FACULTY OF SCIENCES

SYLLABUS

of

Master of Science (Chemistry)

(Semester: II)

(Under Continuous Evaluation System)

Session: 2020-21

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: 2020-21)

Master of Science (Chemistry) Semester II							
Course Code	**Course Name**	**Course Type**	**Marks**				**Examination time (inHours)**
			Total	**Ext.**		**CA**	
				L	**P**		
MCHL-2081	Organometallics Chemistry	C	50	40	-	10	3
MCHL-2082	Organic Reaction Mechanism -II	C	50	40	-	10	3
MCHL-2083	Physical Chemistry – Quantum Chemistry	C	50	40	-	10	3
MCHL-2084	Reaction Mechanisms and Metal clusters	C	50	40	-	10	3
MCHL-2085	Spectroscopy B: Techniques for Structure Elucidation of Inorganic Compounds	C	75	60	-	15	3
MCHL-2336 MCHL-2057	Mathematics for Chemists Biology for Chemists	C	25	20	-	5	3
MCHP-2088	Organic Chemistry Practical	C	75	-	60	15	3*2
MCHP-2089	Physical Chemistry Practical	C	75	-	60	15	3*2
Total			**450**				

Master of Science (Chemistry) (Semester-II)

Session: 2020-21

COURSE CODE: MCHL-2081

COURSE TITLE: ORGANOMETALLICS CHEMISTRY (Theory)

Course outcomes:

Students will be able to

CO1: familiarize with the Organometallic reaction mechanisms and its applications

CO2: learn about the Catalysis, hydrogenation of olefins and oxoprocess

CO2: study the concept of oxidation of olefins and polymerization

CO3: demonstrate basic principles of organometallic compounds.

CO4: illustrate stability of organometallic compounds.

CO5: identify the structure and bonding aspects of simple organometallic compounds

CO6: apply different electron counting rules to predict the shape/geometry of low and high nuclearity metal carbonyl clusters

CO7: identify different types of organometallic reactions and apply the above concepts to explain different catalytic reactions

CO8: familiarize with the reactions with and of coordination ligands

CO9: understand the role of pi acid ligands

Master of Science (Chemistry) (Semester-II)

Session: 2020-21

COURSE CODE: MCHL-2081

COURSE TITLE: ORGANOMETALLICS CHEMISTRY (Theory)

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 anySection.

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 & 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. Multidecker sandwich compounds.

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, 2ndEd., 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 &VI.Wiley Inter-science.
4. G. L. Miessler, D. A. Tarr, Inorganic Chemistry, 3rd edition, PearsonEducation

Master of Science (Chemistry) (Semester-II)

Session: 2020-21

COURSE CODE: MCHL-2082

COURSE TITLE: Organic Reaction Mechanism – II (Theory)

Course outcomes:

Students will be able to

CO1: learn about the addition reactions between a hetero atom and double bonded carbon compounds

CO2: obtain an outline about elimination reactions and rules used to study elimination reactions

CO3: learn about some specific examples of elimination reactions

CO4: learn the basic mechanism of oxidation in organic compounds

CO5: acquire knowledge about the reagents which causes oxidation and reduction in various compounds

CO6: learn about the formation of carbon - carbon bonds

Master of Science (Chemistry) (Semester-II)

Session: 2020-21

COURSE CODE: MCHL-2082
COURSE TITLE: Organic Reaction Mechanism – II (Theory)

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

(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, Perkin and 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, Knoevengal reaction, Use of malonic, acetoacetic and cyanoacetic esters, Micheal addition, Wittig reactions. 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: 2020-21

COURSE CODE: MCHL-2083

COURSE TITLE: Physical Chemistry-QuantumChemistry (Theory)

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

CO2: apply this knowledge to atomic and molecular structure

CO3:usemathematical 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

CO4:solveall 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.

CO5:relateconcepts that were originally introduced purely as modern atomic physics to molecular systems through harmonic oscillator, spin and rigid rotator

Master of Science (Chemistry) (Semester-II)
Session: 2020-21

COURSE CODE: MCHL-2083

COURSE TITLE: Physical Chemistry – QuantumChemistry (Theory)

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

(Theory: 40, CA:10)

Note: The students are allowed to use Non-ProgrammableCalculator.

Instructions for the PaperSetters:

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. Quantum Theory: Introduction andPrinciples:
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 quantummechanics.

