Chemistry Syllabi for Academic Council

P.G. Department of Chemistry

Session 2022-23

The Heritage Institution
KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)

(Under Continuous Evaluation System)

1) Master of Science (Chemistry) Semester III and IV

2) **Bachelor of Science** Semester I to VI

3) **Bachelor of Science (Biotechnology)** Semester I, III and VI

4) **Bachelor of Science (Home Science)** Semester III and IV

5) Bachelor of Science (Hons) Maths Semester I

6) **Bachelor of Science (Hons) Physics** Semester I to IV

(Under Credit Based Continuous Evaluation Grading System)

7) Master of Science (Chemistry) Semester I to IV

FACULTY OF SCIENCES

SYLLABUS

of

Master of Science (Chemistry)

(Semester: III - IV)

(Under Continuous Evaluation System)

Session: 2022-23

The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR

(Autonomous)

KANYA MAHA VIDYALAYA JALANDHAR (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF TWO YEAR DEGREE PROGRAMME

Master of Science (Chemistry)

(Session: 2022-23)

Master of Science (Chemistry) **Semester-III**							
Course Code	**Course Name**	**Course Type**	**Marks**				**Examination time (in Hours)**
			Total	**Ext.**		**CA**	
				L	**P**		
MCHL-3081	Inorganic Chemistry-II	C	50	40	-	10	3
MCHL-3082	Organic Synthesis	C	50	40	-	10	3
MCHL-3083	Surface and Polymer Chemistry	C	50	40	-	10	3
MCHL-3084	Electrochemistry and Chemical Dynamics	C	50	40	-	10	3
MCHL-3085	Photochemistry and Pericyclic reactions	C	50	40	-	10	3
MCHP-3086	Inorganic Chemistry Practical (Preparations)	C	75	-	60	15	3*2
MCHP-3087	Physical Chemistry Practical	C	75	-	60	15	3*2
Total			400				

Master of Science (Chemistry)
(Semester-III)
Session: 2022-23
COURSE CODE: MCHL-3081
COURSE TITLE: Inorganic Chemistry-II

Course outcomes:

Students will be able to

CO1: know about the various metal ions present in our body, their function in body and role in medicine

CO2: learn about the different enzymes participating in the chemical reactions inside the body and their functions

CO3: study about the different oxygen carriers present in the body with their structure and stereochemistry

CO4: study in detail about nitrogen fixation reactions and microorganisms involved in nitrogen fixation reactions

Master of Science (Chemistry)
(Semester-III)
Session: 2022-23
COURSE CODE: MCHL-3081
COURSE TITLE: Inorganic Chemistry-II

Time: 3Hrs **Max. Marks: 50**

(Theory: 40, CA: 10)

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Metal Ions in Biological Systems-Essential and trace elements, periodic survey of essential and trace elements, biological importance and relative abundance, Na^+/ K^+ ion pump.
Transport and Storage of Dioxygen- Oxygen carriers-Hb and Mb: Structure and mechanism of their function, co-operativity, inhibition and poisoning by ligands and metal ions, hemocyanins and hemerythrin, model complexes of iron, cobalt and copper.
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UNIT-II

Bioenergetics and ATP Cycle- Process concept to phosphate hydrolysis, Nucleotide transfer- DNA polymerase, phosphate transfer pyruvate kinase, phosphoglucomutase, created kinase, ATPase
Photosynthesis andrespiration – chlorophyll : structure, function and its synthetic model.
Bioredox Agents and Mechanism- Enzymes and their functioning, Vitamin B_{12} coenzyme, its function and application in organic syntheses, intake of alcohol and its remedy.

UNIT-III

Biochemistry of Iron- Availability of iron, competition for iron, iron toxicity and nutrition.

Electron Transfer in Biology- Cytochromes-structure and function, CN^- and CO poisoning, Ferredoxin and rubredoxim. **Nitrogenase**- Biological N_2 fixation, molybdenum nitrogenase, spectroscopic and other evidence, other nitrogenases modelsystems.
Metal Storage, Transport- Ferritin, transferrin and siderophores.

UNIT-IV

Metalloenzymes- Zinc enzymes-carboxypeptidase and carbonic anhydrase, Copper enzymes- superoxide dismutase.

Calcium in Biology- Calcium in living cell, transport and regulation, molecular aspects of intramolecular processes,
Metals in Medicine- Metal deficiency and disease, toxic effects of antibiotics and related compounds, chelate therapy

Books Recommended:

1. Principles of Bioinorganic Chemistry, S. J. Lippard and Berg, University ScienceBooks.
2. Inorganic Biochemistry, Vol I and II. Ed. G. L. Eichhorn,Elsevier.
3. J.E. Huheey : Inorganic Chemistry III and IV Ed. Pearson Education Asia –(2002).
4. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, 5^{th}Edition.
5. Progress in Inorganic Chemistry, Vols 18 and 38 Ed. J. J. Lippard,Wiley
6. Bioinorganic Chemistry by D.Banergia

Master of Science (Chemistry)
(Semester-III)
Session: 2022-23
COURSE CODE: MCHL-3082
COURSE TITLE: Organic Synthesis

Course outcomes:

Students will be able to

CO1: understand general mechanistic consideration of organic rearrangements

CO2: understand synthesis and reactions of macroring compounds and fused polynuclear hydrocarbons

CO3: study the synthesis and reactions of three, four, six, seven and large membered Heterocycles

CO4: know about the use of various reagents in organic synthesis and functional group transformations

CO5: understand the basic concepts of supramolecular chemistry

Master of Science (Chemistry)
(Semester-III)
Session: 2022-23
COURSE CODE: MCHL-3082
COURSE TITLE: Organic Synthesis

Time: 3 Hrs **Max. Marks: 50**

(Theory: 40, CA: 10)

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Rearrangements: General mechanistic considerations – nature of migration, migratory aptitude, memory effects. A detailed study of the following rearrangements: Pinacol-pinacolone, Wagner-Merwein, Demjanov, Benzil-Benzilic acid, Favorskii, Arndt-Eistert synthesis, Neber, Beckmann, Hofmann, Curtius, Schmidt, Baeyer-Villiger, Shapiroreaction.

Polynuclear Compounds and Macro-Ring Compounds
Introduction, comparative study of aromatic character of Linear and non-Linear-ortho-fused polynuclear hydrocarbons, ortho-and peri-fused polynuclear hydrocarbons.General method of preparation and reactions of indene, fluorene anthracene and phenanthrene. Modern methods of synthesis of macro ring compounds-civiton, muscone and catenanes.

UNIT-II

Heterocyclic Synthesis
Principles of heterocyclic synthesis involving cyclization reactions and cycloaddition reaction.

Small Ring Heterocycles
Synthesis of aziridines, oxiranes, thiiranes and their ring opening and rearrangement reactions.

Five-Membered Heterocycles with one Heteroatom
Synthesis of Furan, Pyrrole, Thiophene and their electrophilic, nucleophilic, metallation reactions.

Six-Membered Heterocycles with one Heteroatom
Pyridine synthesis (from dicarbonyl compounds,*HantzschSynthesis*, *through cycloaddition reactions*), reactions of pyridine (electrophilic, nucleophilic, metallation), synthesis of pyrylium salts, pyrones, benzopyrylium salts, benzopyrones (coumarins, chromones) and their electrophilic, nucleophilic and addition reactions, reactivity of pyrylium and benzopyrylium salts, pyrones and benzopyrones.

Seven-and Large-Membered Heterocycles
Synthesis and reactions of azepines, oxepines, thiepines, thiazepines.

UNIT-III

Reagents in Organic Synthesis

Use of the following reagents in organic synthesis and functional group transformations; Complex metal hydrides, Gilman's reagent, lithium dimethylcuprate, lithium disopropylamide (LDA) dicyclohexylcarbodimide. 1,3-Dithiane (reactivity umpolung), trimethylsilyl iodide, tri-n-butyltinhybride, Woodward and prevost hydroxylation, osmium tetroxide, DDQ, selenium dioxide, phase transfer catalysts, crown ethers and Merrifield resin, Peterson's synthesis, Wilkinson's catalyst, Bakeryeast.

UNIT-IV

Supramolecular Chemistry

Definition and development of supramolecularchemistry, Classification of supramolecular Host- Guest compounds, Historical concepts such as receptors, coordination, lock and key analogy, Chelate and Macrocyclic effects, Preorganization and Complementarity, Thermodynamics and Kinetic selectivity, Overview of intermolecular forces such as Hydrogen bonding, Hydrophobic effects, Cation-π interactions, Ion-ion, Ion-dipole, Dipole-dipole interactions, π-π stacking, van der Waals forces, Synthesis and structure of supramolecular hosts for Recognition of cations: Crown ethers, Cryptands, Spherands, Siderophores;for Recognition of anions:Guanidinium- based receptors; for Recognition of neutral molecules: Cyclotriveratrylene (CTV).

Book Recommended:

1. Supramolecular Chemistry, Jonathan W. Steed, Jerry L. Atwood, John Wiley and Sons
2. Principles of Modern Hetrocyclic Chemistry by L.A. Paquette
3. Hetrocyclic Chemistry by J.A. Joule and K. Mills
4. Heterocyclic Chemistry by Gilrchirst

Master of Science (Chemistry)
(Semester-III)
Session: 2022-23
COURSE CODE: MCHL-3083
COURSE TITLE: Surface and Polymer Chemistry

Course outcomes:

Students will be able to

CO1: study concept of adsorption and micelle formation

CO2: learn about the different kinetics and thermodynamics of polymerization

CO3: learn about the type and classification of polymers

CO4: know about the structure, properties and utilization of polymers.

CO5: study in detail about the glass transition temperature

Master of Science (Chemistry)
(Semester-III)
Session: 2022-23
COURSE CODE: MCHL-3083
COURSE TITLE: Surface and Polymer Chemistry

Time: 3 Hrs **Max. Marks: 50**

(Theory: 40, CA: 10)

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Adsorption

Surface tension, capillary action, pressure difference across curved surface (Laplace equations), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation), surface films on liquids (Electro-kinetic phenomena), and catalytic activity at surfaces.

UNIT-II

Micelles

Surface active agents, classification of surface active agents, micellization, hydrophobic interactions, critical micellar concentration (CMC), factors affecting CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization – phase separation and mass action models, solubilization, micro emulsion, reverse micelles.

UNIT-III

Macromolecules

Polymer – definition, types of polymers, electrically conducting, fire resistant, liquids crystal polymers, kinetics of polymerization, thermodynamics ofpolymerization.
Molecular mass, number and mass average molecular mass, molecular mass determination (osmometry, viscometry, diffusion and light scattering methods), sedimentation, chain configuration of macromolecules, calculations of average dimensions of various chain structures. Importance of polymers, Basic concepts: monomers, repeat units, degree of polymerization. Linear, branched and network polymers. Classification of polymers. Polymerization: condensation, addition, radical chain-ionic and co-ordination and copolymerization. Polymerization conditions and polymer reactions.Polymerization in homogenous and heterogeneous systems. Number, weight and viscosity average weights.

UNIT IV

Structure andProperties:

Polymer structure and properties-crystalline melting point T_m-melting point of homogenous series, effect of chain flexibility and steric factors, entropy and heat of fusion. The glass transition temperature, T_g-Relationship between $T_m$and T_g, effects of molecular weight, diluents, chemical structure, chain topology, branching and chain linking. Property requirements and polymerutilization.

Books Recommended:

1. Physical Chemistry, P. W.Atkins.
2. Textbook of polymer science, F. W. Billmeyer Jr.Wiley.
3. Polymer science, V. R. Gowariker, N. V. Viswanathan and J. Sreedhar,Wiley-Eastern
4. Polymer Chemistry, Melcolm P. Stevens, Oxford University Press
5. Physical Chemistry of Polymers , A.Tager, Mir Publishers, Moscow

Master of Science (Chemistry)
(Semester-III)
Session: 2022-23
COURSE CODE: MCHL-3084
COURSE TITLE: Electrochemistry and Chemical Dynamics

Course outcomes:

Students will be able to

CO1: Understand the electrochemistry of solutions, method of determination of electrified interfaces, semiconductor electrolyte solution interface

CO2: know theory, monitoring and prevention of corrosion

CO4: understand collision theory of reaction rates, Arrhenius theory and activated complex theory, Lindemann-Hinshelwood theory

CO5: understand various Photochemical reactions, Homogeneous catalysis and kinetics of enzyme reactions, general features and methods of studying fast reactions

CO6: interpret spectra and applications of Voltammetry and Polarography.

Master of Science (Chemistry)
(Semester-III)
Session: 2022-23
COURSE CODE: MCHL-3084
COURSE TITLE: Electrochemistry and ChemicalDynamics

Time: 3 Hrs **Max. Marks: 50**

(Theory: 40, CA: 10)

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

ElectrochemistryElectrochemistry of solutions, Debye-Huckel-Onsager treatment and its extension, ion-solvent interactions, Debye-Huckel-Bjerrum mode, Thermodynamics of electrified interface equation, Derivation of electro-capillarity, Lipmann equation(surface ecess), method of determination, structure of electrified interfaces, Guoy-Chpmann, Stern models, over potential, exchange current density, derivation of Butler-Volmer equation, Tafel plot.

Semiconductor interface theory of double layer at semiconductor electrolyte solution interface, structure of double layer interfaces, effect of light at semiconductor solution interface.
Introduction to corrosion, homogeneous theory, forms of corrosion, corrosion monitoring and prevention

UNIT-II

Chemical Dynamics (A)
Methods of determining rate laws, collision theory of reaction rates, steric factor, activated complex theory, Arrhenius theory and activated complex theory, ionic reactions, kinetic salt effects,, treatment of unimolecular reactions, Lindemann-Hinshelwood theory. Dynamic Chain (hydrogen bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane),

UNIT-III

Chemical Dynamics (B)
Photochemical reactions between hydrogen-bromine and hydrogen-chlorine, oscillatory reactions (Belousov-Zhabotinsky reactions), Homogeneous catalysis and kinetics of enzyme reactions, general features of fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis, nuclear resonance.

UNIT-IV

Voltammetry and Polarography

Polarography, polarographic cells, polarogram, interpretation of polarographic waves, equation for the

polarographic waves, effect of complex formation on polarographic wave, polarograms for irreversible reactions, dropping mercury electrode, current variations during life time of a drop, merits and demerits of dme, polarographic diffusion currents, Ilkovic equation, capillary characteristics, temperature, polarograms for mixture of reactants, anodic and cathodic waves, factors affecting polarographic currents, applications of polarography, treatment of data, organic and inorganic polarographic analysis, voltammetry at solid electrodes, cyclic voltammetry and interpretation of data, , pilot-ion and standard addition method for quantitative analysis

Books Recommended:

1. Chemical Kinetics, K. J. Laddler,McGraw-Hill
2. Modern Electrochemistry Vol.1,2,3, J. Bochris and A.K.N.Reddy
3. Fundamentals of electrochemistry; P.Monk
4. Principles of Instrumental Analysis; Skoog, West; SaundresPublications

Master of Science (Chemistry)
(Semester-III)
Session: 2022-23
COURSE CODE: MCHL-3085
COURSE TITLE: Photochemistry and Pericyclic reactions

Course outcomes:

Students will be able to

CO1: classify the pericyclic reactions and explain them under thermal and photochemical conditions.

CO2: interpret the product of Pericyclic reactions (Cyclo addition, Electocyclic and sigmatropic Reactions)

CO3: know the basic concepts of photochemical reactions and determine their reaction mechanisms

CO4: apply the knowledge of photochemical reactions of Alkenes, carbonyl compounds, aromatic compounds.

CO5:study named photochemical reactions, photochemistry of smog, polymers and vision

Master of Science (Chemistry)
(Semester-III)
Session: 2022-23
COURSE CODE: MCHL-3085
COURSE TITLE: Photochemistry and Pericyclic reactions

Time: 3 Hrs **Max. Marks: 50**

(Theory: 40, CA: 10)

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-1

Pericyclic Reactions (A)
Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene, allyl system, classification of pericyclic reactions FMO approach. Woodward-Hoffmann correlation diagrams method and Perturbation of molecular orbital (PMC) approach for he explanation of pericyclic reactions under thermal and photo-chemical conditions. Electrocyclic reactions – controtatory and disrotatory motions, 4n, 4n+2, allylsystems secondary effects. Cycloadditions – antrafacial and suprafacial additions, notation of cylcoadditions (4n) and (4n+2) systems with a greater emphasis on (2+2) and (4+2)

UNIT-II

Pericyclic Reactions (B)
cycloaddition-stereochemical effects and effects of substituents on the rates of cycloadditions, 1,3-dipolar cyclo-additions and cheleotropicreactions.Sigmatropic Rearrangements-suprafacial and antrafacial shifts [1,2]- sigmatropic shifts involving carbon moieties retention and invertion of configuration, (3,3) and (5,5)sigma-tropic rearrangements, detailed treatment of Claisen and Cope rearrangements, fluxional tautomerism, aza-cope rearrangements, introductions to Ene reactions, simple problems on pericyclic reactions. Elecrocyclic rearrangement of cyclobutenes and 1,3cyclohexadienes.

UNIT-III

Photochemistry
Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.
Determination of Reaction Mechanism
Classification, rate constants and life times of reactive energy states –determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions.Types of photochemical reactions – photodissociation, gas-phasephotolysis.

UNIT-IV

Photochemistry of Alkenes

Intramolecular reactions of the olefinic bond – geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1, -dinenes.

Photochemistry of Carbonyl Compounds

Intramolecular reactions of carbonyl compounds – saturated, cyclic and acyclic, β, γ- unsaturated and α,β-unsaturated compounds, Cyclohexadienones. Intermolecular cycloaddition reactions – dimerisations and oxetane formation.

Photochemistry of Aromatic Compounds

Isomerisations, additions and substitutions.

Miscellaneous Photochemical Reactions

Photo-Fries reactions of anilides.Photo-Fries rearrangement.Barton reaction.Singlet molecular oxygen reactions.Photochemical formation of smog.Photodegradation of polymers.Photochemistry of vision.

Books Recommended:

1. Organic Photochemistry – Chapman andDepuy.
2. Organic Photochemistry – W.H.Horsepool.
3. Photochemistry of Excited States –J.D.Goyle.
4. Pericyclic Reactions: A Mechanistic study by S.M. Mukherji
5. The conservation of orbital Symmetry by R. B. Woodward and R. Hoffman
6. Fundamentals of Photochemistry by K.K.RohtagiMukherji

Master of Science (Chemistry)
(Semester-III)
Session: 2022-23
COURSE CODE: MCHP-3086
COURSE TITLE: Inorganic Chemistry Practical (Preparations)

Course outcomes:

Students will be able to

CO1: plan and Conduct experiments for synthesizing, analysing, identifying and characterizing inorganic compounds

CO2: do measurements of magnetic moments of synthesized complexes.

CO3: estimate metal content in the synthesized complex

Master of Science (Chemistry)
(Semester-III)
Session: 2022-23
COURSE CODE: MCHP-3086
COURSE TITLE: Inorganic Chemistry Practical (Preparations)

Time: 6 Hrs **Max. Marks: 75**
(P: 60, CA: 15)

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

1. Preparation of $Co(acac)_3$, its characterization using NMR, IR, UV-Vis and analysis of Cobalt. (ref. J. Chem. Edu., 1980, 57, 7,525)
2. Preparation of $Co(acac\text{-}NO_2)_3$, its characterization using NMR, IR, UV-Vis andanalysis of Cobalt. (ref. J. Chem. Edu., 1980, 57, 7,525)
3. Preparation of $[Fe(H_2O)_6][Fe(N\text{-salicyldeneglycinato})_2]_2.3H_2O$, its characterization using IR, UV-Vis, magnetic susceptibility and analysis of Iron.(ref. InorganicaChimicaActa, 1977, 23,35).
4. Preparation of $[Ni(NH_3)_6]Cl_2$ its characterization using IR, UV-Vis, magnetic susceptibility and analysis of Nickel and NH_3. (ref. Marr and Rockett,1972).
5. Preparation of $[Ni(ethylenediamine)_3]Cl_2$ its characterization using IR, UV-Vis, magnetic susceptibility and analysis of Nickel. (ref. Marr and Rockett, 1972, page270).
6. Preparation of $[Fe(NO)(S_2CN(Et)_2)_2]$ its characterization using IR, UV-Vis, magnetic susceptibility and analysis of Fe(II). (ref. Marr and Rockett, 1972, page 262, J. Chem. Soc. 1962, 84,3404).
7. Preparation of octahedral and tetrahedral complexes of dichlorodipyridylcobalt(II), differentiate them using IR, UV and magnetic properties. Estimate Co(II) from one of them. (ref. Marr and Rockett, 1972, page 375, Inorganic Chemistry, 1966, 5,615).
8. Preparation of $VO(acac)_2$ and its piperidine complex, characterize using IR, UV and magnetic moment. Estimate for V(IV). (ref. Marr and Rockett, 1972,243).
9. Preparation of diaquotetraacetataocopper(II), magnetic susceptibility IR and UV-Vis, analysis ofCopper(II).
10. Preparation of cis- and trans- potassium dioxalatodiaquochromate(III). Interpretation of IR, UV and magnetic properties. Estimation of Chromium. (ref. Marr and Rockett, 1972, page386).
11. Preparation of $HgCo(NCS)_4$, its IR and measure its magnetic moment. (ref. Marr andRockett, 1972, page365).

12. Preparation of sodium tetrathionate, interpretation of its IR and analysis using potassium iodate. (ref. Marr and Rockett, 1972, page214).
13. Preparation of Potassium dithionate, interpretation of its IR and analysis using potassium iodate. (ref. Marr and Rockett, 1972, page214).
14. Preparation of bis(acetylacetonato)copper(II), UV-Vis, and IR, magnetic studies, Demonstration of Jahn Teller effect by solution spectral studies. (ref. Bull. Chem. Soc. Japan, 1965, 29,852).
15. Preparation of salicylamide complexes of Copper(II). IR, UV, magnetic data and analysis of Cu(II). (ref. Indian J. of Chem., 1977, 15A, No. 5, 459; ibid, 1971, 9,1396).
16. To prepare a macrocyclic ligand 5,7,7,12,14,14-hexamethyl-1,4,8,11-tetraazacyclo tetradeca-4,11-dienedi(hydrogeniodide) and its complex with Ni(II). Study IR, NMR and UV-Vis of ligand and complex and magnetic properties of complex. To analyze for Ni and I. (J. Chem. Edu. 1977, 79,581).
17. Preparation and resolution of tris (ethylenediamine) cobalt (III). UV-Vis, NMR, IR, optical rotation of the resolved complexes. ((ref. Marr and Rockett, 1972, page386).

Books Recommended:

1. B.N. Figgis, Introduction to Ligand Field, WileyEastern.
2. A.B.P. Lever, Inorganic Electronic Spectroscopy,Elsevier.
3. A.Earnshaw, Introduction to Magnetochemistry, AcademicPress.
4. J.E. Huheey, Inorganic Chemistry Principles of Structure and Reactivity, Harper Interscience.
5. R.S. Drago, Physical Medhod in Chemistry, W.B.SaundersCompany.
6. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, WileyInterscience.
7. F.A. Cotton, Chemical Application of Group Theory, WileyEaster

Master of Science (Chemistry)
(Semester-III)
Session: 2022-23
COURSE CODE: MCHP-3087
COURSE TITLE: Physical Chemistry Practical

Course outcomes

Students will be able to

CO1: apply the principle and mechanism of Conductometric and potentiometric titrations

CO2: determine the partial molar volumeof compounds using Dilatometer

CO3: determine specific and molar refractivity using Abbes refractometer

CO4: study complex formation and the kinetics of hydrolysis Spectrophotometrically

CO5: determine the molecular weight of polymers byviscometry

Master of Science (Chemistry)
(Semester-III)
Session: 2022-23
COURSE CODE: MCHP-3087
COURSE TITLE: Physical Chemistry Practical

Time: 6 hrs. **Max. Marks: 75**
(P: 60, CA: 15)

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

1. To determine the partial molar volumeof
   (a) Glycine (b) Urea usingdilatometer
2. To determine the partial molar volumeof
   (a) methanol (b) n-propanol usingdilatometer
3. To determine the surface tension (double capillary) of mixture of solid and water by deferential method and hence find out parachor of themixture.
4. To determine the specific and molar refractivity of n-propanol, butanol, hexane and carbon tetrachloride and calculate refraction equivalents of C, H andCl.
5. To determine the molar refractivity of water, DMF, Dioxane and mixtures of water-DMF, water-Dioxane and verify the refractivity rule. Predict about the interactions between components of mixture by plotting graph between refractive index and molefraction.
6. To determine the equivalent conductance of weak electrolyte (acetic acid) at infinite dilution using Kohlrauschlaw.
7. Determine equivalent conductance of strong electrolyte at several concentrations and hence verify Onsagerequation.
8. Determine equivalent conductance of weak electrolyte, say acetic acid at different concentrations and hence test validity of Ostwald's dilution law. Also determine dissociation constant of theelectrolyte.
9. To determine dissociation constant of a dibasic acid potentiometrically.
10. To study complex formation between Fe (III) and salicylic acid and find out the formula of the complex spectrophotometrically.
11. To determine the formula of the complex ion formed between Fe (III) and thiocyanate ion by Job's method.
12. To study the kinetics of hydrolysis of crystal violetspectrophotometrically.
13. To determine the pH of various mixtures of sodium acetate and acetic acid in aqueous solution and hence determine the dissociation constant of theacid.
14. Titrate potentiometrically Zn(II) by $K_4Fe(CN)_6$ and verify the composition of the complex $K_2Zn_3[Fe(CN)_6]_2$
15. Determination of nitrite in water spectrophotometrically.
16. Determination of molecular weight of polymers by Viscometry.
17. Determine the molar refraction of a solid substance by dissolving it in a solvent and its refractive index.

Books Recommended:

1. Yadav, J. B (2005): *Advanced Practical Physical Chemistry*, 22nd edition, Goel publishing House, Krishna Prakashan Media Ltd.

2. Venkatesan, V., Veeraswamy, R. and Kulandaivelu, A.R (1997): *Basic Principles of Practical Chemistry*", 2nd edition, Sultan Chand and Sons Publication, New Delhi.

KANYA MAHA VIDYALAYA JALANDHAR (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF TWO YEAR DEGREE PROGRAMME

Master of Science (Chemistry)

(Session: 2022-23)

Master of Science (Chemistry) **Semester IV**							
Course Code	**Course Name**	**Course Type**	**Marks**				**Examination time (in Hours)**
			Total	**Ext.**		**CA**	
				L	**P**		
MCHL-4081	Advanced Inorganic Chemistry	C	75	60	-	15	3
MCHL-4082	Chemistry of Natural Products	C	75	60	-	15	3
MCHL-4083	Chemistry of Materials	C	75	60	-	15	3
MCHP-4084	Advanced Practical-Organic Synthesis	C	50	-	40	10	3*2
MCHP-4085	Advanced Practical-Inorganic Synthesis	C	50	-	40	10	3*2
MCHP-4086	Advanced Practical-Physical Chemistry	C	50	-	40	10	3*2
Total			375				

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-23
COURSE CODE: MCHL-4081
COURSE TITLE: Advanced Inorganic Chemistry

Course outcome:

Students will be able to

CO1: understand Franck-Condon principle

CO2:understand Photo substitution reactions,photoredox reactions, photolysis of water

CO3:oxidative addition and reductive elimination, migration (Insertion) reaction and cyclometallation reactions,

CO4:characterise the compound by synthetic methods and know the chemical behaviour and synthetic applications of hydride compounds

CO4:understand hydroformylation, Carbonylation Reaction, decarbonylation reactions, hydrocyanation Polymerization, Oligomerisation and metathesis reactions and Oxidation reaction

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-23
COURSE CODE: MCHL-4081
COURSE TITLE: Advanced Inorganic Chemistry

Time: 3 Hrs **Max. Marks: 75**

(Theory: 60, CA: 15)

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (twelve each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Photo Inorganic Chemistry:

Basics of photochemistry- Absorption, excitation, photochemical laws, quantum yield, electronically excited states, life times- measurements of the times Flash photolysis, energy diddipation by radiative and non-radiative processes, absorption spectra, Franck-Condon principle, photochemical stages-primary and secondary processes, Kashia's rule, Thexi state, Photo substitution reactions, Adamson's rules, Photo substitution reactions of Cr(III)-Polypyridyls, Rh(III) Ammine Complexes, Ru-Polypyridyl complexes, Ligand photo reactions, photoredox reactions, comparison of Fe(II) and Ru(II) complexes, Photo reactions and Solar energy conversions, Photo synthesis in plants and Bacterio chlorophyll photosynthesis, photolysis of water using Inorganic precursors.

UNIT-II

Oxidative-Addition and Migration (Insertion Reactions):

Introduction: Acid base behaviour of metal atoms in complexes, Protonation and Lewis Base behaviour, acceptor properties of Lewis acidity of complexes, oxidative addition and reductive elimination, addition of specific molecules, Hydrogen addition, HX additions, Organic halides addition of some other molecules productive elimination, migration (Insertion) reaction promotion of alkyl migration, insertion of CO into M-H bonds, other aspects of CO insertion reactions, transfer of other molecules, CO_2, SO_2 , NO_2 , RCM, Insertion of alkenes and C-C unsaturated compounds, Cleavage of C-H bonds; alkane activation, Cyclometallation reactions. Reactions of free hydrocarbons.

UNIT-III

Transition Metal Compounds with Bonds to Hydrogen

Characteristics of hydride complexes, synthetic methods, chemical behaviour of hydride compounds, mononuclear polyhydrides, homolepticpolyhydride anions; carbonyl hydrides and onion. Molecular hydrogen compounds; metal hydrogen interaction with C-H bonds; MH interactions; complexes of boron hydride and aluminohydrides, synthetic applications of metal hydrides.

UNIT-IV

Transition Metal Complexes in Catalysis:

Hydroformylation of unsaturated compounds, Reductive carbonylation of alcohols and other compounds; Carbonylation Reaction: Methanol and methyl acetate, Adipic ester. Synthesis and other carbonylation reactions, decarbonylation reactions. Catalytic addition of molecules to C-C multiple bonds homogeneous hydrogenation, hydrocyanation of unsaturated compounds, hydrosilation of unsaturated compounds, hydrocyanation of alkenes, Polymerization, Oligomerisation and metathesis reactions of alkenes and alkynes, Ziegler-Natta polymerisation of ethylene and propylene oligomerisation and related reactions, Cluster compounds in catalysis, supported homogeneous and phase transfer catalysis, Oxidation reaction: Oxidative carbonylations, Palladium catalysed oxidation of ethylene, Acrylonitrile synthesis, oxygen transfer from peroxo- and oxo- species, oxygen transfer from NO_2groups.

Books Recommended:

1. Concepts of Inorganic Photochemistry, A. W. Adamson and P. D. Fleischauer,Wiley.
2. W.W. Porterfield, Inorganic Chemistry: A Unified Approach.
3. F.A. Cotton and G. Willkinson, Advanced Inorganic Chemistry, 5^{th}ed, John Wiley and Sons, NewYork.
4. C.ElschenbroichandA.Salzer,Organometalics:AConciseIntroduction,2^{nd}Ed.,VCH 1992.

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-23
COURSE CODE: MCHL-4082
COURSE TITLE: Chemistry of Natural Products

COURSE TITLE: Chemistry of Natural Products

Course outcome:

Students will be able to

CO1: study the biosynthetic pathways of natural products

CO2: understand the isoprene rule and its role in terpenoids

CO3: classify and understand the synthesis and structure of steroids and alkaloids

CO4:understand the chemistry of Haemin, chlorophyll, prostaglandins and antibiotics

CO5:classify and elucidate the structure of carbohydrates like starch and cellulose

CO6:determine thestructure conformation and properties of proteins

CO7:determine the structure of nucleic acids DNA and RNA

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-23
COURSE CODE: MCHL-4082
COURSE TITLE: Chemistry of Natural Products

Time: 3 Hrs **Max. Marks: 75**

Credit (LTP): 4-0-0 **(Theory: 60, CA: 15)**

Note: The students are allowed to use Non-Programmable Calculator

Instructions for the Paper Setters:

Eight questions of equal marks (twelve each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-1

Studies on Biosynthetic Pathways of Natural Products
The acetate hypothesis, poly-ketoacids, their aldol type cyclisations and meta orientations of hydroxyl groups in naturally occurring phenols. b) Isoprene rule, mechanism of formation of mevalonic acid from acctyl coenzyme, Biogenetic isoprene rule. Geranyl pyrophosphates and its conversion into alphapinene, thujene and borneol.Farnesyl pyrophosphate, geranyl, geranyl pyrophosphate and mechanistic considerations for their interconversions into cadinene and abieticacid.

