ANNEXURE B

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: 2025-26)

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	100	70	-	30	3
MCHL-3082	Organic Synthesis	C	4-0-0	4-0-0	4	100	70	-	30	3
MCHL-3083	Surface and Polymer Chemistry	C	4-0-0	4-0-0	4	100	70	-	30	3
MCHL-3084	Photochemistry and Pericyclic Reactions	C	4-0-0	4-0-0	4	100	70	-	30	3
MCHP-3085	Inorganic Chemistry Practical (Preparations)	C	0-0-6	0-0-3	3	100	-	70	30	3*2
MCHP-3086	Physical Chemistry Practical	C	0-0-6	0-0-3	3	100	-	70	30	3*2
Total					**22**	**600**				

C- Compulsory Course

Master of Science (Chemistry)
(Semester-III)
Session: 2025-26
COURSE CODE: MCHL-3081
COURSE TITLE: Inorganic Chemistry-II

Time: 3Hrs **Max. Marks: 100**

Credit (LTP): 4-0-0 **(Theory: 70, CA: 30)**

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

Instructions for the Paper Setters:

Eight questions of equal marks (14 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 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 nitrogenasesmodelsystems.
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: 2025-26
COURSE CODE: MCHL-3082
COURSE TITLE: Organic Synthesis

Time: 3 HrsMax. Marks: 100

Credit (LTP): LTP: 4-0-0 **(Theory: 70, CA: 30)**

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

Instructions for the Paper Setters:

Eight questions of equal marks (14each) 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 polynuclearhydrocarbons.General method of preparation and reactions of indene, fluoreneanthracene 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,*Hantzsch Synthesis,* 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: 2025-26
COURSE CODE: MCHL-3083
COURSE TITLE: Surface and Polymer Chemistry

Time: 3 HrsMax. Marks: 100

Credit (LTP): 4-0-0 **(Theory: 70, CA: 30)**

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

Instructions for the Paper Setters:

Eight questions of equal marks (14each) 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 $T_m$andT_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. BillmeyerJr.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: 2025-26
COURSE CODE: MCHL-3084
COURSE TITLE: Photochemistry and Pericyclic Reactions

Time: 3 HrsMax. Marks: 100

Credit (LTP): 4-0-0 **(Theory: 70, CA: 30)**

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

Instructions for the Paper Setters:

Eight questions of equal marks (14 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.Bartonreaction.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: 2025-26
COURSE CODE: MCHP-3085
COURSE TITLE: Inorganic Chemistry Practical (Preparations)

Time: 6 Hrs **Max. Marks: 100**
Credit (LTP): 0-0-3 **(Practical: 70, CA: 30)**

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. 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: 2025-26
COURSE CODE: MCHP-3086
COURSE TITLE: Physical Chemistry Practical

Time: 6 hrs. **Max. Marks: 100**
Credit (LTP): 0-0-3 **(Practical: 70, CA: 30)**

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. 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: 2025-26)
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	100	70	-	30	3
MCHL-4082	Chemistry of Natural Products	C	4-0-0	4-0-0	4	100	70	-	30	3
MCHL-4083	Electrochemistry and Chemical Dynamics	C	4-0-0	4-0-0	4	100	70	-	30	3
MCHP-4084	Advanced Practical-Organic Synthesis	C	0-0-6	0-0-3	3	100	-	70	30	3*2
MCHP-4085	Advanced Practical-Inorganic Synthesis	C	0-0-6	0-0-3	3	100	-	70	30	3*2
MCHP-4086	Advanced Practical-Physical Chemistry	C	0-0-6	0-0-3	3	100	-	70	30	3*2
Total					**21**	**600**				

C- Compulsory Course

Master of Science (Chemistry)
(Semester-IV)
Session: 2025-26
COURSE CODE: MCHL-4081
COURSE TITLE: Advanced Inorganic Chemistry

Time: 3 HrsMax. Marks: 100

Credit (LTP): 4-0-0 **(Theory: 70, CA: 30)**

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

Instructions for the Paper Setters:

Eight questions of equal marks (14 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 desipation 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: 2025-26
COURSE CODE: MCHL-4082
COURSE TITLE: Chemistry of Natural Products

Time: 3 HrsMax. Marks: 100

Credit (LTP): 4-0-0 **(Theory: 70, CA: 30)**

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

Instructions for the Paper Setters:

Eight questions of equal marks (14each) 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: 2025-26
COURSE CODE: MCHL-4083
COURSE TITLE: Electrochemistry and Chemical Dynamics

Time: 3 HrsMax. Marks: 100

Credit (LTP): 4-0-0 **(Theory: 70, CA: 30)**

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

Instructions for the Paper Setters:

Eight questions of equal marks (14 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: 2025-26
COURSE CODE: MCHP-4084
COURSE TITLE: Advanced Practical- Organic Synthesis

Time: 6 hrs. **Max. Marks: 100**
Credit (LTP): 0-0-3 **(Practical: 70, CA: 30)**

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. 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: 2025-26
COURSE CODE: MCHP-4085
COURSE TITLE: Advanced Practical- Inorganic Synthesis

Time: 6 Hrs **Max. Marks: 100**
Credit (LTP): 0-0-3 **(Practical: 70, CA: 30)**

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. 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 derivedfromSalicylaldehyde 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: 2025-26
COURSE CODE: MCHP-4086
COURSE TITLE: Advanced Practical- Physical Chemistry

Time: 6 Hrs **Max. Marks: 100**
Credit (LTP): 0-0-3 **(Practical: 70, CA: 30)**

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.

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.