UNIT-III

3. Applications of QuantumPostulates
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.

`

Master of Science (Chemistry)(Semester-II)
Session: 2020-21

COURSE CODE:MCHL-2084

COURSE TITLE: REACTION MECHANISMS AND METAL CLUSTERS (Theory)

Course outcomes:

Students will be able to

CO1:describe the stability of metal complexes by the use of formation constants

and calculate thermodynamic parameters from them

CO2:learn the mechanism of substitution reaction and explain the parameters that affects the crystal structure of a compound

CO3:determine binary formation constants by different methods

CO4:understand the chemistry of inorganic rings , chains and metal clusters

Master of Science (Chemistry) (Semester-II)
Session: 2020-21

COURSE CODE: MCHL-2084

COURSE TITLE: REACTION MECHANISMS AND METAL CLUSTERS(Theory)

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

(Theory: 40, CA:10)

Note: The students are allowed to use Non-ProgrammableCalculator.

Instructions for the PaperSetters:

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 andspectrophotometery.

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 &sulphides, 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 ofanalogy.

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 & Wilkinson: Inorganic Chemistry V & VI Ed. Willy Eastern –(1999).
4. J.E. Huheey: Inorganic Chemistry III & IV Ed. Pearson Education Asia –(2002).

Master of Science (Chemistry)(Semester-II)

Session: 2020-21

COURSE CODE:MCHL-2085

COURSE TITLE: SPECTROSCOPY – B: Techniques for Structure Elucidation of Inorganic Compounds (Theory)

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: studyselection rules for electronic transitions

CO5: 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: 2020-21
COURSE CODE:MCHL-2085
COURSE TITLE: SPECTROSCOPY – B: Techniques for Structure Elucidation of Inorganic Compounds (Theory)

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

(Theory: 60, CA:15)

Note: The students are allowed to use Non-ProgrammableCalculator.
Instructions for the PaperSetters:

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 anySection.

UNIT – I
Symmetry and Point Groups:

Definition of symmetry, symmetry elements, determination of point groups, introduction to use of character table in determining irreducible representation and symmetry of the atomic orbitals.

UNIT – II
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.
- 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 & ejection of electrons, electronic energy levels in atoms and molecules, Core level photoelectron spectroscopy, symmetry & 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 & 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 & J.R. Bolton, Electron Spin Resonance(p.49-65).
6. N.N. Greenwood & T.C Tibb, MossbauerSpectroscopy.
7. K. Nakamoto, Infrared Spectra of Inorganic and co-ordinationCompounds.

Master of Science (Chemistry)(Semester-II)

Session: 2020-21

COURSE CODE:MCHL-2336

COURSE TITLE: MATHEMATICS FOR CHEMISTS

(For Medical Students)

Course outcomes:

Students will be able to acquire knowledge about

CO1: trignometry

CO2: determinants and matrices

CO3: integration and differentiation

Master of Science (Chemistry) (Semester-II)
Session : 2020-21
COURSE CODE:MCHL-2336
COURSE TITLE: MATHEMATICS FOR CHEMISTS
(For Medical Students)

Time:2Hrs. **Max. Marks:25**

(Theory: 20, CA: 5)

Note: The students are allowed to use Non-Programmable Calculator.
Instructions for the Paper Setters:

Eight questions of equal marks(four 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
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, /6, /3, /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 valuesofmatrices.

UNIT-III
Differential Calculus

Differentiation of standard functions, theorems relating to the derivative of 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, logarithmicdifferentiation.

UNIT-IV

Integral Calculus

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

Books Recommended:

1. Santi Narayan & P.K. Mittal – DifferentialCalculus.
2. Santi Narayan & P.K. Mittal - IntegralCalculus.
3. B.S. Grewal – Higher EngineeringMathematics.
4. Joseph B. Dence – Mathematical Techniques inChemistry.
5. Margenau and Murphy, the MathematicsofPhysics and Chemistry.
6. B.L. Moncha and H.R. Choudhary – A Text Book of EngineeringMathematics.

Master of Science (Chemistry)(Semester-II)
Session : 2020-21
COURSE CODE: MCHL-2057
COURSE TITLE: BIOLOGY FORCHEMISTS
(For Non-MedicalStudents)

Course outcomes:

Students will be able to understand

CO1: organization of life

CO2: genetics

CO3: diversity of life

Master of Science (Chemistry)
(Semester-II)
Session : 2020-21
COURSE CODE: MCHL-2057
COURSE TITLE: BIOLOGY FORCHEMISTS
(For Non-MedicalStudents)

Time:2Hrs. **Max. Marks: 25**

(Theory: 20, CA: 5)

Note 1: The students are allowed to use Non-Programmable Calculator.