UNIT-II

Terpenoids
General classification, General Methods of structure determination, Chemistry of Camphor, Abietic acid, Santonin biosynthetic studies on tri and tetra terpenoids.
Steroids
General biosynthetic studies on steroids, chemistry of Cholesterol, cortisone, progesterone, oestrone, transformations in steroid molecules.
Alkaloids
Classification, chemistry of nicotine, quinine, papaverine, morphine and reserpine.

UNIT-III

Haemin and Chlorophyll
Structure and synthesis of Porphyrins.Chemistry of Haemin and chlorophyll.
Antibiotics
Introduction, chemistry of pencillins, streptomycines, chloromphenicol, tetracyclins.
Prostaglandins
General study, nomenclature, structure of PGE and synthesis of PGE1, PGE2, PGF2x

UNIT-IV

Carbohydrates
Nomenceature and classification, types of naturally occuring sugars, deoxy sugars, sugars, methyl others and acid derivatives of sugars. General methods of structure and ring size determination, structure of maltose, lactose, sucrose, starch and cellulose.

Peptides and Proteins
Sequence determination insulin and oxytocin, Proteins: structure conformation and properties. Enzymes, Kinetics, inhibition mechanism.

Nucleic Acids
Nucleosides, nucleotides, DNA, RNA structure and conformation, Replication, transcription.

Books Recommended

1. Primary Metabolism: A Mechanistic Approach by J.Staunton, Oxford University Press 1978.
2. Secondary Metabolism by J. Mann Oxford University Press. Oxford, 1980.
3. Natural Product Chemistry- A Mechanistic, Biosynthetic and Ecological Approach by Kurt B. G. Torssell, Swadish Pharmaceutical Society, 1997.
4. Fundamentals of BioChemistry by D. Voet, J.G. Voet and C.W.Pratt, John Wiley and Sons Inc., New York, 1999.
5. Principles of Biochemistry by A.L. Lehninger, CBS Publishers, New Delhi

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-23
COURSE CODE: MCHL-4083
COURSE TITLE: Chemistry of Materials

Course outcome:

Students will be able to

CO1:understand types of solids, point defects, electrical properties and conduction in metals

CO2: understand reactions in organic solids, photochemical reactions and decomposition and dehydration reactions.

CO3:explain the properties and applications of different types of polymers.

CO4: define the factors affecting glass formation, types, properties and applications of different types of glasses

CO5:learn glass ceramic compositions, properties and applications

CO6:predict the methods of preparation of smart materials, types of superconductors and their applications

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-23
COURSE CODE: MCHL-4083
COURSE TITLE: Chemistry of Materials

Time: 3 Hrs **Max. Marks: 75**

(Theory: 60, CA: 15)

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (twelve each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Solid State Chemistry
Types of solids, band and bond theories, crystal lattice energy, point defects in metals and ionic compounds, energy and entropy of defects, their concentration, diffusion and electrical conduction via defects, nonstoichiometric types, colourcenters and electrical properties of alkali halides, electron theories for metal conduction in metals , in insulators, impurity semiconductors, reactions in organic solids, photochemical reactions, solid-solid reactions, decomposition and dehydrationreaction.

UNIT-II

Macromolecules
Types of polymers, regular and irregular polymers, synthesis of polymers by chain and step reactions, physical properties of solid polymers(crystallinity, plasticity and elasticity), vulcanization of rubbers, molecular mass determination by osmometric, viscometry, light scattering and ultracentrifuge methods, number and mass average molecular masses, polymer solutions, factors affecting the solubility of polymers , conducting polymers, doping of polymers, mechanism of conduction, polarons and bipolarons,

UNIT-III

Glasses and Ceramics
Factors affecting glass formation, oxide glasses, electronegativity and bond type, viscosity, structural effects(zachariasen's rule(1932), criteria of SUN and Rawson, thermodynamics of glass formation, behavior of liquids on cooling, kinetics of crystallization and glass formation,structure of glasses: vitreous silica, silicate glasses, vitreous B2O3 and borate glasses, viscosity, electrical conductivity of glasses and the mixed alkali effect, commercial silicate and borate glasses, metallic glasses , glass

ceramics, refractories, important glass-ceramics compositions, properties of glass ceramics,applications.

UNIT-IV

Smart Materials

Methods of preparation- conventional ceramic methods, hot pressing and hot static pressing techniques, precursor method, gel method, co-precipitation method, glass crystallization methods, vacuum techniques- chemical vapor deposition method. organic superconductors, magnetism in organic materials, magnetic nano materials, energy storage materials, nano materials for targeted drug delivery, fullerenes as superconductors. High temperature ceramic superconductors, electrical and magnetic properties of superconductors, critical temperature Tc, thermodynamics of superconductors, London equation, BCS theory,applications.

Books Recommended:

1. Principles of polymer chemistry—P J Flory Cornell UniversityPress
2. Physical chemistry of polymers—A J Tager, MirPublishers
3. Physical chemistry of MacromoleculesTanford
4. Handbook of conducting polymers—T ASkotthem
5. Solid state physics—A J Dekker- MacMillanPublishers
6. Solid state chemistry and its applications—A R West ,WileyPublishers
7. Solid state chemistry of drugs S R ByrnAcademicPress
8. Chemistry of solid state—W.E.GarnerButterworth
9. Principles of physical chemistry—Puri-Sharma-Pathania, VishalPublishers
10. Thermotropic Liquid crystals Ed. G W Gray JohnWiley
11. Chemistry of polymers, MargarisonandEast
12. Polymer Chemistry, Malcolm, P, Stevens, Oxford UniversityPress
13. Principles of Solid States, H. V. Keer, WileyEastern.

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-23
COURSE CODE: MCHP-4084
COURSE TITLE: Advanced Practical- Organic Synthesis

Course outcome:

Students will be able to

CO1: plan and implement advance organic synthesis and reactions

CO2: characterize organic molecules by physical and spectroscopic methods like M.P, B.P, and IR

CO3: predict the outcome and mechanism of some simple organic reactions, using a basic understanding of the relative reactivity of functional groups

CO4: design multistep synthesis

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-23
COURSE CODE: MCHP-4084
COURSE TITLE: Advanced Practical- Organic Synthesis

Time: 6 Hrs **Max. Marks: 50**
(P: 40, CA: 10)

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners.Two copies of the same should be submitted for the record to COE Office,Kanya Maha Vidyalaya,Jalandhar.

1. Synthesis and Reactivity ofbenzalacetophenone
   a. Bromination (Electrophilic additions) andsubsequentdebromination (Elimination)
   b. Epoxidation (Cycloaddition, nucleophilic) and ring opening with hydroxideion.
   c. Michael addition ofaniline.
   d. Conversion of benzalacetophenone to its oxime (nucleophilic addition atC=O)
   e. Conversion of oxime to amide (Beckmann rearrangement) and oxazole (Understand the reactivities at conjugated C=O and C=C)bond.
2. Synthesis of Cyclohexene from cyclohexanol and its conversion to 1, 2- *cis* and 1, 2- *trans* –cyclohexanediols.
   a. Epoxidation with peracid (Cycloaddition) and *anti*- ring opening with sodium hydroxide to *cis*- cyclohexane -1, 2-diol.
   b. Dihydroxylation with$KMnO_4$ (Mechanism of *syn*- and *anti*-cyclohexane-1,2-diol)
3. Preparation and characterization of the Aldol-dehydration products from various combinations of aromatic aldehydes andketone.
   Effect of substituents on aromatic aldehydes on the product distribution.
   a. Aldehyde:benzaldehyde, 4-methylbenzaldehyde.4-methoxybenzaldehyde.
   b. Ketone: acetone, cyclopentanons, cyclohexanone (Book4)6.

Books Recommended:

1. An Introduction to Modern Experimental Organic Chemistry, R.M. Roberts, J.C. Gilbert, L.B. Rodewald and A.S Wingrove, Holt Rinehart and Winston Inc, New York.1969.
2. Vogel's Text Book of Practical OrganicChemistry.
3. Laboratory Experiments on Organic Chemistry, R. Edemas, J.R. Johnson andC.F. Wilcox, The Macmillan Limited, London, 1970.
4. Modern Projects and Experiments in Organic Chemistry,J.R.Mohrig,C.N. Hammonad, P.F. Schatz and T.C. Morrill, W.H. Freeman and Company, New York 2003.

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-23
COURSE CODE: MCHP-4085
COURSE TITLE: Advanced Practical- Inorganic Synthesis

Course outcome:

Students will be able to

CO1: apply key concepts of inorganic chemistry and coordination compounds including those related to synthesis, reaction chemistry, and structure and bonding

CO2:design the basic and advanced laboratory procedures used in inorganic synthesis including spectroscopic and analytical techniques for identification and characterization of small molecules

CO3: learn separation of metal cations by chromatographic techniques

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-23
COURSE CODE: MCHP-4085
COURSE TITLE: Advanced Practical- Inorganic Synthesis

Time: 6 Hrs **Max. Marks: 50**
(P: 40, CA: 10)

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners.Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya,Jalandhar.

1. Synthesis of the Linkage Isomers nitrito- and nitropentaamminecobalt(III)chloride
   a) Preparation of chloropentaamminecobalt(III) chloride, $[Co(NH_3)_5Cl]Cl_2$.
   b) Preparation of nitropentaamminecobalt(III) chloride, $[Co(NH_3)_5(NO_2)]Cl_2$.
   c) Preparation of nitritopentaamminecobalt(III) chloride, $[Co(NH_3)_5(ONO)]Cl_2$.
   d) Estimate the chloride in all the complexes using gravimetricanalysis.
   e) Record and interpret the electronic absorption spectra and IR spectra of (III) complexes and assign the observed change to distinguish the twoisomers.
2. Synthesis of a coordination compound containing iron and analysis of thiscompound using redoxmethods
   a) Preparation of iron(II)oxalate
   b) Preparation of$K_3[Fe(C_2O_4)_3].3H_2O$
   c) Characterization of Iron(II) and iron(III) complex with IRspectroscopy
   d) Determination of iron and oxalate in $K_3[Fe(C_2O_4)_3].3H_2O$ using volumetricanalysis
3. Synthesis and characterization of the Ni(II) complex of a Schiff-base ligand derivedfrom Salicylaldehyde and ethylenediamine.
   a) Synthesis the Schiff-baseligand.
   b) Interpret the 1H NMR and IR spectra of theligand.
   c) Synthesis the Ni(II) complex of the ligand and compare its IR spectrum with thatoftheligand.
4. Separation of the metal cationsby
   a) Column chromatography with gradient elution Co(II) and Ni(II). Analyze qualitatively the coloured fractions collected for separatedcations.
   b) Paper chromatography [Fe(II), Co(II), Ni(II) and Cu(II). Determine the Rf values for the separate standard cations and use these to identify the cations present in the unknownmixture.

Books Recommended:

1. G. Marr, B. W. Rockett, Practical Inorganic Chemistry(1972).
2. *I. Grenthe, E. Nordin,* Inorganic Chemistry*, 18 (1979)1869–74.*
3. *J.C. Bailar, M. Eldon, Inorg. Synth. 1 (1939)35–38.*

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-23
COURSE CODE: MCHP-4086
COURSE TITLE: Advanced Practical- Physical Chemistry

Course outcome:

Students will be able to

CO1:experience the scientific methods employed in basic and applied physical chemistry

CO2: design and perform experiments to determine the rate, order, and activation energy of chemical reactions by varying concentrations and/or temperature

CO3: measure equilibrium concentrations and equilibrium constants for acid-base, solubility, and complexation reactions given initial concentrations of reactant

CO4: develop skills in procedures and instrumental methods like polarography, turbidimetry and spectrophotometry,

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-23
COURSE CODE: MCHP-4086
COURSE TITLE: Advanced Practical- Physical Chemistry

Time: 6 Hrs **Max. Marks: 50**
(P: 40, CA: 10)

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners.Two copies of the same should be submitted for the record to COE Office,Kanya Maha Vidyalaya,Jalandhar.

CHEMICAL EQUILIBRIUM

1) Study the effect of solvent on the conductance of $AgNO_3$/Acetic acid and determine the degree of dissociation and equilibrium constant in different solvents and their mixtures (DMSO, DMF, dioxane, acetone, and water) and test the validity of DEBYE-HUCKEL-ONSAGER'Sequation.

2) To determine acid and base dissociation constant of amino acid pHmetrically.

3) To calculate thermodynamic parameters ΔG, ΔS and ΔH for the reaction

$$Zn + Hg_2SO_4 \longrightarrow 2Hg + Zn\ SO_4$$ by emfmeasurement.

CHEMICAL KINETICS

4) Study the salt effects and the solvent effect on the rate law of alkaline hydrolysis of crystal violet.
5)Determine the degree of hydrolysis and hydrolysis constant of CH_3COONa/NaCl/aniline hydrochloride.
6) Determine the order of reaction by analyzing the kinetic dependence ofindividual reactant (e.g. saponification of ester).
7)Determine the energy of activation for the reaction studied above.

ACTIVITY AND ACTIVITY COEFFICIENTS

8) Determination of mean activity coefficient of given electrolyte bycryoscopy.
9) Determine activity coefficients by EMF method.

PHASE EQUILIBRIUM

10) Draw the phase diagram for any one of the following three componentpartially immiscible liquidsystems.

i) DMSO/water/benzene ii) water/benzene/aceticacid

POLAROGRAPHIC TECHNIQUES

11) Estimation of ions in mixture of Pb^{2+} and Cd^{2+} by successive reduction. Evaluate diffusion coefficient of Cd^{2+}

12) Polarographic determination of Cu and Zn in the given sample of brass.

13) Determine stability constants of Cd^{2+} with EDTA.

SPECTROPHOTOMETRIC METHODS

14) To study the effect of extended conjugation on the wave length ofmaximum absorption of organiccompounds.

ADSORPTION

15) To determine the adsorption isotherms of heavy metals like Cd, Zn, Cr, Pb. Ni by using nonconventional adsorbents.

TURBIDITYMETRY

16) To determine concentration of sulphate ions with the help of turbiditymeter.

17) Determine the CMC by turbidimetricmethod.

18) Preparation of soap and determination of its CMC.

LEAST SQUARE FITTING

19) To draw calibration curve for the concentration determination of potassium ions by flame photometry and to study the least square fitting of thedata.

Books Recommended:

1.Yadav, J. B (2005): *Advanced Practical Physical Chemistry*, 22nd edition, Goel publishing House, Krishna Prakashan Media Ltd.
2. Venkatesan, V,Veeraswamy, R and Kulandaivelu, A.R (1997): *Basic Principles of Practical Chemistry*", 2nd edition, Sultan Chand and Sons Publication, New Delhi.
3. Findlay's (1985): *Practical Physical Chemistry*, Revised and edited by B.P. Levitt 9 th edition, Longman, London.
4. Chatwal, G.R. and Anand,S.K (2000): *Instrumental Methods of Chemical Analysis*, Himalaya Publishing House, Delhi.

FACULTY OF SCIENCES

SYLLABUS

For

Bachelor of Science

(Semester I)

(UnderContinuous Evaluation System)

Session: 2022-25

The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR (AUTONOMOUS)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science

(Session: 2022-25)

Bachelor of Science (Semester I)									
				Marks					
Course Name	**Program Name**	**Course Code**		**Course Type**	**Total**	**Paper**	**Ext.**		**CA**	**Examination Time (in Hours)**
							L	**P**		
Chemistry	**Bachelor of Science**	BSMM-1084	I	C	100	Inorganic Chemistry	30	-	20	3
			II			Organic Chemistry	30	-		3
		BSNM-1084	P			Chemistry (Practical)	-	20		$3^{1/2}$

Bachelor of Science

(SEMESTER–I)

Session: 2022-25

COURSE CODE: BSMM/BSNM-1084(I)

COURSE TITLE: INORGANIC CHEMISTRY

Course outcomes:

Students will be able to

CO1: Predict electronic properties of atoms using current models and theories in chemistry, sketch the probability density curves, boundary surface diagrams and shapes of orbitals and write the electronic configuration of atoms.

CO2: identify the periodic trends in physical and chemical properties of elements, describe the arrangement of the elements in the Periodic Table& change from metallic to nonmetallic character.

CO3: describeVBT, VSEPR theory and predicts the geometry of simple molecules&molecular orbital theory of homonuclear diatomic molecules

CO4: explain, predict & draw structures of simple ionic compounds.

Bachelor of Science

(SEMESTER–I)

Session: 2022-25

COURSE CODE: BSMM/BSNM-1084(I)

COURSE TITLE: INORGANIC CHEMISTRY

Time: 3 Hrs. **Max.Marks:30**

Instructions for the Paper Setter

Eight questions of equal marks (six each)are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT–I

I. Atomic Structure

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of ψ^1 and ψ 2, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s,p,d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements and ions.

UNIT–II

II. Periodic Properties

Position of elements in the periodic table; effective nuclear charge and its calculations. Atomic and ionic radii, ionization energy, electron affinity and electronegativity –definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour.

UNIT–III

III. Chemical Bonding

Covalent Bond –Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridizationand shapes of simple inorganic molecules and ions. BeF_2 , BF_3,CH_4, PF_5, SF_6, IF_7, $SnCI_2$, XeF_4, BF_4, $SnC1_6$. Valence shellelectron pair repulsion (VSEPR) theory to NH_3, H_3O+, SF_4,CIF_3, ICl_2 and H_2O. MO theory, homonuclear (elements and ions of 1st and 2nd row), and heteronuclear (BO, CN^-, CO, NO^+, CO^+, CN),

diatomic molecules, multicenter bonding in electron deficient molecule (Boranes). Percentage ionic character from dipole moment and electronegativity difference

UNIT–IV

IV. **Ionic Solids**

Concept of close packing, Ionic structures, (NaCI type, Zinc blende, Wurtzite, CaF_2 and antifluorite, radius ratio rule and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born–Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule. Metallic bond– free electron, valence bond and band theories.

Weak Interactions –Hydrogen bonding, Vander Waals forces

Books Suggested:

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 3rd edition, Pubs: John Wiley Sons. 1995.

2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman Hall Ltd., 1991.

3. Shriver, D.E., Alkins, P.W., Langford, C.H., Inorganic Chemistry; 4th edition, Oxford Publisher: Oxford University Press, 2006.

4. Douglas, B. McDamiel, D., Alexander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994.

5. Miessler, G.L., Larr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004.

6. Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: McGraw-Hill Publishing Company Limited, 1991.

7. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B. Saunders Company, 1977.

8. Puri, B.R., Sharma, L.R., Kalia, K.C., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.

9. University General Chemistry, C.N.R. Rao, Macmillan.

10. Inorganic Chemistry, W.W. Porterfield Addison-Wesley.

11. Inorganic Chemistry, A.G. Sharpe, ELBS.

Bachelor of Science

(SEMESTER–I)

Session: 2022-25

COURSE CODE: BSMM/BSNM-1084(II)

COURSE TITLE: ORGANIC CHEMISTRY

Course outcomes:

Students will be able to

CO1: interpret the bonding, hybridization between different organic compounds, explain the various reaction mechanisms and different electron displacement effects

CO2: interpret the reactions and properties of alkanes, alkenes & alkynes, derive the electrophilic, nucleophilic addition reactions, free radical mechanisms of halogenation of alkanes.

CO3: compare the reactivities of various alkyl and aryl halide, stability of various cycloalkanes

CO4: differentiate between aromatic, anti-aromatic and non-aromatic compounds, explain the effect of various substituents on the reactivity of aromatic compounds

Bachelor of Science

(SEMESTER–I)

Session: 2022-25

COURSE CODE: BSMM/BSNM-1084(II)

COURSE TITLE: ORGANIC CHEMISTRY

Time: 3 Hrs. **Max.Marks:30**

Instructions for the Paper Setter

Eight questions of equal marks(six each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT–I

I. Structure and Bonding

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, Vander Waals interactions, resonance, hyperconjugation, aromticity hydrogen bonding and Inductive and electrometric effects.

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, arenes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species.

UNIT-II

III. 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. Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

IV. Alkenes and Alkynes

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 $KMnO_4$.

Substitution at the allylic and vinylic positions of alkenes.

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

V. Alkyl and Aryl Halides

Nomenclature and classes of alkyl halides, chemical reactions. Mechanisms of nucleophilic substitution reaction of alkyl halides, SN2 and SN1 reactions with energy profile diagrams. Nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides.

VI. Cycloalkanes:

Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring : banana bonds.

UNIT-IV

VII. 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's rule, aromatic ions.

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. Methods of formation and chemical reactions of alkylbenzenes.

Books suggested:

1. Morrison, R.T., Boyd, R.N., Organic Chemistry; 6th edition, Pubs: Prentice-Hall, 1992.
2. Solomons, T.W., Fryhle, C.B., Organic Chemistry; 9th edition, Pubs: Wiley India, 2007.
3. Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson education, 2008.
4. Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: New Age International, 1985.
5. Carey, F.A., Sundberg, R.J., Advanced Organic Chemistry Part B: Reactions and Synthesis.
6. Fundamentals of Organic Chemistry, Solomons, John Wiley.
7. Introduction to Organic Chemistry, Sireitwieser, Heathcock and Kosover, Macmilan.

Bachelor of Science

(SEMESTER–I)

Session: 2022-25

COURSE CODE: BSMM/BSNM-1084(P)

COURSE TITLE: CHEMISTRY PRACTICAL

Course outcomes

Students will be able to

CO1: separate and identify the various ions present in the mixture

CO2: accurately note down the melting point of organic compounds

CO3: accurately note down theboiling point of organic compounds.

CO4: Differentiate between pure & impure compounds.

Bachelor of Science

(SEMESTER–I)

Session: 2022-25

COURSE CODE: BSMM/BSNM-1084(P)

COURSE TITLE: CHEMISTRY PRACTICAL

Time: 3½ Hrs. **Max.Marks: 20**

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners.Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya,Jalandhar.

Inorganic Chemistry: Semi Micro analysis. Cation analysis, Separation and identification of ions from groups I, II, III, IV, V, and VI. Anionic analysis. Four ions with no interference.

Organic Chemistry Laboratory Techniques

Determination of Melting Point

Naphthalene 80–82^{o}C	Cinnamic acid 132.5–133^{o}C
Benzoic acid 121.5–122^{0}C	Salicylic acid 157.5–158^{o}C
Urea 132.5–133^{o}C	Acetanilide 113.5–114^{o}C
Succinic Acid 184.5–185^{o}C	m–dinitro benzene 90^{o}C
P–dichlorobenzene 52^{o}C	Aspirin 135^{o}C

Determination of Boiling Point

Ethanol 78^{o}C	Cyclo Hexane 81.4^{o}C,
Benzene–80^{o}C	Toluene 110°C

Practical Examination

1) Inorganic Mixture	12
2) Melting Point/Boiling point of organic substance	03
3) Viva–Voce	03
4) Note Book	02

Books suggested:

1. Vogel's Qualitative Inorganic Analysis, revised, Svehla, Orient Longman.
2. Experimental Inorganic Chemistry, W.G. Palmer, Cambridge. Standard Methods of Chemical. Analysis, W.W. Scott: The Technical Press.
3. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
4. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
5. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press**.**

FACULTY OF SCIENCES

SYLLABUS

For

Bachelor of Science (Semester II)

(UnderContinuous Evaluation System)

(12+3 System of Education)

Session: 2022-25

The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR (AUTONOMOUS)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science

(Session: 2022-25)

Bachelor of Science (Semester II)									
					Marks				
Course Name	**Program Name**	**Course Code**		**Course Type**	**Total**	**Paper**	**Ext.**		**CA**	**Examination Time (in Hours)**
							L	**P**		
Chemistry	**Bachelor of Science**	BSMM-2084	I	C	100	Inorganic Chemistry -I	30	-	20	3
			II			Physical Chemistry -II	30	-		3
		BSNM-2084	P			Chemistry (Practical)	-	20		$3^{1/2}$

Bachelor of Science

(SEMESTER–II)

SESSION: 2022-25

COURSE CODE: BSMM/BSNM-2084(I)

COURSE TITLE: INORGANIC CHEMISTRY

Course outcomes:

Students will be able to

CO1: explains & compares the trends in atomic and physical properties of group 13, 14, 15, 16, 17 elements

CO2: explain the atomic, physical and chemical properties of alkali metals and alkaline earth metals.

CO3: Interpret the properties of carbides, silicates, interhalogen compounds.

CO4: Exhaustive understanding of d–block elements belonging to 4th, 5th and 6th period.

Bachelor of Science

(SEMESTER–II)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-2084(I)
COURSE TITLE: INORGANIC CHEMISTRY

Time: 3 Hrs. **Max.Marks: 30**

Instructions for the Paper Setter

Eight questions of equal marks(6 each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT–I

I. p–Block Elements–I (10 Hrs)

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, fullerenes.

UNIT-II

II. s-Block Elements (5 Hrs)

Comparative studies, diagonal relationship, salient features of hydrides, solvation and complexation tendencies.

III. Acids and Bases (5 Hrs)

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

UNIT-III

IV.p–Block Elements-II (10 Hrs)

Carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalide,Silicones and phosphazenes as examples of inorganicpolymers, nature of bonding in triphosphazenes.

UNIT-IV

V. Chemistry of Transition Elements (15 Hrs)

Characteristic properties of *d*–block elements.Properties of the elements of the first transition series, their simple compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.General characteristics of elements of Second and Third Transition Series, comparative treatment with their *3*d analogues in respect of ionic radii, oxidation states, magnetic behaviour.

Books Suggested:

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 2nd edition, Pubs: John Wiley and Sons, 1995.
2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman and Hall Ltd., 1991.
3. Shriver, D.E., Atkins, P.W., Inorganic Chemistry; 4th edition, Pubs: Oxford University Press, 2006.
4. Douglas, B., Medaniel, D., Atenander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994,
5. Porterfeild, W.W., Wesky, A., Inorganic Chemistry; Pubs: Addison-Wesky Publishing Company, 1984.
6. Miessler, G.L., Tarr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004,
7. Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: Tata McGraw-Hill Publishing Company Limited, 1991.
8. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B.Saunders Company, 1977.
9. Puri, B.R., Sharma, L.R., Kalia, K.K., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.
10.Inorganic Chemistry, W.W. Porterfield Addison-Wesley.
11.Inorganic Chemistry, A.G. Sharpe, ELBS.

Bachelor of Science

(SEMESTER–II)

SESSION: 2022-25

COURSE CODE: BSMM/BSNM-2084(II)

COURSE TITLE: PHYSICAL CHEMISTRY

Course outcomes:

Students will be able to

CO1: explain various gaseous laws and their applications.

CO2: acquire the knowledge of structure and intermolecular forces present between solids, liquids and gases, Discuss liquid crystals& its types.

CO3: understand& apply the basic concepts of colloidal state of matter and applications of colloids.

CO4: demonstrate an understanding of basic principles of colligative properties of dilute solutions.

Bachelor of Science

(SEMESTER–II)

SESSION: 2022-25

COURSE CODE: BSMM/BSNM-2084(II)

COURSE TITLE: PHYSICAL CHEMISTRY

Time: 3 Hrs. **Max.Marks: 30**

Note: Log table and Non-Programmable calculators are allowed

Instructions for the Paper Setter

Eight questions of equal marks (6 each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT–I

I. Gaseous States **(11Hrs)**

Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waal's equation of state.

Critical Phenomena: PV isotherms of real gases, continuity of states, the isotherms of van der Waal's equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state.

Molecular Velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquefaction of gases.

UNIT –II

II. Liquid State

Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquids crystal, solid and liquid.Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.

UNIT –III

III. Colloidal State (11Hrs)

Definition of colloids, classification of colloids. Solids in liquids (Sol): kinetic, optical and electrical properties, stability of colloids,protective action, Hardy Schulze law, gold number. Liquids in liquids (emulsions): Types of emulsions, preparation. Emulsifiers.general applications of colloids.

UNIT –IV

IV.Solutions, Dilute Solutions and Colligative Properties (12Hrs)

Ideal and non–ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient. Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, Law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point, Thermodynamic derivation of relation between molecular weight and elevation 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.

Books suggested:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.

2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.

3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Inc, 1996.

4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India, 1985.

5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.

6. Albert, R.A., Silbey, R.J., Physical Chemistry; 1st edition, Pubs: John Wiley and Sons Inc.,1992.

7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs:Wiley Eastern Limited, 1991.

8. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd., 2002.

9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd, 1983.

10.University General Chemistry, C.N.R. Rao, Macmillan.

Bachelor of Science

(SEMESTER–II)

SESSION: 2022-25

COURSE CODE: BSMM/BSNM-2084(P)

COURSE TITLE: CHEMISTRY PRACTICAL

Course outcomes:

Students will be able to

CO1: understand & apply the technique of crystallization.

CO2: determine the rate of the reactions

CO3: compare& analyze the viscosity and surface tension of different liquids and solutions

CO4: application of calorimeter in various thermochemistry experiments.

Bachelor of Science

(SEMESTER–II)

SESSION: 2022-25

COURSE CODE: BSMM/BSNM-2084(P)

COURSE TITLE: CHEMISTRY PRACTICAL

Time: 3½ Hrs. **Max.Marks:20**

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners.Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Crystallisation:

Concept of indication of crystalisation. Phthalic acid from hot water (using fluted filter paper and stem less funnel)

Acetanilide from boiling water.

Naphthalene from Ethanol

Benzoic acid from water

Physical Chemistry

1. To determine the specific reaction rate of hydrolysis of ethyl acetate catalysed by Hydrogen ions at room temperature.
2. To study the effect of acid strength on hydrolysis of an ester.

Viscosity, Surface Tension (Pure Liquids)

3. To study the viscosity and surface tension of CCl_4, glycerine solution in water.
4. To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
5. To determine the enthalpy of neutralisation of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
6. To determine the enthalpy of dissolution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

Practical Examination:		**Marks**
1)	Crystallisation	05
2)	Physical Experiment	10
3)	Viva–Voce	03
4)	Note Book	02

Books suggested :

1. Experimental Organic Chemistry, Vol. I and II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
2. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
3. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
4. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
5. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill.
6. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
7. Advanced Experimental Chemistry, Vol. I, Physical, J.N. Guru and R. Kapoor, S. Chand and Co.
8. Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghosh and Sons.
9. Experiments Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

FACULTY OF SCIENCES

SYLLABUS

of

Chemistry

for

Bachelor of Science (Semester III)

(UnderContinuous Evaluation System)

(12+3 System of Education)

Session: 2022-25

The Heritage Institution

KANYA MAHA VIDYALAYA

JALANDHAR

(Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Session: 2022-25)

Chemistry

	Bachelor of Science(Semester III)									
Course Name	**Program Name**	**Course Code**		**Course Type**	**Marks**					**Examination time (in Hours)**
					Total	**Paper**	**Ext.**		**CA**	
							L	**P**		
Chemistry	**Bachelor of Science**	BSMM-3084	I	C	100	Organic Chemistry	30	-	20	3
		BSNM-3084	II			Physical Chemistry	30	-		3
			P			Chemistry (Practical)	-	20		3½

Bachelor of Science
(SEMESTER–III)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-3084(I)
ORGANIC CHEMISTRY

Course outcomes:

Students will be able to

CO1: to resolve the different enantiomers and differentiate between dextrorotatory-leavorotatory chiral and achiral compounds,understand the concept of isomerism, axial and equatorial bonds.

