percentage purity of sample of KBr using adsorption indicator.
6. To determine the amount of H_2O_2 in the given solution by titrating against.
   (I) Standard $KMnO_4$
   (II) Standard Sodium thiosulphate solution.
7. To find out the percentage purity of KI by titrating it against standard KIO_3 solution.

SECTION-B

1. To determine the strength of HCl solution by titrating it against NaOH pH- metrically.
2. To determine the strength of acetic acid solution by titrating it against NaOH pH-metrically.
3. To determine the composition of the mixture of HCl & CH_3COOH by titrating it againstNaOH pH- metrically.
4. Determine the strength of HCl solution by titrating it against NaOH conductometrically.
5. Determine the strength of CH_3COOH solution by titrating it against NaOH conductometrically.
6. To determine the composition of the mixture of HCl & CH_3COOH by titrating it againstNaOH conductometrically.
7. Determine the strength of $FeSO_4.7H_2O$ solution by titrating it against $KMnO_4$ potentiometrically.

8. Determine the strength of $CuSO_4.7H_2O$ Colorimetrically.
9. Determine the strength of $K_2Cr_2O_7$ solution Colorimetrically.

Recommended Books

1. Advance Practical Physical Chemistry by JP Yadav. Krishna Prakashan Media
2. Advance Physical Chemistry Experiments by Gurtu & Gurtu. Pragati Parakashan
3. University Practical Chemistry by PC Kamboj Vishal Publishing Co.