Instructions for the Paper Setter

Eight questions of equal marks (four 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

The Organisation of Life

Biologically important molecules: Carbohydrates, lipids, proteins and nucleicacids.The life of cells – The cell theory, general characteristics of cells, difference between prokaryotic and eukaryotic cells, difference between plant and animal cells, cell organells.

UNIT-II

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

UNIT-III

Genetics: The basic principle of heredity: Mendals law, monohybrid cross, dihybridcross.DNA – Double halix structure andreplication.Genes expression: Transcription and translation, geneticcode.

UNIT-IV

The Diversity of Life: The classification of Living things – Criteria of classification, Whittaker's systems of classification, their characteristics with are example ofeach.Viruses, structure ofViruses.

Book Recommended:

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

Master of Science (Chemistry)(Semester-II)
SESSION: 2020-21
COURSE CODE:MCHP-2088
(PRACTICAL)

Course outcomes:

The students will be able to

CO1: understand and perform multi step organic synthesis.

CO2: expertise the various techniques of analysis of organic substances

Master of Science (Chemistry)(Semester-II)
Session : 2020-21
COURSE CODE:MCHP-2088
COURSE TITLE: ORGANIC CHEMISTRY (PRACTICAL)

Time:60Hrs **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

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-bromidesolution.
   (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: 2020-21
COURSE CODE:MCHP-2089
COURSE TITLE: Physical Chemistry(Practical)

Course outcomes:

Students will be able to

CO1: prepare for each experiment by studying lab handouts and links therein

CO2: know about the safety requirements and lab skills required to perform physico-chemical experiments

CO3: design and perform experiments to determine the rate, order, and activation energy of chemical reactions by varying concentrations and/or temperature

CO4: carry out preparation of buffer solutions at a required pH, given a choice of solutions of acid/conjugate base pairs

CO5: know the principle and mechanism of Conductometric titrations and polarimetric experiments

CO6: determine specific and molar refraction using Abbe's refractometer

Master of Science (Chemistry)(Semester-II)
Session: 2020-21
COURSE CODE:MCHP-2089
COURSE TITLE: Physical Chemistry(Practical)

Time:60Hrs **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 strength of given acid by pHmetrically.
2) To determine dissociation constant of given acid pHmetrically
3) Titration of weak acid conductometrically
4) Titration of strong acidconductometrically
5) To determine dissociation constant of given acidconductometrically
6) Determine the dissociation constant of acetic acid in DMSO, DMF, dioxane by titratingit with KOH.
7) Determine the activity coefficient of an electrolyte at different molalitiesbye.m.f. measurements.
8) Compare the cleansing powers of samples of two detergents from surfacetension 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 andwater.
11) Determine the equilibrium constant of reaction Kl +l2 à Kl3 by distribution lawand 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.

FACULTY OF SCIENCES

SYLLABUS

of

Master of Science (Chemistry)

(Semester: IV)

(Under Continuous Evaluation System)

Session: 2020-21

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: 2019-20)

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: 2020-21
COURSE CODE: MCHL-4081
COURSE TITLE: Advanced Inorganic Chemistry(Theory)

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: 2020-21
COURSE CODE: MCHL-4081
COURSE TITLE: Advanced Inorganic Chemistry(Theory)

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, homoleptic polyhydride 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 UnifiedApproach..
3. F.A. Cotton and G. Willkinson, Advanced Inorganic Chemistry, 5^{th}ed., John Wiley & Sons, NewYork.
4. C.ElschenbroichandA.Salzer,Organometalics:AConciseIntroduction,2^{nd}Ed.,VCH 1992.

Master of Science (Chemistry)(Semester-IV)
Session: 2020-21
COURSE CODE: MCHL-4082
COURSE TITLE: Chemistry of Natural Products (Theory)

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: 2020-21
COURSE CODE: MCHL-4082
COURSE TITLE: Chemistry of Natural Products(Theory)

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-1

Studies on Biosynthetic Pathwas of Natural Products
The acetate hypothesis, poly-ketoacids, their addol 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 cellulos.