CO2: understand the methods of formation, chemical reactions, acidic character of alcohols

CO3: preparation of understand structure and bonding phenols, acidic character of phenols

CO4: compare reactivity of aliphatic and aromatic aldehydes and ketones, to understand the various reactions given by carbonyl compounds

Bachelor of Science
(SEMESTER–III)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-3084(I)
COURSE TITLE: ORGANIC CHEMISTRY

Time: 3 Hrs. **Max. Marks: 30**

Instructions for the Paper Setter

Eight questions of equal marks (6 each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions,selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Stereochemistry of Organic Compounds

Concept of isomerism,types of isomerism, Optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogeniccentre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccentres, diastereomers, threo and erythrodiasteremers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D and L and R and S systems of nomenclature. Geometric isomerism–determination of configuration of geometric isomers. E and Z system of nomenclature. Conformational isomerism–conformational analysis of ethane and n–butane; conformation of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between configuration and conformation.

Unit–II

Alcohols

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

Unit–III

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, Reimer Tiemann reaction.

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, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties.Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations.Condensation with ammoniaand its derivatives. Witting reaction,Mannich 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. Halogenation of enoliable ketones

Books suggested:

1. Morrison, R.T., Boyd, R.N., Organic Chemistry; 6th edition, Pubs: Prentice-Hall, 1992.
2. Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson Education, 2008.
3. Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: Wiley Eastern Limited, 1985, Vol. I, II, III.
4. Solomons, T.W., Fryhle, C.B., Organic Chemistry; 9th edition, Pubs: Wiley India, 2007.
5. Carey, F.A., Organic Chemistry; 4th edition, Pubs: McGraw-Hill, 2000.
6. Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; 3rd edition, Pubs:Macmillan Publishing Company, 1989.
7. University General Chemistry, C.N.R. Rao, Macmillan.

Bachelor of Science
(SEMESTER–III)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-3084(II)
COURSE TITLE: PHYSICALCHEMISTRY

Course outcomes:

Students will be able to

CO1: understand and evaluate thermodynamic property of any system and its applications to various systems, acquire the knowledge of phase equilibria of various systems

CO2: demonstrate the carnot cycle, understand the concept of Entropy

CO3: understand the concept of Residual entropy, demonstrate Clausius-Clapeyron equation, CO4: understand concept of spontaneity of a reaction in terms of free energy change.

CO4: understand and demonstrate the concept of phase equilibria of one component system, two component system

Bachelor of Science
(SEMESTER–III)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-3084(II)
COURSE TITLE: PHYSICALCHEMISTRY

Time: 3 Hrs. **Max. Marks: 30**

Instructions for the Paper Setter

Eight questions of equal marks (6 each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions,selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Thermodynamics-I Definition of thermodynamic terms: System, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.

First Law of Thermodynamics:

Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law-Joule-Thomson coefficient and inversion temperature, Calculation of w,q,dUanddH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermochemistry:

Standard state, standard enthalpy of formation-Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation.

Unit–II

Thermodynamics-II

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

Concept of Entropy: Entropy as a state function, entropy as a function of V and T, entropy as a function of P and T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

Unit–III

Thermodynamics-III

Third Law of Thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A and G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of G and A with P,V and T.

Chemical Equilibrium

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Determination of K_p, K_c, $K_a$and their relationship, Clausius-Clapeyron equation, applications.

Unit–IV

Introduction to Phase Equilibrium

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water, CO_2 and S systems. Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-H_2O), $FeCl_3$-H_2O) and $CuSO_4$-H_2O) system. Freezing mixtures, acetone-dry ice. Non-ideal system-azeotropes-HCl-H_2O and ethanol-water system. Partially miscible liquids Phenol-water, trines-thylamin-water, Nicotine-water System. Lower and upper consulate temperature, Effect of impurity on consolute temperature, immiscible liquids, steam distillation. Nernst distribution law-thermodynamic derivation and applications.

Books suggested:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.

2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.

3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Inc, 1996.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India, 1985.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; 1st edition, Pubs: John Wiley and Sons Inc., 1992.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs:Wiley Eastern Limited, 1991.
8. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd., 2002.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd, 1983.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs: McGraw-Hall Book company, 1989.

Bachelor of Science
(SEMESTER–III)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-3084(P)
COURSE TITLE: CHEMISTRY PRACTICAL

Course outcomes:

Students will be able to

CO1: understand and master the technique of volumetric analysis, analyze an acidic and alkali content in different samples,

CO2: To analyze calcium content in various samples permanganometricall, understand the concept of hardness of water and its analysis by EDTA method

CO3: understand and master the technique of gravimetric analysis

CO4: to understand the concept of TLC and its applications

Bachelor of Science
(SEMESTER–III)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-3084(P)
COURSE TITLE: CHEMISTRY PRACTICAL

Duration: 3½ Hrs. **Max. Marks: 20**

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

Quantitative Analysis

Volumetric Analysis

a. Determination of acetic acid in commercial vinegar using NaOH.

b. Determination of alkali content-antacid tablet using HCI.

c. Estimation of calcium content in chalk as calcium oxalate by permanganometry.

d. Estimation of hardness of water by EDTA.

e. Estimation of ferrous and ferric by dichromate method.

f. Estimation of copper using sodiumthiosulphate.

Gravimetric Analysis

Analysis of Cu as CuSCN and Ni as Ni (dimethylgloxime)

Organic Chemistry Laboratory Techniques

Thin Layer Chromatography

Determination of R_f values and identification of organic compounds.

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

(b). Preparation and separation of 2, 4. dinitrophenylhydrazones of acetone, 2-butone, 2-Butanone, hexan-2 and 3-one using toluene and light petroleum (40 : 60).

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

Practical Examination

1) Volumetry / Gravimetry	11
2) Thin Layer chromatography	04
3) Viva-Voce	03
4) Note Book	02

Books suggested:

1. Vogel's Textbook of Quantitative Inorganic Analysis (revised), J. Bassett, R.C. Denney, G.H. Jeffery and J. Mandham, ELBS.
2. Standard Methods of Chemical. Analysis, W.W. Scott: The Technical Press.
3. Experimental Inorganic Chemistry, W.G. Palmer, Cambridge.
4. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
5. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
6. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
7. Experimental Organic Chemistry, Vol. I and II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill

FACULTY OF SCIENCES

SYLLABUS

of

Chemistry

For

Bachelor of Science

(Semester IV)

(Under Continuous Evaluation System)

Session: 2022-25

The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR (AUTONOMOUS)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science

(Session: 2022-25)

Bachelor of Science (Semester IV)										
Course Name	**Program Name**	**Course Code**		**Course Type**	**Marks**					**Examination time (in Hours)**
					Total	**Paper**	**Ext.**		**CA**	
							L	**P**		
Chemistry	Bachelor of Science	BSMM-4084	I	C	100	Inorganic Chemistry	30	-	20	3
		BSNM-4084	II			Organic Chemistry	30	-		3
			P			Chemistry (Practical)	-	20		3½

Bachelor of Science
(SEMESTER–IV)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-4084(I)
COURSE TITLE: INORGANIC CHEMISTRY

Course outcomes:

Students will be able to

CO1: understand the key features of coordination compounds viz. Nomenclature, Isomerism and electronic configurations of coordination compounds, have general knowledge of Chelates, Postulates of VBT

CO2: understand theproperties and reactions of non-aqueous solvents.

CO3: write both reduction and oxidation half reactions for a simple redox reaction , Frost and understand the Latimer Pourbaix diagram.

CO4: understand the positions,electronic configurations,relative stability,preparation, properties, structures and characteristics of the f-block elements in the periodic table

CO5: understand the role of metal ions and other inorganic elements in biological systems

Bachelor of Science
(SEMESTER–IV)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-4084(I)
COURSE TITLE: INORGANIC CHEMISTRY

Time: 3 Hrs. **Max. Marks: 30**

Note: Instructions for the Paper Setter

Eight questions of equal marks (6 each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Coordination Compounds **(10 Hrs)**

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

Non-AqueousSolvents **(5 Hrs)**

Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

Unit–II

Oxidation and Reduction **(8 Hrs)**

Use of redox potential data-analysis of redox cycle, redox stability in water, Frost, Latimer and Pourbaix diagrams

Chemistry of Lanthanide Elements **(7 Hrs)**

Electronic structure, oxidation states and ionic radii and lanthanide contraction. Electronic absorption and magnetic properties of lanthanides

Unit–III

Chemistry of Actinides **(5 Hrs)**

General features and chemistry of actinides, similarities between the later actinides and the later lanthanides. Electronic and magnetic properties of actinides and their general comparison with the lanthanide elements

Unit–IV

Bioinorganic Chemistry **(10 Hrs)**

Essential and trace elements in biological processes, metalloporphyrins and special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+}

Books Suggested:

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 3rd edition, Pubs: John Wiley Sons. 1995.
2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman Hall Ltd., 1991.
3. Shriver, D.E., Alkins, P.W., Langford, C.H., Inorganic Chemistry; 4th edition, Oxford Publisher: Oxford University Press, 2006.
4. Douglas, B. McDamiel, D., Alexander, J., Concepts and Models of Inorganic Chemistry; 3rd edition, Pubs: John Wiley and Sons Inc., 1994.
5. Porterfield, W.W., Wesley, A., Inorganic Chemistry; Pubs: Addison-Wesley Publishing Company, 1984.
6. Miessler, G.L., Larr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004.
7. Jolly, W.L., Modern Inorganic Chemistry; 2nd edition, Pubs: McGraw-Hill Publishing Company Limited, 1991.
8. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B. Saunders Company, 1977.
9. Puri, B.R., Sharma, L.R., Kalia, K.C., Principles of Inorganic Chemistry; 30th edition, Pubs: Milestones Publisher, 2006-07.
10. Inorganic Chemistry, W.W. Porterfield Addison-Wesley.
11. Inorganic Chemistry, A.G. Sharpe, ELBS.
12. University General Chemistry, C.N.R. Rao, Macmillan.

Bachelor of Science
(SEMESTER–IV)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-4084(II)
COURSE TITLE: ORGANIC CHEMISTRY

Course outcomes:

Students will be able to

CO1: understand structure and bonding in carboxylic acids and carboxylic acid derivatives, Compare the acidity of alcohols,phenols and acids

CO2: understand preparations and reactions of ethers and epoxides, understand cleavages in ethers, the ring opening reactions of epoxides

CO3:understand preparation and reactions of nitroalkanes and nitroarenes, differentiate between primary, secondary and tertiary amines, basicity of amines

CO 4:understand nomenclature, structural features, methods of formation and chemical reactions of Organomagnesium, Organolithium, Organozinc and Organocopper compounds.

CO 5: know the various methods of synthesis and compare electrophilic substitution, basicity, reactions of pyrrole, furan, thiophene and nucleophilic substitution reactions of pyridine.

Bachelor of Science
(SEMESTER–IV)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-4084(II)
COURSE TITLE: ORGANIC CHEMISTRY

Time: 3 Hrs. **Max. Marks: 30**

Note:

Instructions for the Paper Setter
Eight questions of equal marks (6 each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Carboxylic Acids **(8 Hrs)**

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength.Reactions of carboxylic acids.Hell-Volhard-Zelinskyreaction.Synthesis of acid chlorides, esters and amides.Reduction of carboxylic acids.Mechanism of decarboxylation.

Carboxylic Acids Derivatives **(7 Hrs)**

Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides, Relative stability and reactivity 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–II
Ethers and Epoxides **(5 Hrs)**

Nomenclature of ethers and methods of their formation, physical properties.Chemical reaction- cleavage and autoxidation, Ziesel'smethod.Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

Unit-III

Organic Compounds of Nitrogen (10 Hrs)

Preparation of nitroalkanes and nitroarenes.Chemical reactions of nitroalkanes, Mechanisms of nucleophilc substitution in nitroarenes and their reduction in acidic, neutral and alkaline media.Reactivity, Structure and nomenclature of amines, Methods of preparation of amines by Reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction and Hoffmann bromamide reaction.Physicalproperties.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.

Unit–IV

Organometallic Compounds (7 Hrs)

Organomagnesium Compounds: The Grignard reagentsformation, structure and chemical reactions.Organolithium Compounds: Formation and chemical reactions.Organozinc and Organo copper Compounds: Nomenclature, structural features, Methods of formation and chemical reactions.

Heterocyclic Compounds (8 Hrs)

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.

Book Suggested:

1. Morrison, R.T., Boyd, R.N., Organic Chemistry; 6th edition, Pubs: Prentice-Hall, 1992.
2. Wade Jr., L.G., Singh, M.S., Organic Chemistry; 6th edition, Pubs: Pearson Education, 2008.
3. Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: Wiley Eastern Limited, 1985, Vol.I, II, III.
4. Solomons, T.W., Fryhle, C.B., Organic Chemistry; 9th edition, Pubs: Wiley India, 2007.
5. Carey, F.A., Organic Chemistry; 4th edition, Pubs: McGraw-Hill, 2000.
6. Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; 3rd edition, Pubs: Macmillan Publishing Company, 1989.
7. Introduction to Organic Chemistry, Sireitwieser, Heathcock and Kosover, Macmilan.

Bachelor of Science
(SEMESTER–IV)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-4084(P)
COURSE TITLE: CHEMISTRY PRACTICAL

Course outcomes:

Students will be able to analyze the given organic compound through

CO1:understand the basics of Qualitative analysis

CO2: detection of elements (N, S and halogens) in organic compounds.

CO3:detection of functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines,amides, nitro and anilide) in simple organic compounds

CO4: preparation of their derivatives

Bachelor of Science
(SEMESTER–IV)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-4084(P)
COURSE TITLE: CHEMISTRY PRACTICAL

Duration: 3½ hrs. **Max. Marks: 20**

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE office, KanyaMahaVidyalaya, Jalandhar.

Qualitative Analysis

Detection of elements: N, S and halogens

Detection of functional groups:phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide in simple organic compounds and preparing their derivatives.

Practical Examination

1) Detection of Elements, functional group and derivative preparation	15
2) Viva-Voce	03
3) Note Book	02

Book Suggested:

1. Experimental Organic Chemistry, Vol. I and II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
2. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
3. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
4. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.

FACULTY OF SCIENCES

SYLLABUS

of

Chemistry

for

Bachelor of Science

(Semester V)

(UnderContinuous Evaluation System)

(12+3 System of Education)

Session: 2022-25

The Heritage Institution

KANYA MAHA VIDYALAYA

JALANDHAR

(Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science

(Session: 2022-25)

Bachelor of Science (Semester V)										
Course Name	**Programme Name**	**Course Code**		**Course Type**	**Marks**					**Examination time (in Hours)**
					Total	**Paper**	**Ext.**		**CA**	
							L	**P**		
Chemistry	**Bachelor of Science**	BSMM-5084	I	C	100	Inorganic Chemistry	30	-	20	3
		BSNM-5084	II			Physical Chemistry	30	-		3
			P			Chemistry (Practical)	-	20		3½

Bachelor of Science
(SEMESTER–V)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-5084(I)
COURSE TITLE: INORGANIC CHEMISTRY

Course outcomes

Students will be able to:

CO1: use Crystal Field Theory to understand the structure, hybridisation, geometry and predict the colour of the complexes.

CO2: to describe the magnetic properties of coordination compounds.

CO3: describe the stability of metal complexes by the use of formation constants and to calculate thermodynamic parameters from them.

CO4: to draw Orgel diagrams for d^1 to d^{10} systems and predict the possible transitions and to calculate number of microstate and ground state term symbols

CO5: understand preparations, properties and applications of alkyls aryls of lithium and aluminium, bonding in metal-ethylenic complexes, mechanism of homogeneous hydrogenation.

Bachelor of Science
(SEMESTER–V)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-5084(I)
COURSE TITLE: INORGANIC CHEMISTRY

Time: 3 Hrs. **Max. Marks: 30**

Instructions for the Paper Setters:

Eight questions of equal marks (6 each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

1.Metal-ligand Bonding in Transition Metal Complexes

Limitations 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

2. Magnetic Properties of Transition Metal Complexes

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for characterization of 3d-metal complexes.

3. 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

4. Electronic Spectra of Transition Metal Complexes

Term Symbols for $p^2$and d^2 systems, spectroscopic ground states for d^1-d^{10} electronic configurations. Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, Orgel diagram for d^1-d^5.

Unit-IV

5. Organometallic Compounds

Definition, nomenclature and classification of organometallic compounds. EAN rule, preparation, properties, and applications of alkyls aryls of lithium and aluminium, bonding in metal-ethylenic complexes, Mechanism of homogeneous hydrogenation reactions.

Books Suggested:

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; 3rd edition, Pubs: John Wiley Sons. 1995.
2. Lee, J.D., Concise Inorganic Chemistry; 4th edition, Pubs: Chapman Hall Ltd., 1991.
3. Shriver, D.E., Alkins, P.W., Langford, C.H., Inorganic Chemistry; 4th edition, Oxford Publisher: Oxford University Press, 2006.
4. Porterfield, W.W., Wesley, A., Inorganic Chemistry; Pubs: Addison-Wesley Publishing Company, 1984. 5
.Miessler, G.L., Larr, D.A., Inorganic Chemistry; 3rd edition, Pubs: Pearson Education Inc., 2004.
6. Puri, B.R., Sharma, L.R., Kalia, K.C., Principles of Inorganic Chemistry; 30th edition, Pubs:
Milestones Publisher, 2006-07.

Bachelor of Science
(SEMESTER–V)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-5084(II)
COURSE TITLE: PHYSICAL CHEMISTRY

Course outcomes:

Students will be able to:

CO1: understand conductance and its types, applications of conductivity measurements, conductometric titrations, transport numbers

CO2: acquire knowledge about electrodes, reversible and irreversible cells, concentration cells, E.M.F, potentiometric titrations

CO3: understand radioactivity, laws of radioactive decay, nuclear reactions, applications of radioactivity

CO4: characterise the molecules with the help of various spectroscopic techniques such as vibrational, rotational, raman and electronic spectroscopy

Bachelor of Science
(SEMESTER–V)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-5084(II)
COURSE TITLE: PHYSICALCHEMISTRY

Time: 3 Hrs. **Max. Marks: 30**

Instructions for the Paper Setters:

Eight questions of equal marks (6 each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

Unit-I

1. Electrochemistry-I

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution, migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method. Applications of conductivity measurements: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Unit-II

2. Electrochemistry – II

Types of reversible electrodes-gas metal ion, metal ion, metal insoluble salt-anion and redox electrodes. Electrode reactions. Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode, reference electrodes, standard electrode potential, sign conventions, electrochemical series and its significance. Electrolytic and Galvanic cells -reversible and irreverisible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements. Computation of cell. EMF, Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K), polarization, over potential and hydrogen overvoltage. Concentration cells with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.Definition of pH and pK_a, determination of pH using hydrogen, quinhydrone and glass electrodes by potentiometric methods. Buffers-mechanism

of buffer action, Henderson-Hazel equation, Hydrolysis of salts. Corrosion-types, theories and methods of combating it.

Unit-III

3. Nuclear Chemistry

Introduction: Radioactivity, Nuclear Structure, Size of Nucleus, Mass Defects and Binding Energy, Nuclear Stability, Nuclear Forces, Nuclear Spin and Moments of Nuclei, Nuclear Models, Nuclear Decay Processes, The Laws of Radioactive Decay, Soddy-Fajans Group Displacement Law, Rate of Nuclear Decay and Half Life Time (Kinetics of Radioactive Decay), Induced Nuclear Reactions, Types of Nuclear Processes, High Energy Nuclear Reactions, Nuclear Reaction Cross-Section, Artificial radioactivity, Detection and Measurement of Radioactivity, Nuclear Fission, Nuclear Fusion, Applications of Radioactivity.

Unit-IV

4. Spectroscopy

Introduction: Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

5. Rotational Spectrum

Diatomic molecules. Energy levels of a rigid rotor (semiclassical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

6. Vibrational Spectrum

Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Raman Spectrum: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

7. Electronic Spectrum

Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle. Qualitative description of s, p, and n M.O., their energy levels and the respective transitions.

Books Suggested: -

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; 8th edition, Pubs: Oxford University Press,
2008.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs:
Vishal Publishing Co., 2008.
3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Companies Inc, 1996.
4. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.
5. Albert, R.A., Silbey, R.J., Physical Chemistry; 1st edition, Pubs: John Wiley and Sons Inc., 1992.
6. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd,2002.

Bachelor of Science
(SEMESTER–V)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-5084(P)
COURSE TITLE: CHEMISTRY PRACTICAL

Course outcomes:

Students will be able to

CO1: synthesize and analyse the coordination compounds

CO2: determine the end point of various conductometric titrations

CO3: know the principle and working of Abbe's Refractometer

CO4: determine the composition of unknown mixture of two liquids by refractive index measurements.

CO5: learn the technique of Rast's methods

CO6: learn phenomenon of adsorption of acetic acid and oxalic acid on charcoal

CO7: learn distribution coefficient of of iodine between CCl_4 and water

Bachelor of Science
(SEMESTER–V)
SESSION: 2022-2025
COURSE CODE: BSMM/BSNM-5084(P)
COURSE TITLE: CHEMISTRY PRACTICAL

Duration: 3½ Hrs. **Max. Marks: 20**

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

(I) Synthesis and Analysis

(a) Preparation of Sodium trioxalatoferrate (III)
(b) Preparation of Ni-DMG Complex
(c) Preparation of Copper tetrammine complex
(d) Preparation of cis-bisoxalatodiaquachromate (III) ion

(II) Physical Chemistry
(a) Conductometric Titrations
(i) Determine the end point of the following titrations by the conductometric methods.
Strong acid-Strong base
Strong acid-Weak base
Weak acid-Strong base
Weak acid-Weak base
(ii) Determine the composition of a mixture of acetic acid and the hydrochloric acid by conductometric titration.
(b) (i) Molecular Weight Determination of acetanilide, napthalane, using camphor as solvent **(Rast's methods).**
(ii) To determine the molecular weight of a polymer by viscosity measurements.
(c) Adsorption (i)To study the adsorption of acetic acid oxalic/acid from aqueous solutions by charcoal.
(d) Phase Equilibria (i) To determine the distribution coefficient of iodine between CCl_4 and water.
(e) Refractometry
(i) Determination of refractive index of a liquid by Abbe refractometer, and hence the specific and molar refraction.
(ii) To determine the composition of unknown mixture of two liquids by refractive index measurements.

Practical Examination

1) Inorganic Synthesis 07
2) Physical experiment 08
3) Viva- Voce 03
4) Note Book 02

Books Suggested: -

1. Experimental Inorganic Chemistry, W.G. Palmer, Cambridge.

2. Handbook of preparative Inorganic Chemistry, Vol. I and II, Brauer, Academic Press.

3. Inorganic Synthesis, McGraw Hill.

4. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press

5. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill.

6. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.

7. Advanced Experimental Chemistry, Vol. I, Physical, J.N. Guru and R. Kapoor, S. Chand and Co.

8. Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghosh and Sons.

9. Experiments Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

FACULTY OF SCIENCES

SYLLABUS

of

Chemistry

For

Bachelor of Science

(Semester VI)

(Under Continuous Evaluation System)

Session: 2022-25

The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR (AUTONOMOUS)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science

(Session: 2022-25)

Bachelor of Science (Semester VI)										
Course Name	**Program Name**	**Course Code**		**Course Type**	**Marks**					**Examination time (in Hours)**
					Total	**Paper**	**Ext.**		**CA**	
							L	**P**		
Chemistry	Bachelor of Science	BSMM-6084	I	C	100	Molecular Spectroscopy	30	-	20	3
			II			Physical Chemistry	30	-		3
		BSNM-6084	P			Chemistry (Practical)	-	20		3½

Bachelor of Science
(SEMESTER-VI)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-6084(I)
COURSE TITLE: Molecular Spectroscopy

Students will be able to

CO1: understand the principle and applications of ultraviolet and apply Woodward Fisher Rule to calculate λ_{max}

CO2: understand the concepts of Vibrational spectroscopy, Vibrational coupling overtones and Fermi resonance and its application in Organic Chemistry

CO3: know about the Nuclear magnetic resonance spectroscopy. Proton chemical shift, spin-spin coupling, coupling constants and its applications to determine organic structures

CO4: to understand different cleavage patterns of organic compounds in Mass spectrometry and apply the knowledge for interpretation of the spectrum of an unknown compound.

Bachelor of Science
(SEMESTER-VI)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-6084(I)
COURSE TITLE: Molecular Spectroscopy

Examination Time: 3 Hrs. **Max. Marks: 30**

Instructions for the Paper Setters:

Eight questions of equal marks (six marks each) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

UNIT –I

1. Energy and ElectromagneticSpectrum

Introduction, electromagnetic spectrum and Units, Regions of the spectrum,Statement of Born-Oppenheimer approximation, Degree of freedom, Frank Condon Principle, Fluorescence and Phosphorescence.

II. Ultraviolet and Visible Spectroscopy

The energy of electronic excitation, Measurement techniques, Beer-Lambert Law, Molar extinction coefficient. Different types of transition noticed in UV spectrum of organic functional groups and their relative energies. Chromophore, Auxochromes, Absorption and intensity shifts, Factors affecting λ_{max} , Effect of steric hindrance to coplanarity, Solvent effects.

UNIT – II

III. Infrared Spectroscopy

Vibrational energy levels, Selection rules, Force constant, Fundamental vibration frequencies, Factors influencing Vibrational Frequencies (Vibrational Coupling, Hydrogen Bonding, Electronic effect, Bond Angles, Field Effect) of different functional groups, Sampling techniques.

IV. Applications of UV and IR Spectroscopy

Applications of UV spectroscopy, Woodward Fieser rules for calculating λ_{max} of conjugated polyenes and α,ß -unsaturated carbonyl compounds. Applications of IR

spectroscopy, Absorption of Common functional Groups, Interpretation of simple IR spectra, Finger print regions. Simple numerical problems based on UV and IR spectroscopy.

UNIT-III

V. Proton Magnetic Resonance spectroscopy (^{1}HNMR)

The Nuclear spin, Larmor frequency, the NMR isotopes, Population of nuclear spin level, Spin and Spin lattice relaxation, Measurement techniques (CW and FT method), Solvent used, Reference compounds, Chemical shift, nuclear shielding and deshielding, chemical shift, spin-spin splitting and coupling constants, Anisotropic effect, Application of structure elucidation of simple organic molecules

UNIT- IV

VI. Mass Spectrometery

Basic Principles, Elementary theory, Molecular ions, isotope ions, Fragment ions of odd and even electron types, Nitrogen rule, Factors affecting cleavage patterns, Simple cleavage, Cleavages at a hetero atom, Multicentre fragmentations, Rearrangements, Diels – Alder fragmentation, Mc Lafferty rearrangement, Interpretation of the spectrum of unknown simple molecules.

Books Recommended:

1. Organic Spectroscopy By W. Kemp; Publisher- Palgrave, NewYork
2. D.H. Williams and I. Fleming. Spectroscopic Methods in OrganicChemistry.
3. Spectrometric Identification of Organic Compounds - R.M. Silverstein and F. X. Webster; Publisher: John Willey andSons,Inc.
4. Introductory Problems in Spectroscopy- By R.C. Banks, E.R. Matjeha and G. Mercer; Publisher : The Benzamine / Cummings Publishing CompanyInc.
5. Introduction to Spectroscopy – D. L. Pavia, G. M .Lampman, and G. S. Kriz Publisher: Brooks / Cole, a part of cengage learning

Bachelor of Science
(SEMESTER–VI)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-6084(II)
COURSE TITLE: PHYSICAL CHEMISTRY

Course outcomes:

Students will be able to

CO1: understand schrodinger wave equation (S.W.E) and its applications to partical in one, two and three dimensional boxes.

CO2: understand the applications of S.W.E to rigid rotator, harmonic oscillators, hydrogen and hydrogen like atoms, quantum numbers

CO3: acquire knowledge about unit cell,space lattice, miller indices, symmetry operations, Bragg equation, powder method

CO4: understand photophysical, photo chemical, radioative and non-radiative processes, quantum yield, energy transfer processes

Bachelor of Science
(SEMESTER–VI)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-6084(II)
COURSE TITLE: PHYSICAL CHEMISTRY

Time: 3 Hrs. **Max. Marks: 30**

Note:Instructions for the Paper Setter

Eight questions of equal marks (6 each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT–I

1. Quantum Mechanics-I (12 Hrs)

Black-body radiation, Planck's radiation law, Photoelectric effect, heat capacity of solids, Bohr's
model of hydrogen atom (no derivation) and its defects, Compton effect. de Broglie hypothesis, Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box, quantization of energy levels, extension to two and three dimensional boxes, degeneracy.

UNIT–II

2. Quantum Mechanics-II (12 Hrs)

Simple harmonic oscillator model of vibrational motion, setting up Schrodinger equation and discussion of solution and wave functions. Rigid rotator model of rotation of diatomic molecules
transformation to spherical polar coordinates spherical harmonics and their discussion. Qualitative
investigation H-atom, setting up Schrodinger equation, radial and angular part, radial distribution
functions of 1s, 2s, 2p, 3s, 3p and 3d

UNIT–III

3. Solid State **(10 Hrs)**

Definition of space lattice and unit cell, Law of crystallography- (i) Law of constancy of interfacial

angles, (ii) Law of rationality of indices, (iii) Symmetry elements in crystals. X-ray diffraction by crystals.Derivation of Bragg's Law in Reciprocal space.Determination of crystal structure of NaCl, KCl by use of Powder method; Laue's method.

UNIT-IV

4.Photochemistry **(11Hrs)**

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus–Drapper law, Stark–Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of flourescence, phosphorescence, non–radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions–energy transfer processes (simple examples).

Books Suggested :

1. Atkins, P., Paula, J.de, Atkins, Physical Chemistry; 8th edition, Pubs: Oxford University Press, 2008.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; 43rd edition, Pubs: Vishal Publishing Co., 2008.
3. Barrow, G.M., Physical Chemistry; 6th edition, Pubs: McGraw Hill Company Inc., 1996.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan of India, 1985.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; 2nd edition, Pubs: Oxford University Press, 2000.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; I edition, Pubs: John Wiley and Sons Inc., 1992.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems, Pubs: Wiley Eastern Ltd., 1991.
8. Levine, I.N., Physical Chemistry; 5th edition, Pubs : Tata McGraw Hill Publishing Co. Ltd.,2002.
9. Moore, W.J., Basic Physical Chemistry; Pubs : Prentice Hall of India Pvt. Ltd., 1983.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs:McGraw-Hall Book Company, 1989.
11. Banwell, C.N., McCash, E.M., Fundamentals of Molecular Spectroscopy; 4th edition, Pubs:Tata McGraw Hill Publishing Co. Ltd., 1999.
12. Atkins, P. Friedman, R., Molecular Quantum Mechanics; 4th edition Pubs: Oxford University Press, 2007.
13. Levine, I.N., Quantum Chemistry; 5th edition, Pubs: Prentice Hall International Inc., 2000.
14. Inorganic Chemistry, W.W. Porterfield Addison-Wesley.
15. Inorganic Chemistry, A.G. Sharpe, ELBS.

Bachelor of Science
(SEMESTER–VI)
SESSION: 2022-25
COURSE CODE: BSMM/BSNM-6084(P)
COURSE TITLE: CHEMISTRY PRACTICAL

Course outcomes:

Students will be able to

CO1:separate the various mixtures by Column Chromatography technique

CO2:synthesize different Organic Compounds

CO3:synthesise the different compounds by Green Approach

CO4:prepare the different dyes

Bachelor of Science
(SEMESTER–VI)
SESSION 2022-25
COURSE CODE: BSMM/BSNM-6084(P)
COURSE TITLE: CHEMISTRY PRACTICAL

Duration: 3½ hrs. **Max. Marks: 20**

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE office, KanyaMahaVidyalaya, Jalandhar.

(I) Organic Chemistry Laboratory Techniques

(a) Column Chromatography

Separation of o and p nitrophenol

Separation of Leaf pigments from Spinnach leaves

Separation of o and p nitro aniline

Separation of dyes.

(b) Synthesis of Organic Compounds

Preparation of p-nitroacetanilide

Preparation of p-bromoacetanilide

Green Chemistry Experiment: Preparation of benzilic acid from Benzyl-using green approach.

Preparation of Methyl Orange, Methyl Red

Preparation of benzilic acid from benzyl-using green approach

Practical Examination

1) Column Chromatography= 07

2) Organic Synthesis =16

3) Viva-Voce =04

4) Note Book= 03

Books suggested:

1. Experimental Organic Chemistry, Vol. I and II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.

2. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.

3. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.

4. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.

FACULTY OF LIFE SCIENCES

SYLLABUS

of

Chemistry

for

Bachelor of Science (Biotechnology) (Semester I)

(Under Continuous Evaluation System)

(12+3 System of Education)

Session: 2022-25

The Heritage Institution

KANYA MAHA VIDYALAYA

JALANDHAR

(Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Biotechnology) (Session 2022-25)

Bachelor of Science (Biotechnology) Semester-I									
Course Name	**Program Name**	**Course Code**	**Course Type**	**Marks**					**Examination time (in Hours)**
				Total	**Paper**	**Ext.**		**CA**	
						L	**P**		
Chemistry-I (Inorganic Chemistry)	Bachelor of Science Biotechnology	BBTM-1087	C	60	Chemistry-I (Inorganic Chemistry)	30	-	12	3
					Chemistry-I (Inorganic Chemistry) Practical	-	18		3.5

Bachelor of Science (Biotechnology)
(Semester-I)
Session: 2022-25
Course Code: BBTM-1087
COURSE TITLE: Chemistry I (Inorganic Chemistry)

Course outcomes:

Students will be able to:

CO1: understand the key features of coordination compounds viz.variety of structures, oxidation numbers and electronic configurations, coordination numbers and explain the bonding and stability of complexes along with their nomenclature and structure.

CO2: understand the postulates of VBT, inner and outer orbital complexes

CO3: describe the stability of metal complexes by the use of formation constants and to calculate thermodynamic parameters from them, understand macrocyclic effect, crown ethers, cryptands

CO4: understand Crystal field splitting of d-orbitals in octahedral, tetrahedral, cubic and square planer fields of ligands.

Bachelor of Science (Biotechnology)
(Semester-I)
Session: 2022-25
Course Code: BBTM-1087
Chemistry I (Inorganic Chemistry)

Time: 3 Hrs. **Max. Marks: 60**
Theory: 30 Practical: 18 CA: 12

Instructions for the Paper Setters:
Eight questions of equal marks (6 each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section

Unit-I

Introduction, Werner's coordination theory, naming of co-ordinate complexes.

Co-ordination numbers 1-12. Factors affecting co-ordination numbers and stereo-chemistry, Isomerism in coordination compounds.

Unit-II

Valence bond theory for co-ordinate complexes, inner and outer orbital complexes, electro-neutrality and back bonding, limitations of V.B. theory.

Unit-lll

Stability of co-ordination compounds

Introduction Factors affecting the stability of metal ion complexes with general ligands

Alkali metal and alkaline earth metal chelators: Definition and few examples of macrocyclic ligands, macrocyclic effect, crown ethers and cryptands.

Unit-IV

Crystal field theory-Splitting of d-orbitals in octahedral, tetrahedral, cubic and square planer fields of ligands, calculations of C.F.S.E. in high spin and low spin octahedral and high spin tetrahedral complexes, factors affecting the 10 Dq value.

Books Recommended:
1. G.L. Eichorn, Inorganic Biochemistry, Vol. I Elsevier,
2. J.E. Huheey, E.A. Keiter, R.L. Keiter, Inorganic Chemistry, 4th ed. Pearson Education, Singapore, 1999.
3. D.F.C Shriver, P.W. Atkins and C.H. Langford, Inorganic Chemistry, ELBS Oxford, 1991.
4. Cowan, J.A. (1997) – Inorganic Biochemistry – An Introduction, Wiley- VCH

Bachelor of Science (Biotechnology)
(Semester-I)
Session: 2022-25
Course Code: BBTM-1087(P)
COURSE TITLE: Chemistry I (Inorganic Chemistry)
(Practical)

Course outcomes:

Students will be able to:

CO1: understand the technique of volumetric analysis

CO2: understand Iodimetry, Iodometry

CO3: understand Redox titrations using $K_2Cr_2O_7$ and $KMnO_4$.

CO4: identify the various ions present in the mixture.

Bachelor of Science (Biotechnology)
(Semester-I)
Session: 2022-25
Course Code: BBTM-1087(P)
Course Title: Chemistry I (Inorganic Chemistry)
(Practical)

Time: 3.5 Hrs. **Practical**
Marks: 18

Insructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Experiments

Volumetric Analysis:

Iodimetry, Iodometry, Redox titrations using $K_2Cr_2O_7$ and $KMnO_4$.

Inorganic qualitative analysis:

Four ions (Two cations two anions).

A. Preliminary tests: Physical examination, Dry heating test, charcoal cavity test,

$Co(NO_3)_2$ test, flame test, borax bead test.

B. Acid radical analysis:

Dil. H_2SO_4 group: CO^{2-}_3, NO^-_2, S^{2-}, SO_3^{2-}

Conc, H_2SO_4 group: Cl^-, Br^-, I^-, NO_3^-, CH_3COO^-

Individual group: SO_4^{2-}, PO_4^{3-}, BO_3^{3-}

C. Basic radical analysis:

NH_4^+ Pb^{2+}, Cu^{2+}, Cd^{2+}, Fe^{2+} or Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+} Mg^{2+}, Na^+, K^+ and their confirmation.

Book recommended:

G. Svehla, B. Sivasankar, Vogels Qualitative Inorganic Analysis 7 Edition, 2012

FACULTY OF LIFE SCIENCES

SYLLABUS

of

Chemistry

for

Bachelor of Science (Biotechnology) (Semester III)

(UnderContinuous Evaluation System)

(12+3 System of Education)

Session: 2022-25

The Heritage Institution

KANYA MAHA VIDYALAYA

JALANDHAR

(Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Biotechnology) (Session 2022-25)

Chemistry

Bachelor of Science (Biotechnology) Semester-III									
Course Name	**Program Name**	**Course Code**	**Course Type**	**Marks**					**Examination time (in Hours)**
				Total	**Paper**	**Ext.**		**CA**	
						L	**P**		
Chemistry-II (Organic Chemistry)	Bachelor of Science(Biotechnology)	BBTM-3083	C	60	Chemistry-II (Organic Chemistry)	30	-	12	3
					Chemistry-II (Organic Chemistry) Practical	-	18		3.5

Bachelor of Science (Biotechnology)

(Semester-III)

SESSION: 2022-25

COURSE CODE: BBTM-3083

COURSE TITLE: Chemistry-II (Organic Chemistry)

Course outcome:

Students will be able to

CO1:explain the various reactive intermediates.

CO2:explain the bonding between different organic compounds

CO3: explain the effect of various substituents on the reactivity of aromatic compounds

CO4:learn Molecular chirality, enantiomers, the Cahn-Ingold Prelog R-S notational system, Resolution of enantiomers, chiral centres other than carbon.

CO5: understand mechanism of nucleophilic substitution , stereochemistry of SN^1 and SN^2 reactions

Bachelor of Science (Biotechnology)

(Semester-III)

SESSION: 2022-25

COURSE CODE: BBTM-3083

COURSE TITLE: Chemistry-II (Organic Chemistry)

Time: 3 Hrs. **Max. Marks: 60**

(Theory: 30, Practical: 18, CA: 12)

Instructions for the Paper Setters:

Eight questions of equal marks (6 each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section

UNIT-I

Reactive intermediates

Carbocations, carbanions, free radicals, carbenes, arenes and nitrenes(with examples). Assigning formal charges on intermediates and other ionic species

Bonding

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, Van der Waals interactions, resonance, hyperconjugation, hydrogen bonding and Inductive and electrometric effects.

UNIT-II

Aromaticity

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. Methods of formation and chemical reactions of alkylbenzenes

UNIT-III

Stereochemistry: Molecular chirality, enantiomers/symmetry in achiaral structures, chiral centres in chiral molecules, properties of chiral molecules-optical activity, absolute and relative configuration, the Cahn-Ingold Prelog R-S notional system physical properties of enantiomers. Stereochemistry of chemical reactions that produce chiral centres, chemical reactions that produce stereoisomers, Resolution of enantionmers, chiral centres other than carbon, prochirality.

UNIT-IV

Nucleophilic substitution :Functional group transformation by nucleophilic substitution, the biomolecular (SN^2), mechanism of nucleophilic substitution , stereochemistry of SN^2 reactions, how SN^2 reactions occur, steric effect in SN2reactions, nucleophiles and nucleophilicity, the unimolecular (SN^1) mechanism of nucleophilies substitution, carbocation stability and the rate of substitution, by the SN^1 mechanism sterochemistry of SN1reactions, carbocation real arrangements in SN^1 reactions, solvent effects, subtitution and elimination as competing reactions.

Books Recommended:

1. R.T. Morison and R.N. Boyd, Organic chemistry
2. I. L. Finar, Organic Chemistry, Vol.I, IV ed. J. March, Advanced Organic Chemistry, Reactions Mechanisms and Structure.
3. Schaum's Outlines Series, Theory and Problems of Organic chemistry.
4. I.L. Finar, Problems and their solution in Organic chemistry.
5. J. D. Robert and M. C. Caserio, Modern Organic Chemistry.
6. D. J. Cram and G. S. Hammond, Organic chemistry.
7. J. E. Banks, Naming Organic Compounds - Programmed Introduction to Organic Chemistry
8. E.L. Eliel, Stereochemistry of carbon compounds.
9. W. Camp, Organic Spectroscopy.
10. F. A. Carey, Organic chemistry

Bachelor of Science (Biotechnology)

(Semester-III)

SESSION: 2022-25

COURSE CODE: BBTM-3083(P)

COURSE TITLE: Chemistry-II (Organic Chemistry)

(Practical)

Course outcome:

Students will be able to

CO1.Detect elements (N, S and halogens) in simple organic compounds

CO2: Detect functional groups (Aldehydes, ketones carbohydrates, hydrocarbons, Amides ,Amines Carboxylic acids and phenols) in simple organic compounds

CO3: Prepare their derivatives of organic compounds.

CO4: Confirm the unknown organic compounds by determining its M.P.

Bachelor of Science (Biotechnology)

(Semester-III)

SESSION: 2022-25

COURSE CODE: BBTM-3083(P)

COURSE TITLE: Chemistry-II (Organic Chemistry)

(Practical)

Time: 3.5 Hrs. **Practical Marks: 18**

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Organic qualitative analysis:

Complete identification including derivation of following organic compounds:

- Amides

- Amines

- Carboxylic acids and phenols.

Organic qualitative analysis:

Complete identification including derivation of following organic compounds:

- Aromatic hydrocarbons

- Aldehydes

- Ketones

- Carbohydrates

Books Recommended:

Arthur Vogel (1978), Vogel's Textbook of practical organic chemistry, including qualitative organic analysis, 4th ed., Longman Scientific and Technical

FACULTY OF LIFE SCIENCES

SYLLABUS

of

Chemistry

for

Bachelor of Science (Biotechnology) (Semester VI)

(Under Continuous Evaluation System)

(12+3 System of Education)

Session: 2022-25

The Heritage Institution

KANYA MAHA VIDYALAYA

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Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Biotechnology) (Session 2022-25)

Chemistry

Bachelor of Science (Biotechnology) Semester-VI									
Course Name	**Program Name**	**Course Code**	**Course Type**	**Marks**					**Examination time (in Hours)**
				Total	**Paper**	**Ext.**		**CA**	
						L	**P**		
Chemistry-III (Physical Chemistry)	Bachelor of Science (Biotechnology)	BBTM-6083	C	60	Chemistry-II (Physical Chemistry)	30	-	12	3
					Chemistry-II (Physical Chemistry) Practical	-	18		3.5

Bachelor of Science (Biotechnology) Semester-VI

SESSION: 2022-25

COURSE CODE: BBTM-6083

COURSE TITLE: Chemistry-III (Physical Chemistry)

Course outcome:

Students will be able to

CO1: understand the various thermodynamic properties and laws of Thermodynamics.and acquire knowledge about the various thermodynamic terms like enthalpy of formation, enthalpy of ionisation, entropy, internal energy. Calculate entropy change for reversible and irreversible processes under isothermal and non-isothermal conditions and also absolute entropies of substances.

CO2:acquire the knowledge of structure and intermolecular forces present between solids, liquids and gases.

CO3 Understand the concept of reaction rates and determine the rate law from initial rate data.Determine the order of reaction with respect to each reactant, the overall order of reaction, the rate constant with units. learn about the Catalysis, hydrogenation Catalysis

CO4: understand the concept of Electrochemistry and various terms related to it like resistance, conductance, specific resistance, cell constant, EMF and determine the transference number of ions using Hittorf and moving boundary methods.

Bachelor of Science (Biotechnology) Semester-VI

SESSION: 2022-25

COURSE CODE: BBTM-6083

COURSE TITLE: Chemistry-III (Physical Chemistry)

Time: 3 Hrs. **Max. Marks: 60**

(Theory: 30, Practical: 18, CA: 12)

Instructions for the Paper Setters:

Eight questions of equal marks (6 each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section

UNIT-I

CHEMICAL THERMODYNAMICS:

Objectives and limitations of Chemical Thermodynamics, State functions, thermodynamic equilibrium, work, heat, internal energy, enthalpy. First Law of Thermodynamics : First law of thermodynamics for open, closed and isolated systems. Reversible isothermal and adiabatic expansion/compression of an ideal gas. Irreversible isothermal and adiabatic expansion. Enthalpy change and its measurement, standard heats of formation and absolute enthalpies. Kirchoff's equation. Second and Third Law: Various statements of the second law of thermodynamics. Efficiency of a cyclic process (Carnot's cycle).Entropy. Entropy changes of an ideal gas with changes in P,V, and T. Free energy and work functions. Gibbs-Helmholtz Equation. Criteria of spontaneity in terms of changes in free energy. Third law of thermodynamics: Absolute entropies. Thermodynamics of Simple Mixtures: Partial molar quantities and their significance. Chemical potential and its variation with T and P. Fugacity function and its physical significance. Concept of activity and activity coefficient.

UNIT-II

SOLUTIONS:

Ideal and non- ideal solutions, method of expression concentrations of solution, activity and activity coefficients, dilute solution, Osmotic pressure, its law and measurements, Elevation of boiling point and depression of freezing points. Chemical Equilibrium : General characteristics of chemical equilibrium, thermodynamic derivation of the law of chemical

equilibrium, Van't Hoff reaction isotherm. Relation between Kp, Kc and Kx. Temperature dependence of equilibrium constant Van't Hoff equation, homogeneous & heterogreneous equilibria, Le Chetalier's principle.

UNIT-III

CHEMICAL KINETICS AND CATALYSIS:

Scope, rate of reaction, influencing factors such as concentration, temperature, pressure, solvent etc. theories of chemical kinetics. Arrhenius equation, concept of activation energy. Rates of reactions, rate constant, order and molecularity of reactions. Chemical Kinetics: Differential rate law and integrated rate expressions for zero, first, second and third order reactions. Half-life time of a reaction. Methods for determining order of reaction. Effect of temperature on reaction rate and the concept of activation energy. Reaction mechanism. Steady state hypothesis. Catalysis : Homogeneous catalysis, Acid-base catalysis and enzyme catalysis (Michaelis-Menten equation). Heterogeneous catalysis. Unimolecular surface reactions.

UNIT-IV

ELECTRO-CHEMISTRY:

Specific conductance, molar conductance and their dependence on electrolyte concentration. Ionic Equilibria and conductance, Essential postulates of the Debye-Huckel theory of strong electrolytes. Mean ionic activity coefficient and ionic strength. Transport number and its relation to ionic conductance and ionic mobility. Conductometric titrations. pH scale. Buffer solutions, salt hydrolysis.Acid-base indicators.

Books Recommended:

1. Physical Chemistry by Samuel H, Carl P. Putton; 4th Edition, Americ Inc. Co.
2. Physical Chemistry by Glassstone, 2ndEdition,TheMacmillian Press Ltd.
3. Kinetic and Mechanism by Frost A and Pearson R.G, 3rd Edition, Wiley Eastern Pvt. Ltd.
4. Chemical Kinetic by K.J. Laidler, Harper and Row.
5. Physical Chemistry by Glberg W. Castellian Addison:3rd Revised Edition Wesley publishing Comp
6. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Ed. V and VI. Wiley Inter-science

Bachelor of Science (Biotechnology) Semester-VI

SESSION: 2022-25

COURSE CODE: BBTM-6083

COURSE TITLE: Chemistry-III (Physical Chemistry)

Practical

Course outcome:

Students will be able to

CO1: know the principle and mechanism of Conductometric titrations and polarimetric experiments

CO2: determine the heat of of neutralization and Heat of solution Calorimetrically

CO3: verify Beer Lambert Law for different solutions.

CO4: determine the pH of the solution and analyze optical active substances

Bachelor of Science (Biotechnology) Semester-VI

SESSION: 2022-25

COURSE CODE: BBTM-6083

COURSE TITLE: Chemistry-III (Physical Chemistry)

(Practical)

Time: 3.5 Hrs. **Practical Marks: 18**

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Books Recommended:

1. Calorimetry:
a) Determination of Heat of neutralization
(i) Strong acid-strong base
(ii) Weak acid-strong base.
b) Determination of Heat of solution of KCl, NH4Cl, KNO3
2. Conductometry:
a) Determination of cell constant.
b) Determination of specific and equivalent conductance of electrolyte (NaCl and HCl).
c) Precipitation titration of Na2SO4 vs. BaCl2.
d) Neutralization titrations NaOH vs. HCl and NaOH vs. CH3COOH.
3. Photometry.
Verification of Lambert beer's law for solution of CoCl2H2O (in water) and K2Cr2O7 (in water)
4. a) pH of buffer solution
b) Acid base titration HCl vs. NaOH.
c) Determination of ionization constant of a weak acid (CH3COOH)
5. Determine composition of HCl and CH3COOH in the given solution pH metrically.
6. Polarimetry: Determine the %age composition of an optically active solution.

Books Recommended:

1. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
2. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill.
3. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
4. Advanced Experimental Chemistry, Vol. I, Physical, J.N. Guru and R. Kapoor, S. Chand and Co.
5. Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghosh and Sons.
6. Experiments Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

FACULTY OF SCIENCES

SYLLABUS

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Bachelor of Science (Home Science) (Semester III)

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Session: 2022-25

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KANYA MAHA VIDYALAYA

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SCHEME AND CURRICULUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Home Science) (Session 2022-25)

Chemistry

Bachelor of Science (Home Science) **Semester-III**									
Course Name	**Program Name**	**Course Code**	**Course Type**	**Marks**					**Examination time (in Hours)**
				Total	**Paper**	**Ext.**		**CA**	
						L	**P**		
Basic Chemistry	Bachelor of Science Home Science	BHSL-3084	C	50	Basic Chemistry	40	-	10	3

Bachelor of Science (Home Science)
(Semester-III)
Session: 2022-25
Course Code: BHSL-3084
Course Title: Basic Chemistry

Course outcomes:

Students will be able to:

CO1: understand various formulae and symbols used in chemistry.

CO2: understand the atomic structure, acquire knowledge about various atomic models

CO3: understand postulates of VBT

CO4: understand the concept of normality, molarity, molality and strength of solution.

CO 5: knowledge of fibers, pH of water, hard water

Bachelor of Science (Home Science)
(Semester-III)
Session: 2022-25
Course Code: BHSL-3084
Course Title: Basic Chemistry

Examination Time: 3 Hours **Max. Marks: 50**
Theory: 40 CA: 10

Instructions for the Paper Setters: -
Eight questions of 8 marks each are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

UNIT-I

Symbols, formulae, valency, variable valency, elementary idea of mole concept, empirical formulae and molecular formulae, definition of atomic and molecular weight.Chemical equation and reaction parts, types, essentials, implications and limitations of chemical equation, balancing of equation hit trial method, exothermic, endothermic, catalytic and reversible reaction.

UNIT-II

Atomic structure, elementary idea of electron, proton, neutron arrangement of fundamental particles in an atom. Rutherford atomic model, atomic number, mass number, isotopes, isobars. Bohr's atomic model (postulates)

UNIT-III

Chemical bonding, definition of chemical bond, cause of chemical combination, types of chemical bonds, ionic bonds, covalent bond, coordinate bond, definition and simpleexamples based on electron dot picture (example include H_2, Cl_2, 0_2, NH_3, CH_4, C_2H_2, MgF_2, CaO,NH_4^+,H_3O^+).

UNIT-IV

Elementary idea about normality, morality, molality and strength of solution.

Structure of fibers (Natural and synthetic).

Elementary idea about pH of water, hard' water, its cause and type, heavy water with its uses.

Books recommended:

1. N.C.E.R.T. Books for XI and XII.
2. Modern Approach to Chemistry by S. P. Johar Vol. I and Vol. II.

FACULTY OF SCIENCES

SYLLABUS

of

Chemistry

for

Bachelor of Science (Home Science) (Semester IV)

(Under Continuous Evaluation System)

(12+3 System of Education)

Session: 2022-25

The Heritage Institution

KANYA MAHA VIDYALAYA

JALANDHAR

(Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Home Science)

(Session 2022-25)

Bachelor of Science (Home Science) **Semester-IV**									
Course Name	**Program Name**	**Course Code**	**Course Type**	**Marks**					**Examination time (in Hours)**
				Total	**Paper**	**Ext.**		**CA**	
						L	**P**		
Applied Chemistry	Bachelor of Science(Home Science)	**BHSM-4087**	C	50	**Applied Chemistry (Theory)**	30	-	10	3
		BHSM-4087(P)	C		**Applied Chemistry (Practical)**	-	10		3

Bachelor of Science (Home Science)
(Semester-IV)
SESSION 2022-25

COURSE CODE: BHSM-4087

COURSE TITLE: Applied Chemistry (Theory)

After passing this course the student will be able to :

CO1: to understand the composition and properties of different organic compounds used in daily life.

CO2 : to do the naming of various Organic Compound, to draw the structure of the given Molecular Formula

CO3: understand the structure and properties of Soaps and Detergents, prepare Soaps and Detergents by different Chemical methods, differentitate between Soaps and Detergents.

CO4: understand the structure and importance of rubbers and plastics.

CO5:have an elementary idea about composition of cosmetics.

Bachelor of Science (Home Science)
(Semester-IV)
SESSION 2022-25

COURSE CODE: BHSM-4087

COURSE TITLE: Applied Chemistry (Theory)

Max Time: 3 Hrs. **Max. Marks: 50**

(Theory: 30; Practical: 10; CA: 10)

Instructions for the Paper Setters:

Eight questions of equal marks (6 each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Nomenclature of organic compounds.

Unit –II

Soaps and detergents, their structure, properties and preparation.

Unit-III

Plastics and rubber, their structure and uses. Elementary idea about composition of cosmetics.

Unit –IV

Fuels for home.

Books recommended:

1. Textbook of polymer science, F. W. Billmeyer Jr.Wiley.
2. Polymer science, V. R. Gowariker, N. V. Viswanathan and J. Sreedhar,Wiley-Eastern
3. Polymer Chemistry, Melcolm P. Stevens, Oxford University Press
4. Morrison, R.T., Boyd, R.N., Organic Chemistry; 6th edition, Pubs: Prentice-Hall, 1992.
5. Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: New Age International, 1985.
6. Fundamentals of Organic Chemistry, Solomons, John Wiley.

Bachelor of Science (Home Science)
(Semester-IV)
SESSION 2022-25
Course Code: BHSM-4087(P)
COURSE TITLE: Applied Chemistry (Practical)

Course Outcomes

After passing this course the student will be able to:

CO1: prepare the solutions of different normalities and molarities.

CO2: calculate the strength of solutions of different normalities.

CO3: find out the percentage purity of the given sample solution.

CO4: compare the hardness of the various water samples.

CO5: to do Chemical testing of different Textile fibres (cotton, wool, silk, synthetic fibres).

CO6: to determine the pH of an unknown sample.

CO7: to determine the melting point of an organic compound.

Bachelor of Science (Home Science)

(Semester-IV)

SESSION 2022-25

COURSE CODE: BHSM-4087(P)

COURSE TITLE: Applied Chemistry (Practical)

Time: 3 Hrs **Practical Marks: 10**

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

1. Preparation of standard solution.
2. To determine the normality and strength of given alkali solution.
3. To determine the percentage purity of given sample of alkali solution
4. Volumetric titration for estimation of hardness of water.
5. Chemical testing of Textile fibers. (cotton, wool, silk, synthetic fibers)
6. Determination of melting point of Organic compound.
7. Preparation of soap
8. Determination of pH of some samples

Books recommended:

1) Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
2) Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
3) Advanced Practical Physical Chemistry,J. B. Yadav Goel Publishing House, 1981.
4) Modern Approach to Chemistry by S. P. Johar Vol. I and Vol. II.

FACULTY OF SCIENCES

SYLLABUS

of

Chemistry

for

Bachelor of Science (Honours) Mathematics (Semester I)

(Under Continuous Evaluation System)

(12+3 System of Education)

Session: 2022-25

The Heritage Institution

KANYA MAHA VIDYALAYA

JALANDHAR

(Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Honours) Mathematics

(Session: 2022-25)

Bachelor of Science (Honours) Mathematics **Semester-I**									
Course Name	**Program Name**	**Course Code**	**Course Type**	**Marks**					**Examination time (in Hours)**
				Total	**Paper**	**Ext.**		**CA**	
						L	**P**		
Physical Chemistry	Bachelor of Science (Honours) Mathematics	BOMM-1085	C	100	Physical Chemistry	60	-	20	3
					Physical Chemistry (Practical)	-	20		3.5

Bachelor of Science (Honours) Mathematics
(Semester–I)
Session: 2022-25
Course Title: Physical Chemistry
Course Course Code: BOMM-1085

Course outcomes:

Students will be able to:

CO1: understand the various thermodynamic properties and laws of Thermodynamics, acquire knowledge about the various thermodynamic terms like enthalpy of formation, enthalpy of ionisation, entropy, internal energy

CO2: calculate entropy change for reversible and irreversible processes under isothermal and non-isothermal conditions and also absolute entropies of substances

CO3: understand the relation between free energy change and equilibrium constants K_p, K_c and $K_{f,}$: describe the Phases and Phase rule and its thermodynamic derivation

CO4: draw and explain the phase diagrams of water system, sulphur system

CO5: understand the concept of Electrochemistry and various terms related to it like resistance, conductance, specific resistance, cell constant, EMF, importance of Nernst Equation

CO6: determine the transference number of ions using Hittorf and moving boundary methods

CO7: understand the concept of reaction rates and determine the rate law from initial rate data, determine the order of reaction with respect to each reactant, the overall order of reaction, the rate constant with units

Bachelor of Science (Honours) Mathematics
(Semester–I)
Session: 2022-25
Course Title: Physical Chemistry
Course Code: BOMM-1085

Examination Time: 3 Hours **Max. Marks: 100**
Theory:60 Practical: 20 CA: 20

Instructions for the Paper Setters:
Eight questions of 12 marks each are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Unit I

Chemical Thermodynamics
Laws of thermodynamics, Enthalpy of a system, heat capacity, Isothermal and adiabatic process in ideal gases, Carnot cycle, thermodynamic efficiency, Thermo-Chemistry : heat of reaction at constant volume and pressure thermo chemical equations, calculations of E from H and vice versa, Hess's law of heat summation, heat of formation, heats of combustion, heat of solution, heat of neutralization of acids and bases, dependence of H and E for a reaction

(Kirchoff's equation). II and III law of thermodynamics: Entropy, dependence ofentropy on variables of a system, Entropy change in ideal gases, entropy of mixing for ideal gases, entropy change in physical transformations, entropy change in chemical reactions, absolute Entropies, residual entropy, thermodynamics of III Law.

Unit II

Equilibrium
Equilibrium and Spontaneity under constraints- General conditions. Helmholtz free energy (A) for reactions. Gibbs free energy.Chemical potential, Gibbs free energy and entropy of mixing of ideal gases. The Equilibrium constants K_p and K_c of real gases.Phase Rule, Gibbs Phase rule, derivation of phase rule, one component system, the water system, the sulfur system.

Unit III

Chemical Kinetics
Measurement of reaction rate, order, molecularity of reaction, first order reactions, second order reactions, third order reactions, Methods of determination of order, effect of temperature, activation energy.

Unit IV

Electro-Chemistry
Conductance and Ionic Equilibrium: Faraday's law of electrolysis, Kohlrausch law of independent migration of ions, transference numbers, determination of transference numbers, electrolytic conductance, variation of conductance with concentration, equivalent conductance at infinite dilution, Applications of conductance measurements, Reversible and

Irreversible cells, standard cells, cell reaction and EMF. Single electrode potential and its calculation, thermodynamic and EMF, standard potential and equilibrium constants.

Books Recommended:

1. Physical Chemistry by Samuel H, Carl P. Putton; 4th Edition, Americ Inc. Co.
2. Physical Chemistry by Glassstone, 2ndEdition,TheMacmillian Press Ltd.
3. Kinetic and Mechanism by Frost A and Pearson R.G, 3rd Edition, Wiley Eastern Pvt. Ltd.
4. Chemical Kinetic by K.J. Laidler, Harper and Row.
5. Physical Chemistry by Glberg W. Castellian Addison:3rd Revised Edition Wesley publishing Comp

Bachelor of Science (Honours) Mathematics
(Semester–I)
Session: 2022-25
Course Title: Physical Chemistry Practical
Course Code: BOMM-1085 (P)

Course outcomes:

Students will be able to:

CO1: determine the surface tension of different liquids and solutions

CO2: determine the viscosity of different liquids and solutions

CO3: efficiently use of calorimeter in various experiments

CO4: determine heat of neutralization and heat of solution

Bachelor of Science (Honours) Mathematics
(Semester–I)
Session: 2022-25
Course Title: Physical Chemistry Practical
Course Code: BOMM-1085(P)

Examination Time: 3.5 Hours **Max. Marks: 20**

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners.Two copies of the same should be submitted for the record to COE Office, KanyaMahaVidyalaya, Jalandhar.

1. Determine the coefficient of viscosity of the given liquid (CCl_4, glycerine solution in water).
2. Determine the surface tension of given liquid (CCl_4, glycerine solution in water) by drop number method.
3. Determine the surface tension of given liquid (CCl_4, glycerine solution in water) by drop weight method.
4. Determine the water equivalent of given calorimeter.
5. Determine the enthalpy of neutralisation of a strong acid versus strong base.
6. Determine the enthalpy of neutralisation of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
7. Determine the enthalpy of dissolution of solid calcium chloride in water at room temperature.

Books Recommended:

1. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
2. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill.
3. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
4. Advanced Experimental Chemistry, Vol. I, Physical, J.N. Guru and R. Kapoor, S. Chand and Co.
5. Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghosh and Sons.
6. Experiments Physical Chemistry, J.C. Ghosh, BharatiBhavan.

FACULTY OF SCIENCES

SYLLABUS

of

Chemistry

for

Bachelor of Science (Honours) Physics (Semester I)

(Under Continuous Evaluation System)

(12+3 System of Education)

Session: 2022-25

The Heritage Institution

KANYA MAHA VIDYALAYA

JALANDHAR

(Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Honours) Physics (Session: 2022-25)

Chemistry

Bachelor of Science (Honours) Physics **Semester-I**									
Course Name	**Program Name**	**Course Code**	**Course Type**	**Marks**					**Examination time (in Hours)**
				Total	**Paper**	**Ext.**		**CA**	
						L	**P**		
Chemistry-I	Bachelor of Science (Honours) Physics	BOPL-1086	C	50	Chemistry-I	40	-	10	3
Chemistry Lab-I	Bachelor of Science (Honours) Physics	BOPP-1088	C	50	Chemistry Lab-I	-	40	10	3

Bachelor of Science (Honours) Physics
(Semester–I)
Session: 2022-25
Course Title: Chemistry-I
Course Code: BOPL-1086

Course outcomes:

Students will be able to

CO1: differentiate between chiral and achiral compounds, configuration and conformation and understand the concept of isomerism

CO2: understand the resolution of enantiomers and differentiate between dextrorotatory and laevorotatory compounds, do conformational analysis of ethane, butane, cyclohexane, mono substituted and disubstituted cyclohexane and explain the various methods of formation and chemical reactions of alkanes, alkenes and alkynes.