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 & Sons Inc., New York, 1999.
5. Principles of Biochemistry by A.L. Lehninger, CBS Publishers, New Delhi

Master of Science (Chemistry)(Semester-IV)
Session: 2019-20
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: 2020-21
COURSE CODE: MCHL-4083
COURSE TITLE: Chemistry of Materials(Theory)

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, non stoichiometry types, colourcentres and electrical properties of alkali halides, electron theories for metal conduction in metals , in insulators, impurity semi conductors, 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 osmometry, 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, polarones 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, viscosiy, 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: 2020-21
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: 2020-21
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) &subsequentdebromination (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) andoxazole (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. Johnsonand C.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: 2020-21
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: 2020-21
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 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-baselignad.
   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: 2020-21
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 likpolarography,turbidimetr and spectrophotometry,

Master of Science (Chemistry)(Semester-IV)
Session: 2020-21
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 calculatethermodynamicparameters, ΔG, $\Delta S$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 hydrolysisofcrystalviolet.
5. Determine the degree of hydrolysis and hydrolysis constantof CH_3COONa/NaCl/anilinehydrochloride.
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 studiedabove.

ACTIVITY AND ACTIVITY COEFFICIENTS

8. Determination of mean activity coefficient of given electrolyte bycryoscopy.
9. Determine activity coefficients by EMFmethod.

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 ofCd^{2+}
12. Polarographic determination of Cu and Zn in the given sample ofbrass.

13. Determine stability constants of Cd^{2+} withEDTA.

SPECTROPHOTOMETRIC METHODS

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

ADSORPTION

1. To determine the adsorption isotherms of heavy metals like Cd, Zn, Cr, Pb. Ni by using nonconventiopnaladsorbents.

TURBIDITYMETRY

2. To determine concentration of sulphate ions with the help of turbiditymeter.
3. Determine the CMC by turbidimetricmethod.
4. Preparation of soap and determination of its CMC.

LEAST SQUARE FITTING

5. 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

of

Chemistry

for

Bachelor of Science (Honours) Physics (Semester II)

(UnderContinuous Evaluation System)

(12+3 System of Education)

Session: 2020-2021

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: 2020-2021)

Chemistry

Chemistry 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: 2020-2021)
COURSE CODE: BOPL-2086
COURSE TITLE: Chemistry-II (Theory)

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. CO2: describe the shapes and structures of coordination complexes with coordination numbers ranging from 4 to 12.

CO3: describe the stability of metal complexes by the use of formation constants.

CO4: understand the splitting of d-orbitals in octahedral, tetrahedral, cubic and square planar fields of ligands.

CO5: calculate C.F.S.E. of high spin and low spin octahedral and high spin tetrahedral complexes.

CO6: explain thermodynamic effects of crystal field splitting and determine microstate and ground state terms.

CO7: draw MOEL diagram for octahedral and tetrahedral complexes. CO8: explain bonding in polynuclear metal carbonyls and counting of electrons in carbonyl clusters. CO9: describe the effect of macrocyclic ligands on anion and cation complex structure.

Bachelor of Science (Honours) Physics (Semester II)
(Session: 2020-2021)
Course Code: BOPL-2086
COURSE TITLE: Chemistry-II (Theory)

Maximum Marks: External	40	Examination Time: 3 Hours
Internal	10	Total Teaching hours: 60
Total	50	Pass Marks: 40%

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.

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.

Text and Reference Books:

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: 2020-2021)
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.

Bachelor of Science (Honours) Physics (Semester II)
(Session: 2020-2021)
COURSE CODE: BOPP-2088
COURSE TITLE: Chemistry Lab-II (Practical)

Time: 3 Hours **Total Marks: 50 Pass Marks: 40%**

(External: 40 + Internal Assessment: 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

of

Chemistry

For

Bachelor of Science (Medical and Non- Medical)

(Semester VI)

(Under Continuous Evaluation System)

Session: 2020-21

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 (Medical and Non- Medical)

(Session: 2020-2021)

Bachelor of Science (Medical and Non- Medical) **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(Medical)	BSMM-6084	I	C	100	Organic Chemistry–I	30	-	20	3
			II			Physical Chemistry–II	30	-		3
	Bachelor of Science(Non-Medical)	BSNM-6084	P			Chemistry (Practical)	-	20		3½

Bachelor of Science (Medical and Non- Medical) SEMESTER-VI
SESSION: 2020-21
COURSE CODE: BSMM/BSNM-6084(I)
COURSE TITLE: ORGANIC CHEMISTRY–I (THEORY)

Course outcomes:

Students will be able to

CO1:learn about the Principle and applications of ultraviolet and Woodward Fisher Rule

CO2: understand the infra-red spectroscopy in organic structure determination

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

CO4: learn about the different mechanisms involved in the polymer preparation

CO5: learn about the different polymerization techniques

CO6:Familiarize with structure, classification and the biological functioning of carbohydrates,amino acids and nucleic acids.