CO3: understand functional group transformation by nucleophilic substitution

CO4: describe the mechanism and stereochemistry of nucleophilic substitution reactions and understand the principles of nucleophilic addition to carbonyl groups.

Bachelor of Science (Honours) Physics
(Semester–I)
Session: 2022-25
Course Title: Chemistry-I
Course Code: BOPL-1086

Examination Time: 3 Hours **Max. Marks: 50**
(Theory: 40, CA: 10)

Instructions for the Paper Setters:
Eight questions of equal marks (eight marks each) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT I

Stereochemistry: General introduction to stereochemistry and molecular chirality, properties of chiral molecules-optical activity, enantiomerism, introduction to absolute and relative configuration, the Cahn-Ingold Prelog R-S notional system physical properties of enantiomers. Stereochemistry of alkenes, naming stereo isometric alkenes by the E-Z system.
Conformational analysis. Conformational analysis of ethane, butane, cyclohexane, mono substituted and disubstituted cyclohexane

UNIT II

Chemistry of alkanes and alkenes: General chemistry of alkanes and alkenes, preparation of alkanes by decarboxylation. Wurtz reaction and Corey House reaction with mechanisms. Dehydration of alcohols and regioselectivity of these reactions. Acid catalysed dehydration of alcohols with complete mechanistic discussion, Mechanism of dehydrohalogenation of alkyl halides (Elimination mechanism), stereoselective and anti-elimination in elimination reactions.
Mechanism of hydrogenation of alkenes, stereochemistry of hydrogenation of cyclo alkenes, electrophilic addition of hydrogen halides to alkenes its regioselectivity explained on the basis of mechanism, free radical addition of hydrogen bromide to alkenes, acid catalysed hydration of alkene with mechanism, stereochemistry of halogen addition to alkenes and its mechanistic explanation. Hypohalous acid addition to alkenes, epoxidation of alkenes.
Alkynes: General chemistry of alkynes, preparation of alkynes, acidity of acetylene and terminal alkenes, metal ammonia reduction of alkyne, addition of hydrogen halides and water to alkynes, with detailed discussion of mechanism of these reactions.

UNIT-III

Nucleophilic substitution reactions: Functional group transformation by nucleophilic substitution, the biomolecular (S_N2), mechanism of nucleophilic substitution, stereochemistry of S_N2 reactions, steric effect in S_N2 reactions, nucleophiles and nucleophilicity. The unimolecular (S_N1) mechanism of nucleophilicsubstitution, carbocation stability and the rate of substitution, stereochemistry of S_N1 reactions, carbocation arrangements in S_N1 reactions, solvent effects, substitution and elimination as competing reactions.

UNIT-IV

Chemistry of carbonyl compounds. Principles of nucleophillic addition to carbonyl groups: Hydration, acetal formation, cyanohydrin formation; reactions with primary and secondary amines, Wittig reaction, mechanism of halogenation, acid and base catalysed enolization, haloform reaction, aldol condensation, conjugate nucleophillic addition to unsaturated carbonyl compounds

Books Recommended:

1. Advanced Organic Chemistry, Reactions Mechanisms and Structure by J. March.
2. Organic Chemistry by F. A Carey
3. Schaum's Outlines Series Theory and Problems of Organic Chemistry by Herbert Meislick and Jacob Sharefkin
4. Problems and their solution in Organic chemistry by I.L. Finar,
5. Organic Chemistry by D.J. Cram and G.S. Hammond.
6. J.E. Banks, Naming Organic Compounds – Programmed Introduction to Organic Chemistry.
7. E.L. Eliel, Stereochemistry of carbon compounds.

Bachelor of Science (Honours) Physics
(Semester–I)
Session: 2022-25
Course Title: Chemistry Lab-I
Course Code: BOPP-1088

Course outcomes

Students will be able to

CO1: develop skills required for the qualitative analysis of organic compounds and to detect elements (N, S and halogens).

CO2: detect functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro) in simple organic compounds

CO3: determine the physical constants of organic compounds

CO4: prepare the derivatives of organic compounds

Bachelor of Science (Honours) Physics
(Semester–I)
Session: 2022-25
Course Title: Chemistry Lab-I
Course Code: BOPP-1088

Examination Time: 3 Hours Max. Marks: 50
Practical: 40, CA: 10

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

General Guidelines for Practical Examination

The preliminary examination of physical and chemical characteristics (physical state, colour, odor and ignition tests), elemental analysis (nitrogen, sulphur, chlorine, bromine, iodine), solubility tests including acid-base reactions, classification tests involving functional reactivity other than acid-base test, preparation of derivatives for given pure organic compounds.

The following categories of compounds should be analysed:

-Phenols
- Carboxylic acids
-Carbonyl compounds (ketones, aldehydes)
-Carbohydrates
-Aromatic amines
-Amides and Nitro compounds

Books Recommended:

1. Practical Organic Chemistry by F.G. Mann and B.C. Saunders
2. Practical Organic Chemistry by Vogel

FACULTY OF SCIENCES

SYLLABUS

of

Chemistry

for

Bachelor of Science (Honours) Physics (Semester II)

(UnderContinuous Evaluation System)

(12+3 System of Education)

Session: 2022-25

The Heritage Institution

KANYA MAHA VIDYALAYA

JALANDHAR

(Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Honours) Physics (Session: 2022-25)

Bachelor of Science (Honours) Physics **Semester-II**									
Course Name	**Program Name**	**Course Code**	**Course Type**	**Marks**					**Examination time (in Hours)**
				Total	**Paper**	**Ext.**		**CA**	
						L	**P**		
Chemistry-II	Bachelor of Science (Honours) Physics	BOPL-2086	C	50	Chemistry-II	40	-	10	3
Chemistry Lab-II	Bachelor of Science (Honours) Physics	BOPP-2088	C	50	Chemistry Lab-II	-	40	10	3

Bachelor of Science (Honours) Physics
(Semester II)
Session: 2022-25
COURSE CODE: BOPL-2086
COURSE TITLE: Chemistry-II

Course outcomes:

Students will be able to

CO1: understand the key features of coordination compounds viz. variety of structures, oxidation numbers and electronic configurations, coordination numbers and explain the bonding and stability of complexes. Describe the shapes and structures of coordination complexes with coordination numbers ranging from 4 to 12. Describe the stability of metal complexes by the use of formation constants.

CO2: Understand the splitting of d-orbitals in octahedral, tetrahedral, cubic and square planar fields of ligands. Calculate C.F.S.E. of high spin and low spin octahedral and high spin tetrahedral complexes. Explain thermodynamic effects of crystal field splitting and determine microstate and ground state terms.

CO3: Draw MOEL diagram for octahedral and tetrahedral complexes. Explain bonding in polynuclear metal carbonyls and counting of electrons in carbonyl clusters

CO4: Describe the effect of macrocyclic ligands on anion and cation complex structure.

Bachelor of Science (Honours) Physics
(Semester II)
Session: 2022-25
Course Code: BOPL-2086
COURSE TITLE: Chemistry-II

Examination Time: 3 Hours **Max. Marks: 50**
(Theory: 40, CA: 10)

Instructions for the Paper Setters:
Eight questions of equal marks (eight marks each) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.
Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT- I

Co-ordination Chemistry: Introduction, Werner's coordination theory, naming of co-ordinate complexes. Co-ordination numbers 1-12 and their stereo-chemistries. Factors affecting co-ordination numbers and stereo-chemistry
(a) Configurational Isomers
(b) Conformational isomerism, VSPER theory, molecular orbital theory applied to homoneuclear diatomic molecules and heteronuclear Diatomic molecules.

Bonding in metal complexes: Valence bond theory for co-ordinate complexes, inner and outer orbital complexes, Electro-neutrality and back bonding, limitations of V.B. theory.
Stability of coordination compounds: Introduction, Stability constant, stepwise stability constant, overall stability constant. Factors affecting the stability of metal ion complexes with general ligands, HSAB principle.

UNIT-II

Crystal field theory: Splitting of d-orbitals in octahedral, tetrahedral fields of ligands. Calculation of C.F.S.E. in high spin and low spin octahedral and High spin tetrahedral complexes, factors affecting the 10 Dq Value. Structural effects of crystal field splitting (Jahn-Teller distortion, variation of Ionic radii with increase in atomic number). Thermodynamics effects of C.F. splitting, variation in lattice energies, Hydration energies, Dissociation energies, Formation constants of 71 hexammines. Site selection in spinels, Paramagnetism, diamagnetism, ferro and anti ferromagnetism. Microstates and spectroscopic terms, a calculation of spectroscopic terms for d1 electronic configurations, L S coupling, Hund‟s rule for finding the ground state terms, Electronic spectral properties of Ist transition series, limitations of C.F.T.

UNIT-III

Molecular Orbital Theory: Evidence for covalent character in Bonding, MOEL diagram for octahedral and tetrahedral complexes involving bonding, charge transfer transitions.
πAcid Ligands: Definition Carbon monoxide complexes, bonding in linear MCO groups. polynuclear metal carbonyls, carbonyl hydrides and halides. Metal-metal bonding metal-metal multiple bonding, isolable analogies, Structure of high nuclearity carbonyl clusters, counting of electrons in carbonyl clusters.

UNIT-IV

Alkali metal and alkaline earth metal chelators: Macrocyclic ligands, macrocyclic effect, crown ethers and podands, coronands, cryptands, structure of 18 crown-6 complex with KNCS, ion cavity complex, effect of anion and cation type on complex structure, simultaneous complexation of metal ion and water or of two metal ions,sandwich formation, cryptands and their cation complexes, podands with aromatic donors and groups.

Books Recommended:

1. J.E. Huheey, Inorganic Chemistry, 3rd Ed.

2. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry.

3. B.E. Douglas and D.H. McDaniel, Concepts and Models of Inorganic Chemistry.

4. R. Hilgenfeld and W. Saengar, Topics in current chemistry Vol-II.

Bachelor of Science (Honours) Physics
(Semester II)
Session: 2022-25
COURSE CODE: BOPP-2088
COURSE TITLE: Chemistry Lab-II (Practical)

Course outcomes:

Students will be able to

CO1: separate and identify the various ions present in the mixture.

CO2: detect and remove interfering radicals present in the mixture.

CO3: understand the principle of inorganic qualitative analysis.

C04: separate, identify and confirm the various cations present in the mixture.

Bachelor of Science (Honours) Physics
(Semester II)
Session: 2022-25
COURSE CODE: BOPP-2088
COURSE TITLE: Chemistry Lab-II (Practical)

Examination Time: 3 Hours **Max. Marks: 50**
Practical: 40, CA: 10

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners.Two copies of the same should be submitted for the record to COE Office,Kanya Maha Vidyalaya,Jalandhar.

Qualitative Analysis
Identification of cations and anions in a mixture which may contain combinations of acid ions. These must contain interfering acid anions.

a) Special Tests for Mixture of anions

I. Carbonate in the presence of sulphate.
II. Nitrate in the presence of nitrite
III. Nitrate in the presence of bromide and iodide.
IV. Chloride in the presence of bromide and iodide.
V. Chloride in the presence of bromide.
VI. Chloride in the presence of iodide.
VII. Bromide and iodide in the presence of each other and of chloride.
VIII. Sulphide, sulphite, thiosulphate and sulphate in the presence of each other.
IX. Borate in the presence of copper and barium salts

b) Separation and identification of cations in mixtures

i) Separation of cations in groups.
ii) Separation and identification of Group I, Group II ,Group III, Group IV, Group V and Group VI cations.

Reference Books:

1. G. Svehla, and B. Sivasankar, Vogel's Qualitative Inorganic Analysis (revised), Pearson
2. R. C. Bassett, G. H. Denney,and J. Jeffery, Mendham, Vogel's Textbook of Quantitative Inorganic Analysis (revised).
3. Vogel's book on Inorganic Qualitative Analysis.

FACULTY OF SCIENCES

SYLLABUS

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Chemistry

for

Bachelor of Science (Honours) Physics (Semester III)

(UnderContinuous Evaluation System)

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Session: 2022-25

The Heritage Institution

KANYA MAHA VIDYALAYA

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Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Honours) Physics

(Session: 2022-25)

Chemistry

Bachelor of Science (Honours) Physics Semester-III									
Course Name	**Program Name**	**Course Code**	**Course Type**	**Marks**					**Examination time (in Hours)**
				Total	**Paper**	**Ext.**		**CA**	
						L	**P**		
Chemistry-III (Physical Chemistry)	Bachelor of Science (Honours) Physics	BOPL-3084	C	50	Chemistry-III (Physical Chemistry)	40	-	10	3
Chemistry Lab-III	Bachelor of Science (Honours) Physics	BOPP-3086	C	50	Chemistry Lab-III	-	40	10	3

Bachelor of Science (Honours) Physics
(Semester–III)
Session: 2022-25
Course Title: Chemistry- III
(Physical Chemistry)
Course Code: BOPL-3084

Course outcomes

Students will be able to

CO1: acquire the knowledge of structure and intermolecular forces present between solids, liquids and gases.

CO2: Understand the concept of surface tension and interfacial tension

CO3: Understand the concept of reaction rates and determine the rate law from initial rate data

CO4: demonstrate an understanding of basic principles of colligative properties and understand the basic concepts of colloidal state of matter and applications of colloids.

Bachelor of Science (Honours) Physics
(Semester–III)
Session: 2022-25
Course Title: Chemistry -III
(Physical Chemistry)
Course Code: BOPL-3084

Examination Time: 3 Hours **Max. Marks: 50**
Theory: 40, CA: 10

Instructions for the Paper Setters:

Eight questions of equal marks (eight marks each) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT I

1. Solutions

Ideal and non–ideal solutions, methods of expressing concentrations of solutions, Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weightdetermination.Osmosis,lawofosmoticpressureanditsmeasurement,determinationof molecular weight from osmotic pressure, elevation of boiling point and depression of freezing point.

UNIT-II

2. SurfaceChemistry

Bulk phases and interfacial region, types of interfaces; Surface tension and interfacial tension. Thermodynamics of surfaces, plane interface, curved interface, Laplace and Kelvin equations, the contact angle, capillary rise and surface tension. Surface tension of solutions, Gibbs adsorptionequationanditsderivationfromthermodynamicconsiderations.Surfactants,Surface films on liquids. Criteria for spreading in liquid-liquid systems. (Wetting as contact angle and capitulary action Phenomenon solid liquidsystems).

UNIT-III

3. Chemical Kinetics

Rate of reaction,rateconstantandratelaws,theorderofreaction,first,secondandthirdandzero orderreactions,half-lives;determinationofreactionorder.Temperaturedependenceofreaction rates, reaction mechanism, rate-determining step approximation, steady-state approximation. Catalysis, homogeneous catalysis, autocatalysis, oscillation reactions. Enzyme catalysis, heterogeneouscatalysis.

UNIT-IV

4. Liquid State

Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquids crystal, solid

And liquid. Classification, structure of nematic and cholestric phases. Thermography and sevensegment cell.

5. Colloidal State

Definition of colloids, classification of colloids, Solids in liquids (Sol): kinetic, optical andelectrical, properties, stability of colloids,protective action, Hardy Schulze law, gold number. Liquids in liquids (emulsions): Types of emulsions, preparation. Emulsifiers, General applications of colloids.

Book Recommended:

1. Physical Chemistry by P.W. Atkins, 8th Ed., Oxford University Press, 2006 (Indian Print).
2. Physical Chemistry by T. Engel and P. Reid, 1st ed., Pearson Education,2006.
3. Physical Chemistry by Castellan, 3rd Ed., Addison Wisley/Narosa, 1985 (IndianPrint)

BACHELOR OF SCIENCE (HONOURS) PHYSICS

(SEMESTER-III)

SESSION: 2022-25

COURSE CODE: BOPP-3086

COURSE TITLE: CHEMISTRY LAB-III

Course outcomes

Students will be able to

CO1: understand the technique of crystallisation

CO2: compare the viscosity and surface tension of different liquids and solutions

CO3: determine the rate of the reactions

CO4: efficiently use of calorimeter in various experiments

BACHELOR OF SCIENCE (HONOURS) PHYSICS

(SEMESTER-III)

SESSION: 2022-25

COURSE CODE: BOPP-3086

COURSE TITLE: CHEMISTRY LAB-III

Examination Time: 3 Hours Max. Marks: 50
Practical: 40, CA: 10

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Crystallisation:

Concept of indication of crystallisation. Phthalic acid from hot water (using fluted filter paper andstem less funnel)Acetanilide from boiling water, Naphthalene from Ethanol, Benzoic acid from water

Physical Chemistry

1. To determine the specific reaction rate of hydrolysis of ethyl acetate catalyzed byHydrogen ions at roomtemperature.
2. To study the effect of acid strength on hydrolysis of anester.

Viscosity, Surface Tension (Pure Liquids)

3. To study the viscosity and surface tension of glycerine solution inwater.
4. To determine the solubility of benzoic acid at different temperatures and to determine Hof the dissolutionprocess.
5. To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weakbase.
6. To determine the enthalpy of dissolution of solid calcium chloride and calculate thelattice energy of calcium chloride from its enthalpy data using Born Habercycle.

Book Recommended:

1. Experimental Organic Chemistry, Vol. I and II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
2. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
3. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
4. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
5. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill.
6. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
7. Advanced Experimental Chemistry, Vol. I, Physical, J.N. Guru and R. Kapoor, S. Chand and Co.
8. Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghosh and Sons.
9. Experiments Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

FACULTY OF SCIENCES

SYLLABUS

of

Chemistry

for

Bachelor of Science (Honours) Physics (Semester IV)

(UnderContinuous Evaluation System)

(12+3 System of Education)

Session: 2022-25

The Heritage Institution

KANYA MAHA VIDYALAYA

JALANDHAR

(Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Honours) Physics

(Session: 2022-25)

Chemistry

Bachelor of Science (Honours) Physics Semester-IV									
Course Name	**Program Name**	**Course Code**	**Course Type**	**Marks**					**Examination time (in Hours)**
				Total	**Paper**	**Ext.**		**CA**	
						L	**P**		
Chemistry-IV (Molecular Spectroscopy)	Bachelor of Science (Honours) Physics	BOPL-4084	C	50	Chemistry-IV (Molecular Spectroscopy)	40	-	10	3
Chemistry Lab-IV	Bachelor of Science (Honours) Physics	BOPP-4087	C	50	Chemistry Lab-IV	-	40	10	3

BACHELOR OF SCIENCE (HONOURS) PHYSICS

(SEMESTER-IV)

SESSION: 2022-25

COURSE CODE: BOPL-4084

COURSE TITLE: CHEMISTRY-IV

(Molecular Spectroscopy)

Students will be able to

CO1: understand the concept of electronic transitions and Factors affecting λ_{max}

CO2: understand the infra-red spectroscopy in organic structure determination and understand the various applications of UV & IR Spectroscopy.Learn about the Principle and applications of ultraviolet and Woodward Fisher Rule

CO3:explain common terms in NMR spectroscopy such as chemical shift, coupling constant, and anisotropic effect, spin spin splitting, shielding constant and their affect on the spectra of the compound. Study the various measurement techniques in NMR spectroscopy. understand the various applications of NMR spectroscopy.

CO4: understand the various cleavages and rearrangements in Mass spectroscopy. Factors affecting cleavage patterns in Mass spectroscopy . Understand the various applications of Mass spectroscopy.

BACHELOR OF SCIENCE (HONOURS) PHYSICS
(SEMESTER-IV)
SESSION 2022-25
COURSE CODE: BOPL-4084
COURSE TITLE: CHEMISTRY-IV
(Molecular Spectroscopy)

Examination Time: 3 Hours **Max. Marks: 50**
Theory: 40, CA: 10

Instructions for the Paper Setters:
Eight questions of equal marks (eight marks each) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Note: Students can use Non-Scientific calculators or logarithmic tables.

UNIT –I

1. Energy and ElectromagneticSpectrum

Introduction, electromagnetic spectrum and Units, Regions of the spectrum, Basic features of differentspectrometers,StatementofBorn-Oppenheimerapproximation,Degreeoffreedom,Frank Condon Principle, Fluorescence andPhosphorescence.

2. Ultraviolet and Visible Spectroscopy

Theenergyofelectronicexcitation,Measurementtechniques,Beer-LambertLaw,Molarextinction coefficient. Different types of transition noticed in UV spectrum of organic functional groups and their relative energies. Chromophore, Auxochromes, Absorption and intensity shifts, Transition probability. Factors affecting λ_{max} , Effect of steric hindrance to coplanarity, Solvent effects.

UNIT – II

Infrared Spectroscopy

Vibrational energy levels, Selection rules, Force constant, Fundamental vibration frequencies, Factors influencing Vibrational Frequencies (Vibrational Coupling, Hydrogen Bonding,Electronic effect, Bond Angles, Field Effect) of different functional groups. Samplingtechniques.

Applications of UV and IR Spectroscopy

Applications of UV spectroscopy, Woodward Fieser rules for calculating λ_{max} of conjugated polyenes and α,ß -unsaturated carbonyl compounds. Applications of IR spectroscopy, Absorption of Common functional Groups, Interpretation of simple IR spectra, Finger print regions. Simple numerical problems based on UV and IR spectroscopy.

UNIT-III

Proton Magnetic Resonance spectroscopy (^{1}HNMR)

TheNuclearspin,Larmorfrequency,theNMRisotopes,Populationofnuclearspinlevel,Spinand Spinlatticerelaxation.Measurementtechniques(CW and FTmethod),Solventused.Chemicalshift, Reference compounds, Shielding constant, Range of typical chemical Shifts, Simple application of chemical shifts, Anisotropic effect. Spin spin splitting, Coupling constant.

Applications ofNMR spectroscopy

NMR spectra with various examples such as ethyl bromide, ethanol, acetaldehyde, 1,1,2- tribromoethane, ethyl acetate, toluene, o-, m-, p- anisidine, o-, m-, p-nitrophenols, acetophenone. Simple numerical of structure elucidation of NMR spectroscopic data.

UNIT- IV

II. MassSpectrometery

Basic Principles. Elementary theory. Molecular ions, isotope ions, Fragment ions of odd and even electron types, Nitrogen rule, Factors affecting cleavage patterns, Simple cleavage, Cleavages at a hetero atom, Multicentre fragmentations, Rearrangements, Diels – Alder fragmentation, Mc Lafferty rearrangement.

III. Applications of MassSpectroscopy

Cleavage associated with common functional groups , Aldehydes, Ketones, Cyclic and Acyclic Esters, Alcohols, Olefins, Aromatic compounds, Amines, Interpretation of the spectrum of unknown simplemolecules.

Books Recommended:

1. Organic Spectroscopy By W. Kemp; Publisher- Palgrave, NewYork
2. D.H. Williams and I. Fleming. Spectroscopic Methods in OrganicChemistry.
3. Spectrometric Identification of Organic Compounds - R.M. Silverstein and F. X. Webster; Publisher: John Willey andSons,Inc.
4. Introductory Problems in Spectroscopy- By R.C. Banks, E.R. Matjeha and G. Mercer; Publisher : The Benzamine / Cummings Publishing CompanyInc.
5. Introduction to Spectroscopy – D. L. Pavia, G. M .Lampman, and G. S. Kriz Publisher: Brooks / Cole, a part of cengagelearning

BACHELOR OF SCIENCE (HONOURS) PHYSICS

(SEMESTER-IV)

SESSION: 2022-25

COURSE CODE: BOPP-4087

COURSE TITLE: CHEMISTRY LAB-IV

Students will be able to

CO1: know the principle and mechanism of Conductometric titrations and polarimetric experiments

CO2: determine the heat of of neutralization and Heat of solution Calorimetrically .

CO3: know the principle and working of Abbe's Refractometer

CO4: determine the composition of unknown mixture of two liquids by refractive index measurements.

BACHELOR OF SCIENCE (HONOURS) PHYSICS

(SEMESTER-IV)

SESSION: 2022-25

COURSE CODE: BOPP-4087

COURSE TITLE: CHEMISTRY LAB-IV

Examination Time: 3 Hours Max. Marks: 50

Practical: 40, CA: 10

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

1. Refractometry: Determine refractive index of a given liquid as a criterion for its purity. (Benzene i.e. commercial) benzene + A.R.acetone).

2. Polarimetry: Determine the %age composition of an optically activesolution.

3. Calorimetry:
   a) Determination of Heat ofneutralization
      (i) Strong acid-strongbase
      (ii) Weak acid-strongbase.
   b) Determination of Heat of solution of KCl, NH_4Cl,KNO_3

4. Conductometry:
   a) Determination of cellconstant.
   b) Determination of specific and equivalent conductance ofelectrolyte (NaClandHCl).
   c) Precipitation titration of Na_2SO_4 vs.$BaCl_2$.
   d) Neutralization titrations NaOH vs. HCl and NaOH vs.CH_3COOH.

5. Determination of adsorption isotherm of oxalic acid on charcoal

Books Recommended:

1) Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
2) Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill.
3) Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
4) Advanced Experimental Chemistry, Vol. I, Physical, J.N. Guru and R. Kapoor, S. Chand and Co.
5) Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghosh and Sons.
6) Experiments Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

FACULTY OF SCIENCES

SYLLABUS

of

Master of Science (Chemistry)

(Semester: I - IV)

(Under Credit Based Continuous Evaluation Grading System)

Session: 2022-24

The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR

(Autonomous)

KANYA MAHA VIDYALAYA JALANDHAR (AUTONOMOUS)

SCHEME AND CURRICULUM OF EXAMINATION OF TWO YEAR DEGREE PROGRAMME

Master of Science (Chemistry)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Session: 2022-2024)

Semester I

Master of Science (Chemistry) Semester I										
Course Code	**Course Title**	**Course Type**	**Hours Per Week L-T-P**	**Credits L-T-P**	**Total Credits**	**Marks**				**Examination time (in Hours)**
						Total	**Th**	**P**	**CA**	
MCHL-1081	Ligand Field Theory	C	4-0-0	4-0-0	4	50	40	-	10	3
MCHL-1082	Organic Reaction Mechanism-I	C	4-0-0	4-0-0	4	50	40	-	10	3
MCHL-1083	Physical Chemistry – Thermodynamics	C	4-0-0	4-0-0	4	50	40	-	10	3
MCHL-1084	Spectroscopy A: Techniques for Structure Elucidation of Organic Compounds	C	4-0-0	4-0-0	4	75	60	-	15	3
MCHM-1135	Computer for Chemists	IDC	2-0-2	2-0-1	3	75	40	20	15	3+3
MCHP-1086	Inorganic Chemistry Practical (Quantitative Analysis)	C	0-0-6	0-0-3	3	75	-	60	15	3*2

MCHP-1087	Organic Chemistry Practical	C	0-0-6	0-0-3	3	75	-	60	15	3*2
Student can opt any one of the following Interdisciplinary compulsory courses		IDE			4					
Total				**25**		**450**				
IDEC-1101*	Effective Communication Skills		4-0-0			100	80	-	20	3
IDEM-1362*	Basics of Music (Vocal)		2-1-1			100	40	40	20	
IDEH-1313*	Human Rights and Constitutional Duties		4-0-0			100	80	-	20	
IDEI-1124*	Basics of Computer Applications		2-0-4			100	50	30	20	3+3
IDEW-1275	Indian Heritage: Contribution to the world		4-0-0			100	80	-	20	3
(*Credits of these ID courses will not be added to SGPA)										

C- Compulsory Course

IDE- Inter Disciplinary Elective Course

IDC-Inter Disciplinary Compulsory Course

Programme Specific Outcomes

On successful completion of this Programme, students will have ability to:

PSO1: do global level research, pursue Ph.D. programme and targeted approach of CSIR-NET examination and competitive exams conducted by service commission

PSO2: attain enormous job opportunities at all levels of chemical, pharmaceutical, food products and life oriented material industries.

PSO3: get recruitment in R and D and synthetic division of polymer industries and Allied division.

PSO4: apply modern methods of analysis to chemical systems in a laboratory setting.

PSO5: work effectively and safely in a laboratory environment, use technologies/instrumentation to gather and analyse data and work in teams as well as independently.

PSO6: think critically, develop scientific temper and analyse various chemical.

Master of Science (Chemistry)
(Semester-I)
Session 2022-24
COURSE CODE: MCHL-1081
Course Title: Ligand Field Theory

Course outcomes:

Students will be able to

CO1: learn mathematical rules for the formation of symmetry point groups

CO2: construct the Character table for various point groups and to determine the

symmetry of hybrid orbitals

CO3: analyze Tanabe – Sugano /Orgel diagrams and determine the magnetic properties of complexes.

CO4: analyze and understand the electronic spectra of octahedral and tetrahedral metal complexes.

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Master of Science (Chemistry)
(Semester-I)
Session: 2022-24
COURSE CODE: MCHL-1081
COURSE TITLE: Ligand field Theory

Time: 3Hrs **Max. Marks: 50**
Credit (L-T-P): 4-0-0 **(Theory: 40, CA: 10)**

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Symmetry

Symmetry elements, symmetry operations and their matrix representation, group postulates and types, multiplication tables, point group determination, determination of reducible and irreducible representations, character tables, construction of character tables for C_{2v}, C_{3v} (non-abelian group), use of symmetry in obtaining symmetry of orbitals in molecules, use of character table to determine which metal orbitals are used in σ and π bond formation in octahedral, tetrahedral and square planar transition metal complexes, qualitative splitting of s, p, d, f orbitals in octahedral, tetrahedral and square planar fields using character tables and without the use of character Tables.

UNIT-II

Molecular Orbital Theory for Metal Complexes:

Recapitulations, ligands symmetry orbitals and metal orbitals involved in molecular orbitals formation in octahedral complexes, MOEL diagrams for octahedral tetrahedral and square planar complexes showing σ and π bonding in transition metal complexes.

InterelectronicRepulsions:

Spin-spin, orbital-orbital and spin orbital coupling, LS and jj coupling schemes, determination of all the spectroscopic terms of p^n, d^n ions, determination of the ground state terms for p^n, d^n, f^n ions using L.S. scheme, determination of total degeneracy of terms, order of interelectronic repulsions and crystal field strength in various fields, two type of electron repulsion parameters, spin orbit coupling parameters (λ) energy separation between different j states, The effect of octahedral and tetrahedral fields on S, P, D and F terms (with help of the character table), splitting patterns of and G, H and I terms

UNIT-III

Free Ions in Medium and Strong Crystal Fields:

Strong field configurations, transition from weak to strong crystal fields, evaluation of strong crystal field terms of d^2 configuration in octahedral and tetrahedral crystal fields (using group

theory), construction of the correlation energy level diagrams of d^2 configuration in octrahedral field, study of energy level diagrams for higher configurations, selection rules of electronic transitions in transition metal complexes, their proof using group theory, relaxation of the selection rule in centrosymmetric and non-centrosymmetric molecules, Orgel diagrams, Tanabe Sugano diagrams

Magnetic Properties:
Van Vlecks formula for susceptibility, first order Zeeman effect, second order Zeeman effect, KT states, quenching of orbitals angular momentum by ligand field, the magnetic properties of A and E terms, the magnetic properties of T terms, electronic delocalization, magnetic properties of d^n and f^n metal ions**.**

UNIT-IV

Electronic Spectra of Transition Metal Complexes:
Variation of the Racah parameter, nephlauxetic effect -central field covalency, symmetry restricted covalency, differential radial expansion, spectrochemical series, band intensities, factors influencing band widths, discussion of electronic spectra of octahedral and tetrahedral d^1 – d^9 metal ions, calculation of 10Dq and B with use of Orgel and Tanabe Sugano diagrams, low spin complexes of Mn^{3+}, Mn^{2+}, Fe^{3+}, Co^{3+}, Fe^{2+}, comment on the spectra of second and third transition series, spectra of K_3MoCl_6 and $[Rh(NH_3)_6]^{3+}$, spectra of cis and trans$[Co(en)_2X_2]^+$, $[Mn(H_2O)_6]^{2+}$, $CuSO_4.5H_2O$ and its anhydrous complex, comparison of d–d band with f–f bands. Introduction to Charge Transfer Spectra**.**

Books Recommended:

1. F.A. Cotton, Chemical Application of Group Theory, WileyEastern.
2. G. L. Miessler, D. A. Tarr, Inorganic Chemistry, 3rd edition, PearsonEducation.
3. B.N. Figgis, Introduction to Ligand Field, Wiley Eastern.
4. A.B.P. Lever, Inorganic Electronic Spectroscopy,Elsevier.
5. A. Earnshaw, Introduction to Magnetochemistry, Academic Press.
6. J.E. Huheey, Inorganic Chemistry Principles of Structure and Reactivity,Harper Interscience.
7. R.S. Drago, Physical Method in Chemistry, W.B. SaundersCompany.
8. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, WileyInter-science.

Master of Science (Chemistry)
(Semester-I)
Session: 2022-24
COURSE CODE: MCHL-1082
COURSE TITLE: Organic Reaction Mechanism- I

Course outcomes:

Students will be able to

CO1: understand the concept and various types of aromaticity and acquire the skills for correct stereochemical assignment and interpretation in simple organic molecules.

CO2: basics of reaction mechanism and understand the various types of aliphatic nucleophilic substitution reaction and their mechanism

CO3: understand the various types of aliphatic nucleophilic substitution reaction and discuss their mechanism and predict the product of the reactions

CO4: understand the various types of aromatic electrophic and nucleophilic substitution reaction and their mechanism alongwith identification and application of various rearrangemet reactions

Master of Science (Chemistry)
(Semester-I)
Session: 2022-24
COURSE CODE: MCHL-1082
COURSE TITLE: Organic Reaction Mechanism- I

Time: 3Hrs **Max. Marks: 50**

Credit (L-T-P): 4-0-0 **(Theory: 40, CA: 10)**

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Nature of Bonding in Organic Reactions:
Aromaticity in Benzenoid and non-benzenoid compounds. Huckel's Rule, Alternant and non-alternant hydrocarbons. Energy levels of π(pi) molecular orbitals in simple systems. Annulenes, Antiaromaticity, Homoaromaticity, PMO approach.

Stereochemistry:
Elements of symmetry, chirality, molecules with more than one chiral center.Threo and erythro isomers, methods of resolution, optical purity.Prochirality – enantiotopic and diastereotopic atoms, groups and faces. Stereospecific and stereoselective synthesis.Asymmetric synthesis.Optical activity in absence of chiral carbon (Biphenyls, Allenes, Spiranes).Chirality due to helical shape.

UNIT-II

Reaction Mechanism, Structure andReactivity:
Types of mechanisms, types of reactions, thermodynamic and kinetic requirements, Kinetic and thermodynamic control in product formation. Transition states and reaction intermediates, Isotope effects, Hard and Soft Acid Base concept, Study of reactive intermediates – Types of intermediates, isolation and detection of intermediates (including use of spectral techniques), trapping ofintermediates.

Aliphatic Nucleophilic Substitution –A:
The SN^2, $SN^1$and SNi mechanisms, mixed $SN^1$and SN^2 mechanism SET mechanism. The neighboring group mechanism (anchimeric assistance).Neighboring group participation by pi and sigma bonds.

UNIT-III

Aliphatic Nucleophilic Substitution – B:
Classical, non-classical andphenonium cations, Rearrangements in carbocations (general survey).Ester hydrolysis.Nucleophilic substitution at allylic, aliphatic trigonal and vinylic carbon.Effect on the reactivity due to – substrate structure, attacking nucleophile, leaving group and reaction medium.Ambident nucleophiles and substrates, regioselectivity. Meyer's synthesis of aldehydes, ketones, acids and esters.Alkylation by organoboranes.

Aliphatic Electrophilic Substituion:
Bimolecular mechanism – SE2 and SEi. The SE1 mechanism, Hydrogen exchange, electrophilic substitution accompanied by double bond shifts, diazo-transfer reaction, formation of sulphur ylides, effect of substrates, leaving group and solvent polarity on the reactivity.

UNIT-IV

Aromatic Electrophilic Substitution:
The arenium ion mechanism, orientation and reactivity in mono substituted and di substituted aromatics. Energy profile diagrams. The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles. Diazo coupling, Vilsmeir reaction, Gattermann-Koch reaction, Pechmann reaction, Houben – Hoesch reaction, Fries rearangement.

Aromatic Nucleophilic Substitution:
SNAr, SN^1, benzyne and SRN^1 mechanisms. Reactivity effect of substrate structure, leaving group and nucleophile. The von Richter, Sommelet-Hauser, and Smiles rearrangements.

Books Recommended:

1. Stereochemistry -Eliel
2. Advanced Organic Chemistry – JerryMarch.
3. Advanced Organic Chemistry, F. A. Carey, R. J. Sundberg, Volume I andII
4. Highlights of Organic Chemistry, W.J. L. Nobel; An Advanced TextBook.
5. Stereochemistry conformation and Mechanism – P. S.Kalsi

Master of Science (Chemistry)
(Semester-I)
Session: 2022-24
COURSE CODE: MCHL-1083
COURSE TITLE: Physical Chemistry – Thermodynamics

Course outcomes:

Students will be able to

CO1: calculate change in thermodynamic properties, equilibrium constants, partial molar quantities, chemical potential.

CO2: apply phase rule and, draw phase diagrams for one, and two component systems, identify the dependency of temperature and pressure on phase transitions, and identify first/second order phase transitions, solve problems based on Debye-Huckel limiting law, calculate excess thermodynamic properties.

CO3: predict heat capacity (C_v, C_p) of an ideal gas of linear and non-linear molecules from the number of degrees of freedom, rotational and vibrational wave numbers, explain T^3 dependence of heat capacity of solids at low temperatures (universal feature) using Debye and Einstein theory of heat capacity of solids.

CO4: understand non-equilibrium states, apply Onsager's reciprocity relations and irreversible thermodynamics for biological systems.

Master of Science (Chemistry)
(Semester-I)
Session: 2022-24
COURSE CODE: MCHL-1083
COURSE TITLE: Physical Chemistry –Thermodynamics

Time: 3Hrs **Max. Marks: 50**

Credit (L-T-P): 4-0-0 **(Theory: 40, CA: 10)**

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Classical Thermodynamics

Brief resume of concepts of thermodynamics, free energy, chemical potential and entropy. Partial molar properties, partial molar free energy, partial molar volume and partial molar heat content and their significances. Determination of these quantities. Concept of fugacity and determination of fugacity.

UNIT-II

Non-ideal systems

Excess functions for non-ideal solutions. Activity, activity coefficients, Debye-Huckel theory for activity coefficient of electrolytic solutions, determination of activity and activity coefficients, ionic strength. Application of phase rule to three component system, second order phase transitions.

Statistical Thermodynamics:

Concept of distribution law, thermodynamic probability and most probable distribution, Ensemble averaging, postulates of ensemble averaging. Canonical, grand canonical and micro canonical ensembles, corresponding distribution laws (using Lagrange's method of undetermined multipliers).

UNIT-III

Partition functions

Translational, rotational, vibrational and electronic partition function, calculation of thermodynamic properties in terms of partition functions. Application of partition functions.
Heat capacity behavior of solids-chemical equilibria and equilibrium constants in terms of partition functions, Fermi-Dirac statistics, distribution laws, and application to metals. Bose-Einstein statistics- distribution law and application to helium.

UNIT-IV

Non Equilibrium Thermodynamics:
Thermodynamic criteria for non-equilibrium states, entropy production and entropy flow, entropy balance equations for different irreversible processes (e.g., heat flow, chemical reaction etc.) transformations of generalized fluxes and forces, non-equilibrium stationery states, phenomenological equations, microscopic reversibility and Onsager's reciprocity relations, electro kinetic phenomena, diffusion, electric conduction, irreversible thermodynamics for biological systems, coupled reactions.

Books Recommended:

1. I F Nash: Elements of classical and statistical thermodynamics
2. Lee Bot: Irreversible thermodynamics
3. Thermodynamics of Biological Processes, D. Jou and J.E. LeeBot
4. I Prigogine: Introduction to thermodynamics of irreversible processes
5. T L Hill: Introduction to statistical thermodynamics.

Master of Science (Chemistry)
(Semester-I)
Session: 2022-24
COURSE CODE: MCHL-1084
COURSE TITLE: SPECTROSCOPY – A: Techniques in Structure Elucidation of Organic Compounds

Course outcomes:

Students will be able to

CO1: know about the Nuclear magnetic resonance spectroscopy. Proton chemical shift, spin-spin coupling, coupling constants and its applications to determine organic structures

CO2: to understand different cleavage patterns of organic compounds in Mass spectrometry and apply the knowledge for interpretation of the spectrum of an unknown compound and the principle and applications of ultraviolet and apply Woodward Fisher Rule to calculate λ_{max}

CO3: understand the concepts of Vibrational spectroscopy, Vibrational coupling overtones and Fermi resonance and its application in Organic Chemistry

CO4: apply NMR, IR, MS, UV-Vis spectroscopic techniques in solving structure of organic molecules and in determination of their stereochemistry.

Master of Science (Chemistry)
(Semester-I)
Session: 2022-24
COURSE CODE: MCHL-1084
COURSE TITLE: SPECTROSCOPY – A: Techniques in Structure Elucidation of Organic Compounds

Time: 3Hrs **Max. Marks: 75**
Credit (L-T-P): 4-0-0 **(Theory: 60, CA:15)**

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (twelve each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Nuclear MagneticResonance

The Nuclear spin, Larmor frequency, the NMR isotopes, population of nuclear spin level, spin and spin lattice relaxation. Measurement techniques (CW and FT method), solvent used. Chemical shift, reference compounds, shielding constant, range of typical chemical Shifts simple application of chemical shifts, ring current and aromaticity.Shifts for ^{1}H. - Spin-spin interactions, Low and High resolution spectra with various examples, Correlation of H bound to carbon, H bound to other nuclei such as nitrogen, oxygen, sulphur, Complex spin-spin interaction, between two or more nuclei. Effect of chemical exchange, fluxional molecules, Hindered rotation on NMR spectrum Karplus relationship, nuclear magnetic double resonance, chemically induced dynamic nuclear polarization. Brief introduction to multipulse NMR spectroscopy, Application of structure elucidation of simple organic molecules Lanthanide shift.

UNIT-II

MassSpectroscopy

Elementary theory - Measurement techniques (EI, CI, FD, FAB), Resolution, exact masses of nuclides, Molecular ions, isotope ions, fragment ions of odd and even electron types, rearrangement ions, Factors affecting cleavage patterns, simple cleavage, cleavages at a hetero atom, multicentre fragmentations rearrangements, Reteroiels – Alder fragmentation. Cleavage associated with common functional groups (Aldehydes, ketones cyclic and acyclic esters, alcohols, olefins, aromatic compounds amines). - Special methods of GCMS, high resolution MS, Introduction to radical anion mass spectroscopy. Interpretation of the spectrum of an unknown.

Ultraviolet and VisibleSpectroscopy

The energy of electronic excitation, measurement techniques, Beer-Lambert Law, Molar extinction coefficient.The Frank Condon Principle. Different types of transition noticed in UV spectrum of organic functional groups and their relative energies. Chromophore, auxochromes, factors affecting max, Effect of steric hindrance to coplanarity, Solvent Effects. Applications of

U.V. spectroscopy.

UNIT-III

InfraredSpectroscopy

Vibrational Energy Levels, Selection Rules, Force Constant, Fundamental Vibration Frequencies, Factors influencing Vibrational Frequencies (Vibrational Coupling, Hydrogen Bonding, Electronic effect, Bond Angles, Field Effect). Sampling Techniques, Absorption of Common functional Groups, Interpretation, Finger print Regions.

Applications in Organic Chemistry

(a) Determining purity and quantitativeanalysis.
(b) Studying reactionkinetics.
(c) Determining purity and quantitativeanalysis.
(d) Studying hydrogenbonding.
(e) Studying molecular geometry and conformationalanalysis.
(f) Studying reactivespecies

UNIT-IV

1. **Solution of Structural Problems by Combined Use of the following Spectroscopic Techniques:**

(a) Electronicspectra
(b) Vibrational spectroscopy
(c) NMR (^{1}H) spectroscopy
(d) Mass Spectroscopy

Books Recommended:

1. W. Kemp. OrganicSpectroscopy.
2. W. Kemp. N.M.R.Spectroscopy.
3. D.H. Williams and I. Fleming. Spectroscopic Methods in OrganicChemistry.
4. R.M. Silverstein and G.C. Bassler, Spectrometric Identification of OrganicCompounds.
5. Introduction to Spectroscopy –Pavia

Master of Science (Chemistry)
(Semester-I)
Session: 2022-24
COURSE CODE: MCHM-1135
COURSE TITLE: Computer for Chemists

Course outcomes:

The students will be able to:

CO1: Comprehend various programming constructs like variables, data-types, operators, etc of C programming language.
CO2: Apply various control statements of C Programming Language for designing solutions to different real world problems.
CO3: Comprehend signature, declaration, definition and calling of functions in C for modularization of problem.
CO4: Implement single and multidimensional arrays for representing complex data collections.

Master of Science (Chemistry)
(Semester-I)
Session: 2022-24
COURSE CODE: MCHM-1135
COURSE TITLE: Computer for Chemists

Total Marks: 75
Time: (3+3)Hrs **(Theory: 40, CA:15)**
Credit (L-T-P): 3-0-1 **Practical Marks: 20**

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:
Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from anySection.

1. Computer Programming in C language

UNIT-I

Principles of programming, algorithms and owcharts.Elementary programming, a typical C program, printf function. Introduction of declarations, assignments and variables: concept of an integer, concept of a variable, rules for naming variables, assignment statement, arithmetic operators.

Integer arithmetic expressions, truncation effects, relative priority of arithmetic operators, use of parenthesis, modulus operator.

UNIT-II

Floating point numbers, scientific notation, converting integers to floating point and vice versa , coercion and cast operator, type char.
Decision making in C, scanf function, relational operators, logical operators, if statement, if else statement, nesting of if statement.

UNIT-III

The while loop, do while loop, for loop, nesting of for loop.
Type char and ASCII code, character strings and how to print them, octal and hexadecimal notation.
User defined functions, returning value from a function, functions with more than one parameters.

UNIT-IV

Arrays, declaring an array, initializing an array, break statement, strings and character arrays, sorting an array, finding maximum and minimum in an array, multidimensional arrays.
Input and output.

2. Computer programs in Chemistry

(These are also be done in the practical class):

Development of small computer codes involving simple formulae in chemistry:

UNIT-I

1. Calculation of mean, median,mode.
2. Solution of a quadratic equation.
3. Calculation of linear regression.
4. Calculation of curve linear regression.

UNIT-II

5. Calculation of Bohr orbit from de Broglie Lambda for electron.
6. Calculation of wave number and frequency from value of wavelength.
7. Calculation of van der Waals radii.
8. Radioactive decay.
9. Rate constant of a 1st order reaction, 2nd order reaction.
10. Calculation of lattice energy using Born Lande equation.

UNIT-III

11. Addition, multiplication and solution of inverse of 3 X 3matrix.
12. Calculation of average molecular weight of a polymer containing n1 molecules of molecular weight m1, n2 molecules of molecular weight m2 and soon.
13. Program for calculation of molecular weight of organic compound containing C, H, N, O and S.
14. Calculation of reduced mass of diatomic molecule.
15. Calculate the RMS and most probable velocity of a gas.

UNIT-IV

16. Calculate the ionic mobility from ionic conductance values.
17. Determine the thermodynamic parameters for isothermal expansion of monoatomic ideal gas.
18. Calculation of value of g- factor from value of J and S.
19. Calculate the bond length and bond angles using crystal structure data.

Books Recommended:

1. K.V. Raman, Computers in Chemistry, Tata McGraw Hill, 1993.
2. Henry Mullish, Herbert L. Cooper, The Spirit of C: An Introduction to Modern Programming, Jaico Publications, 1987.
3. Anshuman Sharma, Learn Programming in C, Lakhanpal Publishers,7th Edition.
4. E Balagurusamy, Programming in ANSI C, Tata McGraw-Hill, 2002.
5. YashvantKanetkar, Let Us C, BPB Publications, 2016.
6. Byron Gottfried, Schaum's Outline Programming with C, McGraw Hill, 1996.

Note: The latest editions of the books should be followed.

Master of Science (Chemistry)
(Semester-I)
Session: 2022-24
COURSE CODE: MCHP-1086
COURSE TITLE: INORGANIC CHEMISTY (PRACTICAL)
(Quantitative Analysis)

Course outcomes:

Students will be able to

CO1: Experimental observation of Inorganic Quantitative Analysis

CO2: determine the strength of ions by Oxidation reduction titrations

CO3: estimate the amount of ions by precipitation titrations

CO4: estimate the amount of ions by complexometric and gravimetric methods

Master of Science (Chemistry)
(Semester-I)
Session: 2022-24
COURSE CODE: MCHP-1086
COURSE TITLE: INORGANIC CHEMISTY (PRACTICAL)
(Quantitative Analysis)

Time: 6 Hrs **Max. Marks: 75**

Credit (L-T-P): 0-0-3 **(P: 60, CA: 15)**

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

I. Oxidation-ReductionTitrations

1. Standardization with sodium oxalate of $KMnO_4$ and determination of Ca^{2+}ion.
2. Standardization of ceric sulphate with Mohr's salt and determination of NO_3^{-1} and $C_2O_4^{-2}$ ions.
3. Standardization of $K_2Cr_2O_7$ with Fe^{2+} and determination of Fe^{3+} (Ferricalum)
4. Standardization of hypo solution with potassium iodate / $K_2Cr_2O_7$ and determination of available Cl_2 in bleaching powder, Sb^{3+} andCu^{2+}.
5. Determination of hydrazine with KIO_3titration.

II. Precipitation Titrations

1. $AgNO_3$ standardization by Mohr's method by using adsorptionindicator.
2. Volhard's method for Cl^-determination.
3. Determination of ammonium / potassiumthiocyanate.

III. ComplexometricTitrations

1. Determination of Mg^{2+} and Mn^{2+} in a mixture using fluoride ion as a demaskingagent.
2. Determination of Ni^{2+} (backtitration).
3. Determination of Ca^{2+} (by substitutionmethod).

IV. GravimetricAnalysis

1. Determination of Ba^{2+} as its chromate.
2. Estimation of lead as its leadmolybdate.
3. Estimation of chromium (III) as its leadchromate.
4. Estimation of Cu^{2+} using Ammonium/Sodiumthiocyanate.

Books Recommended:

Vogel's book on Inorganic Quantitative Analysis

Master of Science (Chemistry)
(Semester I)
Session: 2022-24
COURSE CODE: MCHP-1087
COURSE TITLE: ORGANIC CHEMISTRY (PRACTICAL)

Course outcomes:

The students will be able to

CO1: independently perform two step organic synthesis.

CO2: identify the synthesized compounds by TLC

CO3: perform analysis of common analgesic drugs by TLC

CO4: extract, identify and characterize the compounds isolated from naturalproducts

Master of Science (Chemistry)
(Semester I)
Session: 2022-24
COURSE CODE: MCHP-1087
COURSE TITLE: ORGANIC CHEMISTRY
(PRACTICAL)

Time: 6Hrs **Max. Marks: 75**

Credit (L-T-P): 0-0-3 **(P: 60, CA: 15)**

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

UNIT–I

1. **Purification and Characterization of Organic Compounds**, the student is expected to carry out the experiments of purification (fractional crystallization, fractional distillation, chromatography) separation, purification and identification of the compounds of binary organic mixture (liquid-liquid, liquid-solid and solid-solid), using chemical analysis and IR and PMR spectral data. The student should also check the purity of the separated components on TLCplates.
2. To carry out the analysis of common analgesic drugs by thin layer chromatography, Acetaminophen, Aspirin, caffeine, phenacetin, salicylamide. (Learn to check purity of the given samples and completion of the chemical reactions).

UNIT–2

Organic Synthesis and Extraction of Organic Compounds from Natural Sources. The student is expected to carry out 4 to 6 organic preparations (usually involving not more than two steps), some of the illustrative experiments are listed below:-

1. *Extraction of Caffeine from tealeaves*
   (Ref. Experiment Organic Chemistry, (H. Dupont Durst, George W. Gokel, P 464 McGraw Hill Book Co., New York).
   Student would be asked to purity crude sample, check the purity on a TLC single spot and get the NMR scanned and interpret (Three methyl singlets and I methane singlet).
2. *Isolation of casein from milk* (try some typical colour reactionsproteins).
3. *Synthesis of 2-phenyllndole-Fischer Indole Synthesis*. Book 1, p.852
   Aim: To Study condensation and cyclization reactions.
4. *Synthesis of 3-nitrobenzoic from benzoic acid* (Rf. Ibid., p.245-247 and 443-448). **Aim:** To demonstrate the process of meta nitration, esterification and saponification of an ester. Make a comparative study of IR and PMR spectra of benzoic acid, methyl benzoate, methyl3-nitrobenzoate.
5. *Cannizaro's reaction of 4-chlorobenzaldehyde.*. Book 1, p760
   Aim: To demonstrate technique of isolation of two products from the reaction mixture and the procedure of intermolecular hydride transfer. Make a comparative study of IR and PMR spectra of 4 chlorobenzadehyde, 4-chlorobenzoic acid 4-chlorobenzyl alcohol.
6. *Synthesis of 1,3,5-Tribromobenzene from aniline*. **Aim:** To demonstrate: Bromination, Diazotization andReduction.

Books Recommended:

Vogel's Text book of practical organic chemistry, 5th edition.

KANYA MAHA VIDYALAYA JALANDHAR (AUTONOMOUS)

SCHEME AND CURRICULUM OF EXAMINATION OF TWO YEAR DEGREE PROGRAMME

Master of Science (Chemistry)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Session: 2022-2023)
Semester II

Master of Science (Chemistry) Semester II										
Course Code	**Course Title**	**Course Type**	**Hours Per Week** **L-T-P**	**Credits** **L-T-P**	**Total Credits**	**Marks**				**Examination time** **(in Hours)**
						Total	**Th**	**P**	**CA**	
MCHL-2081	Organometallics Chemistry	C	4-0-0	4-0-0	4	50	40	-	10	3
MCHL-2082	Organic Reaction Mechanism -II	C	4-0-0	4-0-0	4	50	40	-	10	3
MCHL-2083	Physical Chemistry – Quantum Chemistry	C	4-0-0	4-0-0	4	50	40	-	10	3
MCHL-2084	Reaction Mechanisms and Metal clusters	C	4-0-0	4-0-0	4	50	40	-	10	3
MCHL-2085	Spectroscopy B: Techniques for Structure Elucidation of Inorganic Compounds	C	4-0-0	4-0-0	4	75	60	-	15	3
MCHL-2336 MCHL-2057	Mathematics for Chemists Biology for Chemists	IDE	2-0-0	2-0-0	2	25	20	-	5	3

MCHP-2088	Organic Chemistry Practical	C	0-0-6	0-0-3	3	75	-	60	15	3*2
MCHP-2089	Physical Chemistry Practical	C	0-0-6	0-0-3	3	75	-	60	15	3*2
Total					**28**	**450**				

C- Compulsory Course

IDE- Inter Disciplinary Elective Course

IDC-Inter Disciplinary Compulsory Course

Master of Science (Chemistry)
(Semester-II)
Session: 2022-24
COURSE CODE: MCHL-2081
COURSE TITLE: ORGANOMETALLICSCHEMISTRY

Course outcomes:

Students will be able to

CO1: demonstrate basic principles and illustrate stability of organometallic compounds.

CO2: identify the structure and bonding aspects of simple organometallic compounds

CO3: identify different types of organometallic reactions and apply the above concepts to explain different catalytic reactions

CO4: understand the role of pi acid ligands in organometallic chemistry

Master of Science (Chemistry) (Semester-II)
Session: 2022-24
COURSE CODE: MCHL-2081
COURSE TITLE: ORGANOMETALLICSCHEMISTRY

Time: 3Hrs **Max. Marks: 50**

Credit (L-T-P): 4-0-0 **(Theory: 40, CA: 10)**

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Organometallics

Energy polarity and reactivity of M-C bond, Stability of Main group organometallics: Methods of preparation in perspective-organolithium compounds: structure and bonding and reaction-carbolithiatic organometallics of group 2 and 12 e.g. Mg and Zn, Cd and Hg: Preparation and structure of organoaluminium compounds, Technical applications of Tris (alkyl)aluminium compounds. η^2- ligands: olefenic and acetylenic complexes, chelating olefenic ligands – synthesis and structure. η^2 – ligands: Allylic and η^4– complexes ofcyclopentadiene.

UNIT-II

Synthesis and structure. η^4 –ligands: Butadiene, cyclobutadiene, heterocyclic pentadiene (S, Se, Te). Classification, Nomenclature of cyclopentdienyl complex.MO treatment of ferrocene. η^6 – ligands: Benzene and its derivatives. Multideckersandwichcompounds.

UNIT-III

Homogeneous hydrogenation of unsaturated compounds, reversible cis-dihydrocatalysis, monohydrido compounds, asymmetrical hydrogenation, hydrosilation of unsaturated compounds, hydrocyanation of alkenes, alkane metathesis, Ziegler-Natta polymerization of ethylene and propylene, water gas shift reaction, acetic acid synthesis by carbonyls, Oxopalladation reactions. Organometallic Reagents in Organic synthesis.

Reaction at Coordinated ligands

The role of metal ions in the hydrolysis of amino acid esters, peptides, and amides Molecular orbital concept of role of metal ions participation, Modified aldol condensation, Imine formation, Template and Macrocyclic effect in detail.

UNIT-IV

p-acid ligands

pi-acceptor character of CO, O_2, N_2, NO, PH_3 molecules in terms of MOEL diagram, Metal carbonyls; structure and bonding; vibration spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls; preparation, bonding structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes; tertiaryphosphine as ligand.

Books Recommended:

1. C. Elschenbroich and A. Salzer, Organometallics: A Concise Introduction, 2nd Ed., VCH 1992.
2. J.E. Huheey, Inorganic Chemistry Principles of Structure and Reactivity, Harper Interscience.
3. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Ed. V andVI.Wiley Inter-science.
4. G. L. Miessler, D. A. Tarr, Inorganic Chemistry, 3rd edition, PearsonEducation

Master of Science (Chemistry) (Semester-II)
Session: 2022-24
COURSE CODE: MCHL-2082
COURSE TITLE: Organic Reaction Mechanism – II

Course outcomes:

Students will be able to

CO1: understand the types, mechanism and factors affecting free radical reactions, apply the knowledge to predict the product of free radical reactions and to obtain an outline about elimination reactions and some specific examples of elimination reactions

CO2 : understand the mechanistic and stereochemical aspects of addition to Carbon – Carbon multiple bonds alongwith the reaction and mechanism of some named reactions of this type

CO3: understand the mechanism of metal hydride reduction of saturated/ unsaturated organic compounds learn its basic mechanism and to predict the mechanism of condensation reactions involving enolates and reactions involving carbon- carbon bond formation

CO4: acquire knowledge about the reagents used for oxidation and reduction of various organic compounds

Master of Science (Chemistry)
(Semester-II)
Session: 2022-24
COURSE CODE: MCHL-2082
COURSE TITLE: Organic Reaction Mechanism – II

Time: 3Hrs **Max. Marks: 50**

Credit(L-T-P): 4-0-0 **(Theory: 40, CA:10)**

Instructions for the Paper Setters:

Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from anySection.

UNIT-I

1.Free Radical Reactions

Types of free radial reactions, free radical substitution mechanism.Mechanism at an aromatic substrate, neighbouring group assistance.Reactivity for aliphatic and aromatic substrates at a bridgehead.Reactivity in the attacking radicals.Effect of solvents on reactivity. Allylic halogenation (NBS), oxidation of aldehydes to acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts. Sandmeyer reaction, Free radical rearrangement, Hunsdiecker reaction, Kolbe reaction, Hydroxylation of aromatics by Fenton's reagent.

2. **Elimination Reactions**

The E2, E1, E1cB mechanisms. Orientation of the double bond.Effects of substrate structure, attacking base, leaving group and medium on reactivity.Mechanism and orientation in pyrolytic eliminations.

UNIT-II

3. Addition to Carbon – Carbon MultipleBonds

Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio and chemoselectivity, orientation and reactivity.Addition to cyclopropane ring.Hydroboration, Michael reaction.Sharpless asymmetric epoxidation, Hydrogenation of double and triple bonds.Hydrogenation of aromatic rings.

4. Addition to Carbon – Hetero Multiple Bonds –A

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids, esters and nitriles, Wittig reaction.

UNIT-III

5. Addition to Carbon – Hetero Multiple Bonds –B

Mechanism of condensation reactions involving enolates – Aldol, Kneoevenagel, Claisen, Mannich, Benzoin, Stobbe reactions, Reformatski reaction.

6. Formation of Carbon-Carbon Bond

Principle, disconnections and synthons, electrophilic and nucleophilic carbon species. Base-catalyzed condensations; Aldol condensation, Claisen reaction, Perkin reaction, Stobbe condensation, Darzen condensation. Use of malonic, acetoacetic and cyanoacetic esters, Micheal addition, Use of acetylides, Acid-catalyzed condensation – self condensation of olefins, Friedal-Craft's reactions, Fries reactions, Mannich reaction, Mannich bases as intermediates in organic synthesis. Four centrereactions. Diels-Alder reaction, 1-3 Dipolaradditions.

UNIT-IV

7. Oxidation

Introduction**.**Different oxidative processes. Hydrocarbons - alkenes, aromatic rings, saturated C-H groups (activated and unactivated). Alcohols, diols, aldehydes, ketones, ketals and carboxylic acids.Amines, hydrazines, and sulphides. Oxidations with ruthenium tetraoxide, iodobenzene diacetate and thallium(III) nitrate.

8. Reduction

Introduction**,** Different reductive processes. Hydrocarbons - alkanes, alkenes, alkynes and aromatic rings. Carbonyl compounds – aldehydes, ketones, acids and their derivatives. Epoxides.Nitro, nitroso, azo and oxime groups.Hydrogenolysis.

Books Recommended:

1. Principles of Organic Synthesis – Norman andCoxon

2. Advanced Organic Chemistry – JerryMarch.

3. Advanced Organic Chemistry, F.A. Carey, R.J.Sunberg.

4. Highlights of Organic Chemistry, W, J.L. Nobel; An Advanced TextBook.

5. Hand Book of Reagents for Organic Synthesis - Oxidizing and Reducing Reagents. S. D. Burke and R. L. Danheiser (John Wiley andSons)

6. Organic Synthetic reactions by WilliamCarruthers

Master of Science (Chemistry)
(Semester-II)
Session: 2022-24
COURSE CODE: MCHL-2083
COURSE TITLE: Physical Chemistry-Quantum Chemistry

Course outcomes:

Students will be able to

CO1: have basic idea about quantum chemistry and the mathematics associated with quantum statistics including certain aspects of linear algebra, apply this knowledge to atomic structure

CO2: use mathematical techniques in linear algebra for eigen values and eigen vectors and first and second order differential equations not only in quantum chemistry but in other areas of chemistry

CO3: relate concepts that were originally introduced purely as modern atomic physics to molecular systems through harmonic oscillator, spin and rigid rotator

CO4**:** solve all the model problems in quantum mechanics for which exact analytical methods and solutions are available and will apply them to analyze the basis behind the postulatory method of quantum mechanics and which forms the foundations for advanced study of the subject.