CO7:understand the types and reactions given by organosulphur compounds

Bachelor of Science (Medical and Non- Medical) SEMESTER–VI
SESSION: 2020-21
COURSE CODE: BSMM/BSNM-6084(I)
COURSE TITLE: ORGANIC CHEMISTRY–I (THEORY)

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. Spectroscopy (5 Hrs)

Nuclear Magnetic Resonance (NMR) spectroscopy,Proton Magnetic Resonance (1H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone.

2. Electromagnetic Spectrum: Absorption Spectroscopy (5 Hrs)

Ultraviolet (U.V.) absorption spectroscopy introduction- (Beer-Lambert law), molar absorptivity, analysis of UVspectra, types of electronic transitions effect of conjugation.Conceptofchromophores and auxochrome, Bathochrome, hypsochrome, hyperchrome, hypochromic shifts-UVspectra of conjugated compounds

UNIT–II

Electromagnetic Spectrum: Absorption Spectroscopy (3 Hrs)

Infrared (IR) Absorption spectroscopy-introduction, Hooke's law, Selection rules, intensity and IR bands, measurement of IR spectrum time characteristic absorptionof various fundamental band interpretation of IR spectra of simple organic compounds.

3. Problems based on spectroscopy (4 Hrs)

Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

4. Organosulphur Compounds (3 Hrs)

Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers,sulphonic acids, sulphonamides and sulphaguanidine.

UNIT-III

5. Synthetic Polymers (6 Hrs)

Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers.Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes.Natural and synthetic rubbers.

6. Organic Synthesis *via* Enolates (6 Hrs)

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

UNIT–IV

7. Carbohydrates (7 Hrs)

Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides.Erythro and threodiastereomers.Conversion of glucose into mannose.Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides.Cyclic structure of D(+)-glucose. Mechanism of mutarotation.

Structures of ribose and deoxyribose

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

8. Amino Acids, Peptides, Proteins and Nucleic Acids (6 Hrs)

Classification, structure and stereochemistry of amino acids.Acid-base behaviour, isoelectric pointandelectrophoresis.Preparationand reactions of α-amino acids.Structure and nomenclature of peptides and proteins.Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis.Structures of peptides and proteins.Levels of protein structure.Proteindenaturation/renaturation.Nucleic acids : Introduction. Constituents of nucleic acids.Ribonucleosides and ribonucleotides.Thedouble helical structure of DNA.

Books Suggested :

1. Spectrometric Identification of Organic Compoundsby Robert M. Silverstein, Francis X. Webster , David J. Kiemle, David L. Bryce ; Publisher:Wiley, 1981

2. Morrison, R.T., Boyd, R.N., Organic Chemistry; 6th edition, Pubs: Prentice-Hall, 1992.

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, Vols.I, II, III.

5. Carey, F.A., Organic Chemistry; 4th edition, Pubs: McGraw-Hill, 2000.

6. Solomons, T.W., Fundamentals of Organic Chemistry; 5th edition, Pubs: John Wiley & Sons, 1997.

7. Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; 3rd edition, Pubs: Macmillan Publishing Company, 1989.

Bachelor of Science (Medical and Non- Medical) SEMESTER–VI
SESSION: 2020-21
COURSE CODE: BSMM/BSNM-6084(II)
COURSE TITLE: PHYSICAL CHEMISTRY–II(THEORY)

Course outcomes:

Students will be able to

CO1: understand wave mechanics in three dimensions;

CO2: describe the structure of the hydrogen atom and show an understanding of quantisation of angular momentum.

CO3: understand and explain the differences between classical and quantum mechanics

CO4: understand the idea of wave function

CO5: understand the uncertainty relations

CO6: solve Schroedinger equation for simple potentials

CO7: spot, identify and relate the eigen value problems for energy, momentum, angular momentum and central potentials explain the idea of spin

CO8: apply the knowledge about photochemical and photophysical processes

CO9: acquire knowledge about the unit cell, space lattice, miller indices, symmetry operations , Bragg equation etc.