Master of Science (Chemistry)

(Semester-II)
Session: 2022-24

COURSE CODE: MCHL-2083

COURSE TITLE: Physical Chemistry – Quantum Chemistry

Time: 3 Hrs **Max. Marks: 50**
Credit(L-T-P): 4-0-0 **(Theory: 40, CA:10)**

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

1. Quantum Theory: Introduction and Principles:
Black body radiations, Planck's radiation law, photoelectric effect, Compton effect, De- Broglie hypothesis, the Heisenberg's uncertainty principle, Rydberg relation for explaining atomic spectrum of hydrogen. Bohr's Theory and its limitation solution of classical wave equation by separation of variables method.

UNIT-II

2. Operators and observations, normal and orthogonal functions, hermitian and UNITary operators, introduction to differentiation and integration, Eigen value equation. Hamiltonian operator, interpretation of wave function, postulates of quantum mechanics.

UNIT-III

3. Applications of Quantum Postulates
Solution of particle in one and three dimensional box, degeneracy, the linear harmonic oscillator, rigid rotators, quantization of vibrational and rotational energy levels, hydrogen and hydrogen like atoms.

4. Angular Momentum
Commutative laws, need of polar coordinates, transformation of Cartesian coordinate into polar coordinate, angular momentum of one particle system, orbital angular momentum, the ladder operator method for angular momentum, spin angular momentum and their relations

UNIT-IV

5. General Orbital Theory of Conjugated Systems

Chemical bonding, linear combination of atomic orbital, overlap integral, coulomb's integral, bond order, charge density calculations for ethylene, allyl system,butadiene system, cyclo butadiene cyclopropenylsystem.

6. The ApproximateMethods

Need for approximation methods, Perturbation and Variation methods and their application to Helium atom.

Books Suggested:

1. Physical Chemistry, A Molecular Approach by MacQuarrieandSimon.
2. Quantum Chemistry, Ira N. Levine, PrenticeHall.
3. Quantum Chemistry, H. Eyring, Kimball andWalter.
4. Quantum Chemistry,Atkin.
5. Fundamentals of Quantum Chemistry, Anantharaman.R.

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Master of Science (Chemistry)

(Semester-II)

Session: 2022-24

COURSE CODE: MCHL-2084

COURSE TITLE: REACTION MECHANISMS AND METAL CLUSTERS

Course outcomes:

Students will be able to

CO1:learn the mechanism of substitution reaction and explain the parameters that affects the crystal structure of a compound

CO2: learn the application of electron transfer reactions in chemical kinetics

CO2:describe the stability of metal complexes by the use of formation constants

And calculate thermodynamic parameters from them

CO4:understand the chemistry of inorganic rings , chains and metal clusters

Master of Science (Chemistry)

(Semester-II)
Session: 2022-24

COURSE CODE: MCHL-2084

COURSE TITLE: REACTION MECHANISMS AND METAL CLUSTERS

Time: 3Hrs. **Max.Marks:50**

Credit(L-T-P): 4-0-0 **(Theory: 40, CA:10)**

Note: The students are allowed to use Non-ProgrammableCalculator.

Instructions for the Paper Setters:

Eight questions of equal marks (eight marks) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from anySection.

UNIT-I

Reaction Mechanism of Transition Metal Complexes

Inert and labile complexes, mechanisms of substitution (dissociative, associative interchange mechanism, the conjugate mechanism, substitution in *trans* complexes, substitution in *cis* complexes, isomerism of chelate rings), *trans* effect, explanation for *trans* effect, Ligand replacement reactions of square planar and octahedral complexes: their factors and mechanism of substitution, orbital occupation mechanisms. Anation reaction, Metal carbonyl reactions species with 17 electrons.

UNIT-II

Electron transfer processes with mechanism, key ideas concerning electron transfer reactions between transition Metals. Cross reactions and thermodynamics. Marcus theory, its kinetics and applications.

UNIT-III

Doubly bridged inner sphere transfer and other electron transfer reactions. Two electron transfer, non-complementary reactions. Stereochemical nonrigidity of coordinate and orgonometallic compounds, trigonal bypyramid, system with six or more coordination number. Isomerization and recemization of trischelates, metal carbonylscrambling.

Metal-ligand Equilibria in Solution

Stepwise and overall formation constant and their interaction, trends in step wise constant, factors affecting the stability of metal complex with reference to the nature of metal ion and ligand chelate effect and its thermodynamic origin. Determination of binary formation constants by pH-meter, Job's method and spectrophotometery.

UNIT-IV

Inorganic Rings, Chains and Metal Cluster

Borazines, Phosphazenes and other heterocyclic inorganic ring, systems, homocyclic inorganic systems, cages of P and S, oxides andsulphides, Higher boranes and carboranes, methods of classifying boranes, Molecular orbit view of chlorohydroborane ions and carboranesmetallocarboranes, isopoly and heteropoly acids and salts; metal-metal bonds and bi-, tri-, tetra-, penta-, and hexanuclear clusters, electron counting schemes for HNCC's. Approaches to systematic cluster synthesis; mention of seven, eight and nine atom clusters. Isolobal analogy and examples of application of analogy.

Books Recommended:

1. K.P. Purcell and J. V. Kotz: Inorganic Chemistry W.B. Saunders Co. London,(1977).

2. G. L. Miessler, D. A. Tarr, Inorganic Chemistry, 3rd edition, PearsonEducation.

3. F.A. Cotton and Wilkinson: Inorganic Chemistry V and VI Ed. Willy Eastern –(1999).

4. J.E. Huheey: Inorganic Chemistry III and IV Ed. Pearson Education Asia –(2002).

Master of Science (Chemistry)
(Semester-II)
Session: 2022-24
COURSE CODE: MCHL-2085
COURSE TITLE: SPECTROSCOPY – B: Techniques for Structure Elucidation of Inorganic Compounds

Course outcomes:

Students will be able to

CO1: identify symmetry elements and symmetry operations

CO2: determine the rotational spectra of linear molecules

CO3: determine IR and Raman activity of linear molecules

CO4: understand the principle and spectra interpretation of photoelectron spectroscopy, electron spin resonance spectroscopy, nuclear quadrupole resonance spectroscopy, Mossbauer spectroscopy

Master of Science (Chemistry)
(Semester-II)
Session: 2022-24
COURSE CODE: MCHL-2085
COURSE TITLE: SPECTROSCOPY – B: Techniques for Structure Elucidation of Inorganic Compounds

Time: 3Hrs **Max. Marks: 75**

Credit (L-T-P): 4-0-0 **(Theory: 60, CA:15)**

Note: The students are allowed to use Non-Programmable Calculator.
Instructions for the Paper Setters:

Eight questions of equal marks (twelve each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT – I

Vibration and Rotation Spectroscopy: Infrared, Raman and Microwave

Harmonic and Anharmonic oscillators, vibrational energies of diatomic molecules. Potential energy function for a chemical bond. Absorption of radiations by molecular vibration. Selection rules, forceconstant.
- Rotational energies of linear molecules. Rotational energy level populations, merits and demerits of microwave spectroscopy, rotational spectra of rigid, linear molecules, non-rigid rotators. Determination of moment of inertia and bond length from rotational spectra, relative intensities of spectral lines. Rotational spectra of non-linear molecules (brief mention), vibrations in polyatomic molecules. Effects giving rise to absorption bonds. Group vibrations and limitations of group vibrationconcepts.

UNIT – II

Vibration and Rotation Spectroscopy: Infrared, Raman and Microwave

- Polarisations of light. Theories of Raman Effect, Merits and demerits of Raman spectroscopy. Pure rotational Raman spectra of linear molecules. Vibrational Raman spectra selection rules. Rule of mutual exclusion. Rotational Fine IR spectra, vibroniccoupling.
- Sample handling. Factors affecting absorption frequencies. Interpretation and finger printing
- regions. Use of symmetry considerations to determine the number of active I.R, and
- Ramanlines (character tables to be provided in theExamination)
-

UNIT-III

(A)Applications
- of Raman and IR selection rules to the determination of Inorganic structure with special
- emphasis on:
(i) Metalcarbonyls. (ii)NSF_3 (iii) Geometrical isomerisan – differentiation between Cis and

trans. $[Co(bipy)_2Cl_2]Cl$. (iv) Structures of CO_2, N_2O, H_2O, chlorocomplexes of mercury, camium and zinc and some octahedral complexes ML_6 (eg. SiF_6^{2-}, PF_5^-,SF_6). (v) Changes in the spectra of donor molecules upon coordination with special emphasis on N, N – dimethyl – acetamide and DMSO with Fe^{3+}, Cr^{3+}, Zu^{2+}, Pd^{2+} and Pt^{2+}ions.I.R spectroscopy and modes of coordination of SO_4^{2-}, N_2, O_2, NO, CO_3^{2-} , NO_3^-.

(B)Photo Electron Spectroscopy

Introduction, excitation and ejection of electrons, electronic energy levels in atoms and molecules, Core level photoelectron spectroscopy, symmetry and molecular orbitals, valence electron photo electron spectroscopy, valence excitation spectroscopy. Dissociation, Predissociation, change of shape on excitation.

(C)Electron Spin Resonance Spectroscopy

Features of ESR spectra, measurement technique hyperfine coupling in isotropic system (C_5H_5, C_6H_6, $C_{14}H_{10}$, biphenyl) Anisotropic splitting, Electron – electron interaction, Transition metal complexes g-value and factors affecting g-value, zerofield splitting, Kramer's degeneracy, Rate of electron exchange, Application to p – benzoseniquinone DPPH, pyrazine.
Double resonance technique ENDOR, ELDOR.

UNIT – IV

Nuclear Quadrupole Resonance Spectroscopy

Introduction, effects of magnetic field on the spectra. Relationship between the electric field gradient and molecular structure. Interpretation of eQ, data, the effect of crystal lattiee on the magnitude of eQ4, double resonance technique, Application ($PFCI_4.PCI_5$), $(NH_4)_2TeCl_6$, , group 14 tetra halides, R_3MX_2 (M=As,Sb,Bi), Cis and Trans$[Co(en)_2Cl_2]Cl$, Polyhalide ion, BrCN, HIO_3 (1,2)

Mossbauer Spectroscopy

Introduction, principles, conditions of MB spectra, parameters from MB spectra. Isomer shift electric quadrupole interaction, magnetic interaction, use of additive partial quadrupole splittings to predict quadrupole coupling. Application of {$^{57}F_e$, $^{119}S_N$, $^{151}E_U$ compounds, to biological systems to surface study, I_2CI_6, IBr_2 CL_4, XeF_4, $XeCI_4$.

Books Recommended:

1. E.A.V Ebsworth; W.H Renkin; Cradock, Structure Methods in InorganicChemistry.
2. R.S Drago, Physical Methods for Chemists (Ist and IInd Edition).
3. C.N Banwell, Fundamentals of MolecularSpectroscopy.
4. S. Walker and H. Straugh an Spectroscopy,Vol.I.
5. J.E. Wertz and J.R. Bolton, Electron Spin Resonance(p.49-65).
6. N.N. Greenwood and T.C Tibb, MossbauerSpectroscopy.
7. K. Nakamoto, Infrared Spectra of Inorganic and co-ordination Compounds.

Master of Science (Chemistry) Semester-II
Session 2022-24
Course Title: Mathematics for Chemists
Course Code-MCHL-2336

Course outcomes:

Students will be able to

CO 1: Understand the trigonometric functions with the help of unit circle and application of trigonometric identities and able to solve determinants with the help of its various properties.

CO 2: Demonstrate the concept of matrices and type of matrices and how to calculate transpose, adjoint and inverse of matrices. Manage to solve problems related to addition, subtraction and multiplication.To understand the concept and solve system of linear equations.

CO 3: Solve Complex problems related to derivative of sum, difference, product and quotient of functions and also to find derivative of trigonometric functions, inverse trigonometric functions, logarithmic functions and exponential functions.

CO 4: Recognize integration as an inverse of differentiation and to calculate area under curve and understand integrals as limit of sum and its geometrical interpretation.

Master of Science (Chemistry)
(Semester-II)
Session: 2022-24
COURSE CODE: MCHL-2336
COURSE TITLE: MATHEMATICS FOR CHEMISTS
(For Medical Students)

Time: 3 Hrs **Max. Marks: 25**

Credit (L-T-P): 2-0-0 **(Theory: 20, CA: 5)**

Instructions for the Paper Setters:
Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Trigonometry and Determinants:
Definition of sin, cos, tan, cot, sec, cosec functions with the help of unit circle, values of sin x, cos x for x = 0, π/6, π /3, π /2. Trigonometric identities (without proofs) and their applications. Definition and expansion properties of determinants, product of two determinants of 3rd order.

Unit-II

Matrices:
Introduction to various forms of Matrices, row, column, diagonal unit, Submatrix, square, equal matrices, null, symmetric and skew symmetric matrices, transpose of a matrix, adjoint and inverse of matrices. Addition, multiplication, characteristic equation of a matrix, statement of Cayley Hamilton theorem. Rank of matrix, condition of consistency of a system of linear equations. Eigen vectors and Eigen values of matrices.

Unit-III

Differential Calculus
Differentiation of standard functions, theorems relating to the sum, difference, product and quotient of functions (without proofs), derivative of trigonometric functions, inverse trigonometric functions, logarithmic functions and exponential functions, differentiation of implict functions, logarithmic differentiation

Unit-IV

Integral Calculus
Integration as an inverse of differentiation, area under a curve, indefinite integrals of standard forms, method of substitution, method of partial fractions, integration by parts, definite integrals,definite integrals as limit of a sumand geometrical interpretation.

Reference Books:
1. Mathematics Textbook for class XI, NCERT
2 Mathematics Textbook for class XII, NCERT
3. J. B. Dence, Mathematical Techniques in Chemistry, John Wiley & Sons, First edition, 1975.

Master of Science (Chemistry)
(Semester-II)
Session: 2022-24
COURSE CODE: MCHL-2057
COURSE TITLE: BIOLOGY FORCHEMISTS
(For Non-Medical Students)

Course outcomes:

Students will be able to

CO1: Gain knowledge about the biomolecules and cell structure.

CO2: Understand different types of tissues.

CO3: Understand Mendelian laws, structure of DNA and gene expression.

CO4: Understand Whittaker's system of classification and structure of virus.

Master of Science (Chemistry)
(Semester-II)
Session: 2022-24
COURSE CODE: MCHL-2057
COURSE TITLE: BIOLOGY FOR CHEMISTS
(For Non-Medical Students)

Time: 3 Hrs **Max. Marks: 25**

Credit (L-T-P): 2-0-0 **(Theory: 20, CA: 5)**

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setter

Eight questions of equal marks (4 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from unit I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

The Organization 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, organs and organ systems: Animal tissues; epithelial tissues, connective tissues, muscle tissue, nervous tissue and neoplasias; plant tissue: meristematic tissue, permanent tissues.

UNIT-III

Genetics

The basic principle of heredity: Mendals 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, and their characteristics with are example of each.
Viruses, structure of Viruses.

Book Recommended:

1. Cord Biology - South Western Educational Publications, Texas, 200

Master of Science (Chemistry)
(Semester-II)
Session: 2022-24
COURSE CODE: MCHP-2088
COURSE TITLE: ORGANIC CHEMISTRY (PRACTICAL)

Course outcomes:

The students will be able to

CO1: understand and perform multi step organic synthesis.

CO2: CO2: characterize organic molecules by physical and spectroscopic methods like M.P, B.P, and IR

CO3: design multistep synthesis

CO4: expertise the various techniques of analysis of organic substances

Master of Science (Chemistry)
(Semester-II)
Session: 2022-24
COURSE CODE: MCHP-2088
COURSE TITLE: ORGANIC CHEMISTRY (PRACTICAL)

Time: 6Hrs **Max. Marks:75**
Credit (L-T-P): 0-0-3 **(P: 60, CA: 15)**

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners.Two copies of the same should be submitted for the record to COE Office,Kanya Maha Vidyalaya,Jalandhar

Multistep Organic Synthesis

1. Synthesis of 2-chloro-4-bromoaniline from aniline (Bromination and chlorination) Book 1, page292.
2. Synthesis of methyl orange fromaniline.
   (Aromatic electrophilic substitution and diazocoupling).Book 2, page 250.
3. Synthesis of benzpinacol and its pinacolrearrangement.
4. Synthesis of o-chlorobenzoic acid from phthalimide. Synthesis of acridone from o-chlorobenzoic acid. (Hofmann bromamide and Sandmeyer'sreaction).
5. Synthesis of 2,4-dinitrophenyl hydrazine from chloro benzene. (Electrophilic and nucleophilic substitution reactions on aromaticring).
6. Synthesis of triphenylcarbinol from bromobenzene. (Grignard reaction) Book 2, page220.

B: Quantitative Analysis of Organic Compounds:

1. Estimation of phenol/aniline using bromate-bromide solution.
   (The application to find the purity of the sample and to determine the amount in given solution).
2. Determine the number of hydroxyl and amino groups in the given sample by the acetylation method.
3. Determine the mol. wt. of the given ketone by using 2,4-DNPmethod.
4. Estimation of reducing sugar by Fehling solutionmethod.
5. To determine the saponification value of the given fat or oilsample.
6. To determine the iodine number of the given fat or oilsample.

Books Recommended:

1. An Introduction to Modern Experimental Organic Chemistry, R. M. Roberts, J. C. Gilbert, L.B.Rodewald and A. S. Wingrove Holt, Ranehart and Winston Inc. NewYork.
2. Introduction to Organic Laboratory Techniques – A Contemporary Approach. D. L.Pavia, G. M. Lampmana and G. S. Kriz, W. B. Saunders Company, 1976.
3. Laboratory Experiments in Organic Chemistry, R. Adams, J. R. Johnson and C. F. Wilcox. The Macmillan Limited,London.
4. Text Book of Practical Organic Chemistry, A. I.Vogel.

Master of Science (Chemistry)
(Semester-II)
Session: 2022-24
COURSE CODE: MCHP-2089
COURSE TITLE: Physical Chemistry (Practical)

Course outcomes:

Students will be able to

CO1: know about the safety requirements and lab skills required to perform physico-chemical experiments

CO2: know the principle and mechanism of Conductometric and pH metric titrations experiments

CO3: study distribution of benzoic acid in organic and aqueous solvent

CO4: determine specific and molar refraction using Abbe's refractometer.

Master of Science (Chemistry)
(Semester-II)
Session: 2022-24
COURSE CODE: MCHP-2089
COURSE TITLE: Physical Chemistry (Practical)

Time: 6Hrs **Max. Marks: 75**

Credit (L-T-P): 0-0-3 **(P: 60, CA: 15)**

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office,Kanya Maha Vidyalaya,Jalandhar.

1) To determine the strength of given acid by Ph metrically.
2) To determine dissociation constant of given acid pH metrically
3) Titration of weak acid conductometrically
4) Titration of strong acidconductometrically
5) To determine dissociation constant of given acid conductometrically
6) Determine the dissociation constant of acetic acid in DMSO, DMF, dioxane by titrating it with KOH.
7) Determine the activity coefficient of an electrolyte at different molalities by e.m.f. measurements.
8) Compare the cleansing powers of samples of two detergents from surface tension measurements.
9) Determine the specific refraction, molar refraction and atomic parachor with the helpofAbbe'srefractometer.
10) To study the distribution of benzoic acid between benzene and water.
11) Determine the equilibrium constant of reaction KI $+I_2$ à KI_3 by distribution law and hence find the value of go of the abovereaction.
12) Compare the relative strength of CH_3COOH and $ClCH_2COOH$ from conductance measurements.
13) Determine the solubility (g/litre) of sparingly soluble lead sulphate fromconductance measurements.
14) Titrate a given mixture of HCl and CH_3COOH against NaOH solution conductometrically.
15) Compare the relative strengthof:

i) HCl and ii) H_2SO_4 by following the kinetics of inversion of cane sugarPolarimetrically.

Books Recommended:

1.Yadav, J. B (2005): *Advanced Practical Physical Chemistry*, 22nd edition, Goel publishing House, Krishna Prakashan Media Ltd.

2. Venkatesan, V,Veeraswamy, R and Kulandaivelu, A.R (1997): *Basic Principles of Practical Chemistry*", 2nd edition, Sultan Chand and Sons Publication, New Delhi.

KANYA MAHA VIDYALAYA JALANDHAR (AUTONOMOUS)

SCHEME AND CURRICULUM OF EXAMINATION OF TWO YEAR DEGREE PROGRAMME

Master of Science (Chemistry)

Credit Based Continuous Evaluation Grading System (CBCEGS)

(Session: 2022-2024)

Semester III

Master of Science (Chemistry) Semester III										
Course Code	**Course Title**	**Course Type**	**Hours Per Week** **L-T-P**	**Credits** **L-T-P**	**Total Credits**	**Marks**				**Examination time** **(in Hours)**
						Total	**Th**	**P**	**CA**	
MCHL-3081	Inorganic Chemistry-II	C	4-0-0	4-0-0	4	50	40	-	10	3
MCHL-3082	Organic Synthesis	C	4-0-0	4-0-0	4	50	40	-	10	3
MCHL-3083	Surface and Polymer Chemistry	C	4-0-0	4-0-0	4	50	40	-	10	3
MCHL-3084	Photochemistry and Pericyclic reactions	C	4-0-0	4-0-0	4	50	40	-	10	3
MCHP-3085	Inorganic Chemistry Practical (Preparations)	C	0-0-6	0-0-3	3	75	-	60	15	3*2
MCHP-3086	Physical Chemistry Practical	C	0-0-6	0-0-3	3	75	-	60	15	3*2
Student can opt any one of the following Interdisciplinary compulsory courses		IDE			4					
Total				**22**		**350**				

IDEC-3101*	Effective Communication Skills		4-0-0			100	80	-	20	3
IDEM-3362*	Basics of Music (Vocal)		2-1-1			100	40	40	20	
IDEH-3313*	Human Rights and Constitutional Duties		4-0-0			100	80	-	20	
IDEI-3124*	Basics of Computer Applications		2-0-4			100	50	30	20	3+3
IDEW-3275*	Indian Heritage: Contribution to the world		4-0-0			100	80	-	20	3
(*Credits of these ID courses will not be added to SGPA)										

C- Compulsory Course

IDE- Inter Disciplinary Elective Course

IDC-Inter Disciplinary Compulsory Course

Master of Science (Chemistry)
(Semester-III)
Session: 2022-24
COURSE CODE: MCHL-3081
COURSE TITLE: Inorganic Chemistry-II

Course outcomes:

Students will be able to

CO1: study about the different oxygen carriers present in the body with their structure and stereochemistry

CO2: study the bioenergetics of various biological processes in living/non living organisms and role of bio-enzymes and their functioning.

CO3: learn biochemistry of iron and detailed mechanism of nitrogen fixation reactions

CO4: learn about the different enzymes participating in the chemical reactions inside the body and their functions and role of metal ions in medicines

Master of Science (Chemistry)
(Semester-III)
Session: 2022-24
COURSE CODE: MCHL-3081
COURSE TITLE: Inorganic Chemistry-II

Time: 3Hrs **Max. Marks: 50**

Credit (LTP): 4-0-0 **(Theory: 40, CA: 10)**

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Metal Ions in Biological Systems-Essential and trace elements, periodic survey of essential and trace elements, biological importance and relative abundance, Na^+/ K^+ ion pump.
Transport and Storage of Dioxygen- Oxygen carriers-Hb and Mb: Structure and mechanism of their function, co-operativity, inhibition and poisoning by ligands and metal ions, hemocyanins and hemerythrin, model complexes of iron, cobalt and copper.
.

UNIT-II

Bioenergetics and ATP Cycle- Process concept to phosphate hydrolysis, Nucleotide transfer-DNA polymerase, phosphate transfer pyruvate kinase, phosphoglucomutase, created kinase, ATPase **Photosynthesis and respiration** – chlorophyll : structure, function and its synthetic model.
Bioredox Agents and Mechanism- Enzymes and their functioning, Vitamin B_{12} coenzyme, its function and application in organic syntheses, intake of alcohol and its remedy.

UNIT-III

Biochemistry of Iron- Availability of iron, competition for iron, iron toxicity and nutrition.

Electron Transfer in Biology- Cytochromes-structure and function, CN^- and CO poisoning, Ferredoxin and rubredoxim. **Nitrogenase**- Biological N_2 fixation, molybdenum nitrogenase, spectroscopic and other evidence, other nitrogenases modelsystems.
Metal Storage, Transport- Ferritin, transferrin and siderophores.

UNIT-IV

Metalloenzymes- Zinc enzymes-carboxypeptidase and carbonic anhydrase, Copper enzymes-superoxide dismutase.
Calcium in Biology- Calcium in living cell, transport and regulation, molecular aspects of intramolecular processes,
Metals in Medicine- Metal deficiency and disease, toxic effects of antibiotics and related compounds, chelate therapy

Books Recommended:

1. Principles of Bioinorganic Chemistry, S. J. Lippard and Berg, University ScienceBooks.
2. Inorganic Biochemistry, Vol I and II. Ed. G. L. Eichhorn,Elsevier.
3. J.E. Huheey : Inorganic Chemistry III and IV Ed. Pearson Education Asia –(2002).
4. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, 5^{th}Edition.
5. Progress in Inorganic Chemistry, Vols 18 and 38 Ed. J. J. Lippard,Wiley
6. Bioinorganic Chemistry by D.Banergia

Master of Science (Chemistry)
(Semester-III)
Session: 2022-24
COURSE CODE: MCHL-3082
COURSE TITLE: Organic Synthesis

Course outcomes:

Students will be able to

CO1: understand general mechanistic consideration of organic rearrangements and to understand synthesis and reactions of macroring compounds and fused polynuclear hydrocarbons

CO2: study the synthesis and reactions of three, four, six, seven and large membered Heterocycles

CO3: know about the use of various reagents in organic synthesis and functional group transformations

CO4: understand the basic concepts of supramolecular chemistry

Master of Science (Chemistry)
(Semester-III)
Session: 2022-24
COURSE CODE: MCHL-3082
COURSE TITLE: Organic Synthesis

Time: 3 Hrs **Max. Marks: 50**

Credit (LTP): LTP: 4-0-0 **(Theory: 40, CA: 10)**

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Rearrangements: General mechanistic considerations – nature of migration, migratory aptitude, memory effects. A detailed study of the following rearrangements: Pinacol-pinacolone, Wagner-Merwein, Demjanov, Benzil-Benzilic acid, Favorskii, Arndt-Eistert synthesis, Neber, Beckmann, Hofmann, Curtius, Schmidt, Baeyer-Villiger, Shapiroreaction.

Polynuclear Compounds and Macro-Ring Compounds
Introduction, comparative study of aromatic character of Linear and non-Linear-ortho-fused polynuclear hydrocarbons, ortho-and peri-fused polynuclear hydrocarbons.General method of preparation and reactions of indene, fluorene anthracene and phenanthrene.

UNIT-II

Heterocyclic Synthesis
Principles of heterocyclic synthesis involving cyclization reactions and cycloaddition reaction.

Small Ring Heterocycles
Synthesis of aziridines, oxiranes, thiiranes and their ring opening and rearrangement reactions.

Five-Membered Heterocycles with one Heteroatom
Synthesis of Furan, Pyrrole, Thiophene and their electrophilic, nucleophilic, metallation reactions.

Six-Membered Heterocycles with one Heteroatom
Pyridine synthesis (from dicarbonyl compounds,*HantzschSynthesis*, *through cycloaddition reactions*), reactions of pyridine (electrophilic, nucleophilic, metallation), synthesis of pyrylium salts, pyrones, benzopyrylium salts, benzopyrones (coumarins, chromones) and their electrophilic, nucleophilic and addition reactions.

Seven-and Large-Membered Heterocycles
Synthesis and reactions of azepines, oxepines, thiepines, thiazepines.

UNIT-III

Reagents in Organic Synthesis

Use of the following reagents in organic synthesis and functional group transformations; Complex metal hydrides, Gilman's reagent, lithium dimethylcuprate, lithium disopropylamide (LDA) dicyclohexylcarbodimide. 1,3-Dithiane (reactivity umpolung), trimethylsilyl iodide, tri-n-butyltinhybride, Woodward and prevost hydroxylation, osmium tetroxide, DDQ, selenium dioxide, phase transfer catalysts, crown ethers and Merrifield resin, Peterson's synthesis, Wilkinson's catalyst, Bakeryeast.

UNIT-IV

Supramolecular Chemistry

Definition and development of supramolecularchemistry, Classification of supramolecular Host-Guest compounds, Historical concepts such as receptors, coordination, lock and key analogy, Chelate and Macrocyclic effects, Preorganization and Complementarity, Thermodynamics and Kinetic selectivity, Overview of intermolecular forces such as Hydrogen bonding, Hydrophobic effects, Cation-π interactions, Ion-ion, Ion-dipole, Dipole-dipole interactions, π-π stacking, van der Waals forces, Synthesis and structure of supramolecular hosts for Recognition of cations: Crown ethers, Cryptands, Spherands, Siderophores;for Recognition of anions:Guanidinium- based receptors; for Recognition of neutral molecules: Cyclotriveratrylene (CTV).

Book Recommended:

1. Supramolecular Chemistry, Jonathan W. Steed, Jerry L. Atwood, John Wiley and Sons
2. Principles of Modern Hetrocyclic Chemistry by L.A. Paquette
3. Hetrocyclic Chemistry by J.A. Joule and K. Mills
4. Heterocyclic Chemistry by Gilrchirst

Master of Science (Chemistry)
(Semester-III)
Session: 2022-24
COURSE CODE: MCHL-3083
COURSE TITLE: Surface and Polymer Chemistry

Course outcomes:

Students will be able to

CO1: study concept of adsorption and activity of catalysis at surfaces, solve numerical on BET equation

CO2: understand the concept of micelle formation, learn about CMC and thermodynamics of micellization

CO3: learn about the type and classification of polymers

CO4: know about the structure, properties and utilization of polymers, study in detail about the glass transition temperature

Master of Science (Chemistry)
(Semester-III)
Session: 2022-24
COURSE CODE: MCHL-3083
COURSE TITLE: Surface and Polymer Chemistry

Time: 3 Hrs **Max. Marks: 50**

Credit (LTP): 4-0-0 **(Theory: 40, CA: 10)**

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Adsorption

Surface tension, capillary action, pressure difference across curved surface (Laplace equations), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation), surface films on liquids (Electro-kinetic phenomena), and catalytic activity at surfaces.

UNIT-II

Micelles

Surface active agents, classification of surface active agents, micellization, hydrophobic interactions, critical micellar concentration (CMC), factors affecting CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization – phase separation and mass action models, solubilization, micro emulsion, reverse micelles.

UNIT-III

Macromolecules

Polymer – definition, types of polymers, electrically conducting, fire resistant, liquids crystal polymers, kinetics of polymerization, thermodynamics ofpolymerization.
Molecular mass, number and mass average molecular mass, molecular mass determination (osmometry, viscometry, diffusion and light scattering methods), sedimentation, chain configuration of macromolecules, calculations of average dimensions of various chain structures. Importance of polymers, Basic concepts: monomers, repeat units, degree of polymerization. Linear, branched and network polymers. Classification of polymers. Polymerization: condensation, addition, radical chain-ionic and co-ordination and copolymerization. Polymerization conditions and polymer reactions.Polymerization in homogenous and heterogeneous systems. Number, weight and viscosity average weights.

UNIT IV

Structure and Properties:

Polymer structure and properties-crystalline melting point T_m-melting point of homogenous series, effect of chain flexibility and steric factors, entropy and heat of fusion. The glass transition temperature, T_g-Relationship between $T_m$and T_g, effects of molecular weight, diluents, chemical structure, chain topology, branching and chain linking. Property requirements and polymerutilization.

Books Recommended:

1. Physical Chemistry, P. W.Atkins.
2. Textbook of polymer science, F. W. Billmeyer Jr.Wiley.
3. Polymer science, V. R. Gowariker, N. V. Viswanathan and J. Sreedhar,Wiley-Eastern
4. Polymer Chemistry, Melcolm P. Stevens, Oxford University Press
5. Physical Chemistry of Polymers , A.Tager, Mir Publishers, Moscow

Master of Science (Chemistry)
(Semester-III)
Session: 2022-24
COURSE CODE: MCHL-3084
COURSE TITLE: Photochemistry and Pericyclic reactions

Course outcomes:

Students will be able to

CO1: classify the pericyclic reactions and explain them under thermal and photochemical conditions.

CO2: interpret the product of Pericyclic reactions (Cyclo addition, Electocyclic and sigmatropic Reactions)

CO3: know the basic concepts of photochemical reactions and determine their reaction mechanisms

CO4: apply the knowledge of photochemical reactions of Alkenes, carbonyl compounds, aromatic compounds and to study named photochemical reactions, photochemistry of smog, polymers and vision

Master of Science (Chemistry)
(Semester-III)
Session: 2022-24
COURSE CODE: MCHL-3084
COURSE TITLE: Photochemistry and Pericyclic reactions

Time: 3 Hrs **Max. Marks: 50**

Credit (LTP): 4-0-0 **(Theory: 40, CA: 10)**

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-1

Pericyclic Reactions (A)
Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene, allyl system, classification of pericyclic reactions FMO approach. Woodward-Hoffmann correlation diagrams method and Perturbation of molecular orbital (PMC) approach for he explanation of pericyclic reactions under thermal and photo-chemical conditions. Electrocyclic reactions – controtatory and disrotatory motions, 4n, 4n+2, allylsystems secondary effects. Cycloadditions – antrafacial and suprafacial additions, notation of cylcoadditions (4n) and (4n+2) systems with a greater emphasis on (2+2) and (4+2)

UNIT-II

Pericyclic Reactions (B)
cycloaddition-stereochemical effects and effects of substituents on the rates of cycloadditions, 1,3-dipolar cyclo-additions and cheleotropicreactions.Sigmatropic Rearrangements-suprafacial and antrafacial shifts [1,2]- sigmatropic shifts involving carbon moieties retention and invertion of configuration, (3,3) and (5,5)sigma-tropic rearrangements, detailed treatment of Claisen and Cope rearrangements, fluxional tautomerism, aza-cope rearrangements, introductions to Ene reactions, simple problems on pericyclic reactions. Elecrocyclic rearrangement of cyclobutenes and 1,3cyclohexadienes.

UNIT-III

Photochemistry
Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.
Determination of Reaction Mechanism
Classification, rate constants and life times of reactive energy states –determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions.Types of photochemical reactions – photodissociation, gas-phasephotolysis.

UNIT-IV

Photochemistry of Alkenes

Intramolecular reactions of the olefinic bond – geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1, -dinenes.

Photochemistry of Carbonyl Compounds

Intramolecular reactions of carbonyl compounds – saturated, cyclic and acyclic, β, γ- unsaturated and α,β-unsaturated compounds, Cyclohexadienones. Intermolecular cycloaddition reactions – dimerisations and oxetane formation.

Photochemistry of Aromatic Compounds

Isomerisations, additions and substitutions.

Miscellaneous Photochemical Reactions

Photo-Fries reactions of anilides.Photo-Fries rearrangement.Barton reaction.Singlet molecular oxygen reactions.Photochemical formation of smog.Photodegradation of polymers.Photochemistry of vision.

Books Recommended:

1. Organic Photochemistry – Chapman andDepuy.
2. Organic Photochemistry – W.H.Horsepool.
3. Photochemistry of Excited States –J.D.Goyle.
4. Pericyclic Reactions: A Mechanistic study by S.M. Mukherji
5. The conservation of orbital Symmetry by R. B. Woodward and R. Hoffman
6. Fundamentals of Photochemistry by K.K.Rohtagi Mukherji

Master of Science (Chemistry)
(Semester-III)
Session: 2022-24
COURSE CODE: MCHP-3085
COURSE TITLE: Inorganic Chemistry Practical (Preparations)

Course outcomes:

Students will be able to

CO1:plan and conduct experiments for synthesizing and analysing the inorganic compounds

CO2:do measurements of magnetic moments of synthesized complexes.

CO3:estimate metal ions in the synthesized complex through various analytical techniques

CO4:interpret and characterise the metal complexes through various spectrpscopic and analytical techniques

Master of Science (Chemistry)
(Semester-III)
Session: 2022-24
COURSE CODE: MCHP-3085
COURSE TITLE: Inorganic Chemistry Practical (Preparations)

Time: 6 Hrs **Max. Marks: 75**
Credit (LTP): 0-0-3 **(P: 60, CA: 15)**

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

1. Preparation of $Co(acac)_3$, its characterization using NMR, IR, UV-Vis and analysis of Cobalt. (ref. J. Chem. Edu., 1980, 57, 7,525)
2. Preparation of $Co(acac\text{-}NO_2)_3$, its characterization using NMR, IR, UV-Vis andanalysis of Cobalt. (ref. J. Chem. Edu., 1980, 57, 7,525)
3. Preparation of $[Fe(H_2O)_6][Fe(N\text{-salicyldeneglycinato})_2]_2.3H_2O$, its characterization using IR, UV-Vis, magnetic susceptibility and analysis of Iron.(ref. InorganicaChimicaActa, 1977, 23,35).
4. Preparation of $[Ni(NH_3)_6]Cl_2$ its characterization using IR, UV-Vis, magnetic susceptibility and analysis of Nickel and NH_3. (ref. Marr and Rockett,1972).
5. Preparation of $[Ni(ethylenediamine)_3]Cl_2$ its characterization using IR, UV-Vis, magnetic susceptibility and analysis of Nickel. (ref. Marr and Rockett, 1972, page270).
6. Preparation of $[Fe(NO)(S_2CN(Et)_2)_2]$ its characterization using IR, UV-Vis, magnetic susceptibility and analysis of Fe(II). (ref. Marr and Rockett, 1972, page 262, J. Chem. Soc. 1962, 84,3404).
7. Preparation of octahedral and tetrahedral complexes of dichlorodipyridylcobalt(II), differentiate them using IR, UV and magnetic properties. Estimate Co(II) from one of them. (ref. Marr and Rockett, 1972, page 375, Inorganic Chemistry, 1966, 5,615).
8. Preparation of $VO(acac)_2$ and its piperidine complex, characterize using IR, UV and magnetic moment. Estimate for V(IV). (ref. Marr and Rockett, 1972,243).
9. Preparation of diaquotetraacetataocopper(II), magnetic susceptibility IR and UV-Vis, analysis ofCopper(II).
10. Preparation of cis- and trans- potassium dioxalatodiaquochromate(III). Interpretation of IR, UV and magnetic properties. Estimation of Chromium. (ref. Marr and Rockett, 1972, page386).
11. Preparation of $HgCo(NCS)_4$, its IR and measure its magnetic moment. (ref. Marr andRockett, 1972, page365).

12. Preparation of sodium tetrathionate, interpretation of its IR and analysis using potassium iodate. (ref. Marr and Rockett, 1972, page214).
13. Preparation of Potassium dithionate, interpretation of its IR and analysis using potassium iodate. (ref. Marr and Rockett, 1972, page214).
14. Preparation of bis(acetylacetonato)copper(II), UV-Vis, and IR, magnetic studies, Demonstration of Jahn Teller effect by solution spectral studies. (ref. Bull. Chem. Soc. Japan, 1965, 29,852).
15. Preparation of salicylamide complexes of Copper(II). IR, UV, magnetic data and analysis of Cu(II). (ref. Indian J. of Chem., 1977, 15A, No. 5, 459; ibid, 1971, 9,1396).
16. To prepare a macrocyclic ligand 5,7,7,12,14,14-hexamethyl-1,4,8,11-tetraazacyclo tetradeca-4,11-dienedi(hydrogeniodide) and its complex with Ni(II). Study IR, NMR and UV-Vis of ligand and complex and magnetic properties of complex. To analyze for Ni and I. (J. Chem. Edu. 1977, 79,581).
17. Preparation and resolution of tris (ethylenediamine) cobalt (III). UV-Vis, NMR, IR, optical rotation of the resolved complexes. ((ref. Marr and Rockett, 1972, page386).

Books Recommended:

1. B.N. Figgis, Introduction to Ligand Field, WileyEastern.
2. A.B.P. Lever, Inorganic Electronic Spectroscopy,Elsevier.
3. A.Earnshaw, Introduction to Magnetochemistry, AcademicPress.
4. J.E. Huheey, Inorganic Chemistry Principles of Structure and Reactivity, Harper Interscience.
5. R.S. Drago, Physical Medhod in Chemistry, W.B.SaundersCompany.
6. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, WileyInterscience.
7. F.A. Cotton, Chemical Application of Group Theory, WileyEaster

Master of Science (Chemistry)
(Semester-III)
Session: 2022-24
COURSE CODE: MCHP-3086
COURSE TITLE: Physical Chemistry Practical

Course outcomes

Students will be able to

CO1: apply the principle and mechanism of Conductometric and potentiometric titrations

CO2: determine the partial molar volumeof compounds using Dilatometer

CO3: determine specific and molar refractivity using Abbes refractometer

CO4: study complex formation and the kinetics of hydrolysis Spectrophotometrically

Master of Science (Chemistry)
(Semester-III)
Session: 2022-24
COURSE CODE: MCHP-3086
COURSE TITLE: Physical Chemistry Practical

Time: 6 hrs. **Max. Marks: 75**
Credit (LTP): 0-0-3 **(P: 60, CA: 15)**

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

1. To determine the partial molar volume of
   (a) Glycine (b) Urea using dilatometer
2. To determine the partial molar volume of
   (a) methanol (b) n-propanol using dilatometer
3. To determine the surface tension (double capillary) of mixture of solid and water by deferential method and hence find out parachor of the mixture.
4. To determine the specific and molar refractivity of n-propanol, butanol, hexane and carbon tetrachloride and calculate refraction equivalents of C, H andCl.
5. To determine the molar refractivity of water, DMF, Dioxane and mixtures of water-DMF, water-Dioxane and verify the refractivity rule. Predict about the interactions between components of mixture by plotting graph between refractive index and mole fraction.
6. To determine the equivalent conductance of weak electrolyte (acetic acid) at infinite dilution using Kohlrausch law.
7. Determine equivalent conductance of strong electrolyte at several concentrations and hence verify Onsagerequation.
8. Determine equivalent conductance of weak electrolyte, say acetic acid at different concentrations and hence test validity of Ostwald's dilution law. Also determine dissociation constant of the electrolyte.
9. To determine dissociation constant of a dibasic acid potentiometrically.
10. To study complex formation between Fe (III) and salicylic acid and find out the formula of the complex spectrophotometrically.
11. To determine the formula of the complex ion formed between Fe (III) and thiocyanate ion by Job's method.
12. To study the kinetics of hydrolysis of crystal violetspectrophotometrically.
13. To determine the pH of various mixtures of sodium acetate and acetic acid in aqueous solution and hence determine the dissociation constant of theacid.
14. Titrate potentiometrically Zn(II) by $K_4Fe(CN)_6$ and verify the composition of the complex $K_2Zn_3[Fe(CN)_6]_2$
15. Determination of nitrite in water spectrophotometrically.
16. Determination of molecular weight of polymers by Viscometry.
17. Determine the molar refraction of a solid substance by dissolving it in a solvent and its refractive index.

Books Recommended:

1. Yadav, J. B (2005): *Advanced Practical Physical Chemistry*, 22nd edition, Goel publishing House, Krishna Prakashan Media Ltd.

2. Venkatesan, V., Veeraswamy, R. and Kulandaivelu, A.R (1997): *Basic Principles of Practical Chemistry*", 2nd edition, Sultan Chand and Sons Publication, New Delhi.

KANYA MAHA VIDYALAYA JALANDHAR (AUTONOMOUS)

SCHEME AND CURRICULUM OF EXAMINATION OF TWO YEAR DEGREE PROGRAMME

Master of Science (Chemistry)
Credit Based Continuous Evaluation Grading System (CBCEGS)
(Session: 2022-2024)
Semester IV

Master of Science (Chemistry) Semester IV										
Course Code	**Course Title**	**Course Type**	**Hours Per Week L-T-P**	**Credits L-T-P**	**Total Credits**	**Marks**				**Examination time (in Hours)**
						Total	**Th**	**P**	**CA**	
MCHL-4081	Advanced Inorganic Chemistry	C	4-0-0	4-0-0	4	75	60	-	15	3
MCHL-4082	Chemistry of Natural Products	C	4-0-0	4-0-0	4	75	60	-	15	3
MCHL-4083	Electrochemistry and Chemical Dynamics	C	4-0-0	4-0-0	4	75	60	-	15	3
MCHP-4084	Advanced Practical-Organic Synthesis	C	0-0-6	0-0-3	3	50	-	40	10	3*2
MCHP-4085	Advanced Practical-Inorganic Synthesis	**C** C	0-0-6	0-0-3	3	50	-	40	10	3*2
MCHP-4086	Advanced Practical-Physical Chemistry	C	0-0-6	0-0-3	3	50	-	40	10	3*2
Total					**21**	**375**				

C- Compulsory Course

IDE- Inter Disciplinary Elective Course

IDC-Inter Disciplinary Compulsory Course

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-24
COURSE CODE: MCHL-4081
COURSE TITLE: Advanced Inorganic Chemistry

Course outcome:

Students will be able to

CO1:understand Photo substitution reactions,photoredox reactions, photolysis of water

CO2:understand oxidative addition and reductive elimination, migration (Insertion) reaction and cyclometallation reactions,

CO3:characterise the compound by synthetic methods and know the chemical behaviour and synthetic applications of hydride compounds

CO4:understand hydroformylation, Carbonylation Reaction, decarbonylation reactions, hydrocyanation Polymerization, Oligomerisation and metathesis reactions

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-24
COURSE CODE: MCHL-4081
COURSE TITLE: Advanced Inorganic Chemistry

Time: 3 Hrs **Max. Marks: 75**

Credit (LTP): 4-0-0 **(Theory: 60, CA: 15)**

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (twelve each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Photo Inorganic Chemistry:

Basics of photochemistry- Absorption, excitation, photochemical laws, quantum yield, electronically excited state, energy diddipation by radiative and non-radiative processes, absorption spectra, Franck-Condon principle, photochemical stages-primary and secondary processes, Kashia's rule, Thexi state, Photo substitution reactions, Adamson's rules, Photo substitution reactions of Cr(III)-Polypyridyls, Rh(III) Ammine Complexes, Ru-Polypyridyl complexes, Ligand photo reactions, photoredox reactions, comparison of Fe(II) and Ru(II) complexes, Photo synthesis in plants and Bacterio chlorophyll photosynthesis.

UNIT-II

Oxidative-Addition and Migration (Insertion Reactions):

Introduction: Acid base behaviour of metal atoms in complexes, Protonation and Lewis Base behaviour, acceptor properties of Lewis acidity of complexes, oxidative addition and reductive elimination, addition of specific molecules, Hydrogen addition, HX additions, Organic halides addition of some other molecules productive elimination, migration (Insertion) reaction promotion of alkyl migration, insertion of CO into M-H bonds, other aspects of CO insertion reactions, transfer of other molecules, CO_2, SO_2 , NO_2 , RCM, Insertion of alkenes and C-C unsaturated compounds, Cleavage of C-H bonds; alkane activation, Cyclometallation reactions. Reactions of free hydrocarbons.

UNIT-III

Transition Metal Compounds with Bonds to Hydrogen

Characteristics of hydride complexes, synthetic methods, chemical behaviour of hydride compounds, mononuclear polyhydrides, homolepticpolyhydride anions; carbonyl hydrides and onion. Molecular hydrogen compounds; metal hydrogen interaction with C-H bonds; MH interactions; complexes of boron hydride and aluminohydrides, synthetic applications of metal hydrides.

UNIT-IV

Transition Metal Complexes in Catalysis:

Hydroformylation of unsaturated compounds, Reductive carbonylation of alcohols and other compounds; Carbonylation Reaction: Methanol and methyl acetate, Adipic ester. Synthesis and other carbonylation reactions, decarbonylation reactions. Cluster compounds in catalysis, supported homogeneous and phase transfer catalysis, Acrylonitrile synthesis, oxygen transfer from peroxo- and oxo- species, oxygen transfer from NO_2groups.

Books Recommended:

1. Concepts of Inorganic Photochemistry, A. W. Adamson and P. D. Fleischauer,Wiley.
2. W.W. Porterfield, Inorganic Chemistry: A Unified Approach.
3. F.A. Cotton and G. Willkinson, Advanced Inorganic Chemistry, 5^{th}ed, John Wiley and Sons, NewYork.
4. C.ElschenbroichandA.Salzer,Organometalics:AConciseIntroduction,2^{nd}Ed.,VCH 1992.

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-24
COURSE CODE: MCHL-4082
COURSE TITLE: Chemistry of Natural Products

Course outcome:

Students will be able to

CO1: study the biosynthetic pathways of natural products, understand the isoprene rule and its role in terpenoids

CO2: classify and understand the synthesis and structure of steroids and alkaloids

CO3: understand the chemistry of Haemin, chlorophyll, prostaglandins and antibiotics

CO4: classify and elucidate the structure of carbohydrates like starch and cellulose, determine the structure conformation and properties of proteins, nucleic acids, DNA and RNA

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-24
COURSE CODE: MCHL-4082
COURSE TITLE: Chemistry of Natural Products

Time: 3 Hrs **Max. Marks: 75**

Credit: (LTP): 4-0-0 **(Theory: 60, CA: 15)**

Note: The students are allowed to use Non-Programmable Calculator

Instructions for the Paper Setters:

Eight questions of equal marks (twelve each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-1

Studies on Biosynthetic Pathways of Natural Products
The acetate hypothesis, poly-ketoacids, their aldol type cyclisations and meta orientations of hydroxyl groups in naturally occurring phenols. b) Isoprene rule, mechanism of formation of mevalonic acid from acctyl coenzyme, Biogenetic isoprene rule. Geranyl, Geranyl pyrophosphates and its conversion into thujene. Farnesyl pyrophosphate.

UNIT-II

Terpenoids
General classification, General Methods of structure determination, Chemistry of Camphor, Abietic acid, Santonin biosynthetic studies on tri and tetra terpenoids.
Steroids
General biosynthetic studies on steroids, chemistry of Cholesterol, progesterone, oestrone, transformations in steroid molecules.
Alkaloids
Classification, chemistry of nicotine and morphine.

UNIT-III

Haemin and Chlorophyll
Structure and synthesis of Porphyrins.Chemistry of Haemin and chlorophyll.
Antibiotics
Introduction, types of antibiotics, synthesis and mechanism of action of pencillins.

Prostaglandins
General study, nomenclature, structure of PGE and synthesis of PGE1, PGE2, PGF2x

UNIT-IV

Carbohydrates
Deoxy sugars, sugars, methyl others and acid derivatives of sugars. General methods of

structure and ring size determination, structure of maltose, lactose, sucrose, starch and cellulose.

Peptides and Proteins
Sequence determination insulin and oxytocin, Proteins: structure conformation and properties. Enzymes, Kinetics, inhibition mechanism.

Books Recommended

1. Primary Metabolism: A Mechanistic Approach by J.Staunton, Oxford University Press 1978.
2. Secondary Metabolism by J. Mann Oxford University Press. Oxford, 1980.
3. Natural Product Chemistry- A Mechanistic, Biosynthetic and Ecological Approach by Kurt B. G. Torssell, Swadish Pharmaceutical Society, 1997.
4. Fundamentals of BioChemistry by D. Voet, J.G. Voet and C.W.Pratt, John Wiley and Sons Inc., New York, 1999.
5. Principles of Biochemistry by A.L. Lehninger, CBS Publishers, New Delhi

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-24
COURSE CODE: MCHL-4083
COURSE TITLE: Electrochemistry and Chemical Dynamics

Course outcomes:

Students will be able to

CO1: Understand the electrochemistry of solutions, method of determination of electrified interfaces, semiconductor electrolyte solution interface, know theory, monitoring and prevention of corrosion

CO2: understand collision theory of reaction rates, Arrhenius theory and activated complex theory, Lindemann-Hinshelwood theory

CO3: understand various Photochemical reactions, Homogeneous catalysis and kinetics of enzyme reactions, general features and methods of studying fast reactions

CO4: interpret polarogram and applications of Voltammetry and Polarography.

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-24
COURSE CODE: MCHL-4083
COURSE TITLE: Electrochemistry and Chemical Dynamics

Time: 3 Hrs **Max. Marks: 75**

Credit (LTP): 4-0-0 **(Theory: 60, CA: 15)**

Note: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setters:

Eight questions of equal marks (eight each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from UNITs I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Electrochemistry Electrochemistry of solutions, Debye-Huckel-Onsager treatment and its extension, ion-solvent interactions, Debye-Huckel-Bjerrum mode, Thermodynamics of electrified interface equation, Derivation of electro-capillarity, Lipmann equation(surface ecess), method of determination, structure of electrified interfaces, Guoy-Chpmann, Stern models, over potential, exchange current density, derivation of Butler-Volmer equation, Tafel plot.

Semiconductor interface theory of double layer at semiconductor electrolyte solution interface, structure of double layer interfaces, effect of light at semiconductor solution interface.
Introduction to corrosion, homogeneous theory, forms of corrosion, corrosion monitoring and prevention

UNIT-II

Chemical Dynamics (A)
Methods of determining rate laws, collision theory of reaction rates, steric factor, activated complex theory, Arrhenius theory and activated complex theory, ionic reactions, kinetic salt effects,, treatment of unimolecular reactions, Lindemann-Hinshelwood theory. Dynamic Chain (hydrogen bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane)

UNIT-III

Chemical Dynamics (B)
Photochemical reactions between hydrogen-bromine and hydrogen-chlorine, oscillatory reactions (Belousov-Zhabotinsky reactions), Homogeneous catalysis and kinetics of enzyme reactions, general features of fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis.

UNIT-IV

Voltammetry and Polarography

Polarography, polarographic cells, polarogram, interpretation of polarographic waves, equation for the polarographic waves, effect of complex formation on polarographic wave, polarograms for irreversible reactions, dropping mercury electrode, current variations during life time of a drop, merits and demerits of dme, polarographic diffusion currents, Ilkovic equation, capillary characteristics, temperature, polarograms for mixture of reactants, anodic and cathodic waves, factors affecting polarographic currents, applications of polarography, treatment of data, organic and inorganic polarographic analysis, voltammetry at solid electrodes, cyclic voltammetry and interpretation of data, pilot-ion and standard addition method for quantitative analysis

Books Recommended:

1. Chemical Kinetics, K. J. Laddler,McGraw-Hill
2. Modern Electrochemistry Vol.1,2,3, J. Bochris and A.K.N.Reddy
3. Fundamentals of electrochemistry; P.Monk
4. Principles of Instrumental Analysis; Skoog, West; SaundresPublications

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-24
COURSE CODE: MCHP-4084
COURSE TITLE: Advanced Practical- Organic Synthesis

Course outcome:

Students will be able to

CO1: plan and implement advance organic synthesis and reactions

CO2: characterize organic molecules by physical and spectroscopic means, including M.P, B.P, and IR

CO3: predict the outcome and mechanism of some simple organic reactions, using a basic understanding of the relative reactivity of functional groups

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-24
COURSE CODE: MCHP-4084
COURSE TITLE: Advanced Practical- Organic Synthesis

Time: 6 hrs. **Max. Marks: 50**
Credit (LTP): 0-0-3 **(P: 40, CA: 10)**

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners.Two copies of the same should be submitted for the record to COE Office,Kanya Maha Vidyalaya,Jalandhar.

1. Synthesis and Reactivity ofbenzalacetophenone
   a. Bromination (Electrophilic additions) andsubsequentdebromination (Elimination)
   b. Epoxidation (Cycloaddition, nucleophilic) and ring opening with hydroxideion.
   c. Michael addition ofaniline.
   d. Conversion of benzalacetophenone to its oxime (nucleophilic addition atC=O)
   e. Conversion of oxime to amide (Beckmann rearrangement) and oxazole (Understand the reactivities at conjugated C=O and C=C) bond.
2. Synthesis of Cyclohexene from cyclohexanol and its conversion to 1, 2- *cis* and 1, 2- *trans* –cyclohexanediols.
   a. Epoxidation with peracid (Cycloaddition) and *anti*- ring opening with sodium hydroxide to *cis*- cyclohexane -1, 2-diol.
   b. Dihydroxylation with$KMnO_4$ (Mechanism of *syn*- and *anti*-cyclohexane-1,2-diol)
3. Preparation and characterization of the Aldol-dehydration products from various combinations of aromatic aldehydes andketone.
   Effect of substituents on aromatic aldehydes on the product distribution.
   a. Aldehyde:benzaldehyde, 4-methylbenzaldehyde.4-methoxybenzaldehyde.
   b. Ketone: acetone, cyclopentanons, cyclohexanone (Book4) 6.

Books Recommended:

1. An Introduction to Modern Experimental Organic Chemistry, R.M. Roberts, J.C. Gilbert, L.B. Rodewald and A.S Wingrove, Holt Rinehart and Winston Inc, New York.1969.
2. Vogel's Text Book of Practical OrganicChemistry.
3. Laboratory Experiments on Organic Chemistry, R. Edemas, J.R. Johnson andC.F. Wilcox, The Macmillan Limited, London, 1970.
4. Modern Projects and Experiments in Organic Chemistry,J.R.Mohrig,C.N. Hammonad, P.F. Schatz and T.C. Morrill, W.H. Freeman and Company, New York 2003.

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-24
COURSE CODE: MCHP-4085
COURSE TITLE: Advanced Practical- Inorganic Synthesis

Course outcome:

Students will be able to

CO1: apply key concepts of inorganic chemistry and coordination compounds including those related to synthesis, reaction chemistry, and structure and bonding

CO2:design the basic and advanced laboratory procedures used in inorganic synthesis

CO3:interpret and characterise the metal complexes through various spectrpscopic and analytical techniques

CO4: learn separation of metal cations by chromatographic techniques

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-24
COURSE CODE: MCHP-4085
COURSE TITLE: Advanced Practical- Inorganic Synthesis

Time: 6 Hrs **Max. Marks: 50**
Credit (LTP): 0-0-3 **(P: 40, CA: 10)**

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office,Kanya Maha Vidyalaya,Jalandhar.

1. Synthesis of the Linkage Isomers nitrito- and nitropentaamminecobalt(III)chloride
   a) Preparation of chloropentaamminecobalt(III) chloride, $[Co(NH_3)_5Cl]Cl_2$.
   b) Preparation of nitropentaamminecobalt(III) chloride, $[Co(NH_3)_5(NO_2)]Cl_2$.
   c) Preparation of nitritopentaamminecobalt(III) chloride, $[Co(NH_3)_5(ONO)]Cl_2$.
   d) Estimate the chloride in all the complexes using gravimetricanalysis.
   e) Record and interpret the electronic absorption spectra and IR spectra of allcobalt(III) complexes and assign the observed change to distinguish the twoisomers.
2. Synthesis of a coordination compound containing iron and analysis of thiscompound using redoxmethods
   a) Preparation of iron(II)oxalate
   b) Preparation of$K_3[Fe(C_2O_4)_3].3H_2O$
   c) Characterization of Iron(II) and iron(III) complex with IRspectroscopy
   d) Determination of iron and oxalate in $K_3[Fe(C_2O_4)_3].3H_2O$ using volumetricanalysis
3. Synthesis and characterization of the Ni(II) complex of a Schiff-base ligand derivedfrom Salicylaldehyde and ethylenediamine.
   a) Synthesis the Schiff-baseligand.
   b) Interpret the 1H NMR and IR spectra of theligand.
   c) Synthesis the Ni(II) complex of the ligand and compare its IR spectrum with thatoftheligand.
4. Separation of the metal cationsby
   a) Column chromatography with gradient elution Co(II) and Ni(II). Analyze qualitatively the coloured fractions collected for separatedcations.
   b) Paper chromatography [Fe(II), Co(II), Ni(II) and Cu(II). Determine the Rf values for the separate standard cations and use these to identify the cations present in the unknownmixture.

Books Recommended:

1. G. Marr, B. W. Rockett, Practical Inorganic Chemistry(1972).

2. *I. Grenthe, E. Nordin,* Inorganic Chemistry*, 18 (1979)1869–74.*

3. *J.C. Bailar, M. Eldon, Inorg. Synth. 1 (1939)35–38.*

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-24
COURSE CODE: MCHP-4086
COURSE TITLE: Advanced Practical- Physical Chemistry

Course outcome:

Students will be able to

CO1:experience the scientific methods employed in basic and applied physical chemistry

CO2: design and perform experiments to determine the rate and order of chemical reactions by varying concentrations and/or temperature

CO3: measure equilibrium concentrations and equilibrium constants for acid-base, solubility, and complexation reactions given initial concentrations of reactant

CO4: develop skills in procedures and instrumental methods like turbidimetry and spectrophotometry.

Master of Science (Chemistry)
(Semester-IV)
Session: 2022-24
COURSE CODE: MCHP-4086
COURSE TITLE: Advanced Practical- Physical Chemistry

Time: 6 Hrs **Max. Marks: 50**
Credit (LTP): 0-0-3 **(P: 40, CA: 10)**

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

CHEMICAL EQUILIBRIUM

1. Study the effect of solvent on the conductance of $AgNO_3$/Acetic acid and determine the degree of dissociation and equilibrium constant in different solvents and their mixtures (DMSO, DMF, dioxane, acetone, and water) and test the validity of DEBYE- HUCKEL-ONSAGER'Sequation.
2. To determine acid and base dissociation constant of amino acid pHmetrically.
3. To calculate thermodynamic parameters ,for the reaction
   $Zn + Hg_2SO_4 \longrightarrow 2Hg + Zn\ SO_4$ by emf measurement.

CHEMICAL KINETICS

4. Study the salt effects and the solvent effect on the rate law of alkaline hydrolysis of crystal violet.
5. Determine the degree of hydrolysis and hydrolysis constant of CH_3COONa/NaCl/aniline hydrochloride.
6. Determine the order of reaction by analyzing the kinetic dependence ofindividual reactant (e.g. saponification of ester).
7. Determine the energy of activation for the reaction studied above.

ACTIVITY AND ACTIVITY COEFFICIENTS

8. Determination of mean activity coefficient of given electrolyte by cryoscopy.
9. Determine activity coefficients by EMF method.

PHASE EQUILIBRIUM

10. Draw the phase diagram for any one of the following three componentpartially immiscible liquidsystems.
    i) DMSO/water/benzene ii) water/benzene/aceticacid

SPECTROPHOTOMETRIC METHODS

11. To study the effect of extended conjugation on the wave length of maximum absorption of organic compounds.

TURBIDITYMETRY

12. To determine concentration of sulphate ions with the help of turbidity meter.
13. Determine the CMC by turbidimetric method.
14. Preparation of soap and determination of its CMC.

LEAST SQUARE FITTING

15. To draw calibration curve for the concentration determination of potassium ions by flame photometry and to study the least square fitting of the data.

POLARIMETRY

1. To find the specific rotation and molecular rotation of glucose polarimetrically and also find the concentration of unknown solution. Calculate the intrinsic rotation for glucose.
2. To find out the percentage of two optically active substances such as d-sugar and d-tartaric acid in a given solution polarimetrically.
3. To determine the specific rotation of camphor in benzene or carbon tetrachloride.

Books Recommended:

1.Yadav, J. B (2005): *Advanced Practical Physical Chemistry*, 22nd edition, Goel publishing House, Krishna Prakashan Media Ltd.
2. Venkatesan, V,Veeraswamy, R and Kulandaivelu, A.R (1997): *Basic Principles of Practical Chemistry*", 2nd edition, Sultan Chand and Sons Publication, New Delhi.
3. Findlay's (1985): *Practical Physical Chemistry,* Revised and edited by B.P. Levitt 9 th edition, Longman, London.
4. Chatwal, G.R. and Anand,S.K (2000): *Instrumental Methods of Chemical Analysis*, Himalaya Publishing House, Delhi.