Bachelor of Science (Medical and Non- Medical) SEMESTER–VI
SESSION: 2020-21
COURSE CODE: BSMM/BSNM-6084(II)
COURSE TITLE: PHYSICAL CHEMISTRY–II(THEORY)

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 & 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 (Medical and Non- Medical) SEMESTER–VI
SESSION: 2020-21
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 (Medical and Non- Medical) SEMESTER–VI
SESSION 2020-21
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 & p nitrophenol

Separation of Leaf pigments from Spinnach leaves

Separation of o & 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 & 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 (Biotechnology)

(Semester: VI)

(UnderContinuous Evaluation System)

Session: 2020-2021

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: 2020-2021)

Chemistry Semester VI									
Course Name	**Program Name**	**Course Code**	**Course Type**	**Marks**					**Examination time (in Hours)**
				Total	**Paper**	**Ext.**		**CA**	
						L	**P**		
Physical, Organic & Inorganic Aspects of Spectroscopy-B	Bachelor of Science(Biotechnology)	BBTM-6087	C	60	Physical, Organic & Inorganic Aspects of Spectroscopy -B	30	-	12	3
					Physical, Organic & Inorganic Aspects of Spectroscopy -B (Practical)	-	18		3

Bachelor of Science (Biotechnology) SEMESTER–VI
SESSION: 2020-21
COURSE CODE: BBTM-6087
COURSE TITLE: Physical, Organic & Inorganic Aspects of Spectroscopy-B(THEORY)

Course outcomes:

Students will be able to:

CO1: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.
CO2:study thevarious measurement techniques in NMR spectroscopy.

CO3:understand the various cleavages and rearrangements in Mass spectroscopy.

CO4:factors affecting cleavage patterns in Mass spectroscopy.

CO5: interpret the spectrum of unknown compounds on the basis of NMR and Mass spectroscopy.

CO6:understand the various applications of NMR and Mass spectroscopy.

CO7:use NMR and Mass spectroscopy data in elucidating the chemical structure of a compound.

CO8:solve the numerical problems based on use NMR and Mass spectroscopy.

Bachelor of Science (Biotechnology) SEMESTER–VI
SESSION 2020-21
COURSE CODE:BBTM-6087
COURSE TITLE:Physical, Organic & Inorganic Aspects of Spectroscopy-B(THEORY)

Time: 3 Hrs. **Max. Marks: 40**

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. Proton Magnetic Resonance spectroscopy (1H NMR) (13Hrs)

The Nuclear spin, Larmor frequency, the NMR isotopes, population of nuclear spin level, spin and spin compounds, shielding constant, range of typical chemical Shifts simple application of chemical shifts, Anisotropic effect. Spin spin splitting, Coupling constant.

UNIT-II

II. Applications of NMR spectroscopy (10Hrs)

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- III

III. Mass Spectrometery (12Hrs)

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.

UNIT- IV

IV. Applications of Mass Spectroscopy (10Hrs)

Cleavage associated with common functional groups , Aldehydes, ketones cyclic and acyclic esters, alcohols, olefins, aromatic compounds amines, Interpretation of the spectrum of unknown simple molecules.

Books Recommended:

1. Organic Spectroscopy By W. Kemp; Publisher- Palgrave, New York

2. D.H. Williams and I. Fleming.Spectroscopic Methods in Organic Chemistry.

3. Spectrometric Identification of Organic Compounds - R.M. Silverstein & F. X. Webster; Publisher: John Willey and Sons,Inc.

4. Introductory Problems in Spectroscopy- By R.C. Banks, E.R. Matjeha and G. Mercer; Publisher : The Benzamine / Cummings Publishing Company Inc.

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 Biotechnology SEMESTER–VI
SESSION 2020-21
COURSE CODE: BBTM-6087(P)
COURSE TITLE: Physical, Organic & Inorganic Aspects of Spectroscopy-B
(Practical)

Course outcomes:

Students will be able to:

CO1: interpret the spectrum of unknown compounds on the basis of NMR spectroscopy.

CO2: use NMR data in elucidating the chemical structure of a compound.

CO3:understand the concept of Green Chemistry and will be able to use green approach in preparation of organic compounds.

CO4:understand the concept of chromatography and its applications in separation of various components of the given mixture.

Bachelor of Science Biotechnology SEMESTER–VI
SESSION 2020-21
COURSECODE: BBTM-6087(P)
COURSE TITLE: Physical, Organic & Inorganic Aspects of Spectroscopy-B(Practical)

Duration: 3½ Hrs. **Max. Marks: 20**

Instructions 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 COEoffice,KanyaMahaVidyalaya,Jalandhar.

1.Record ^{1}H NMR spectra of ethylacetate and ethyl acetoacetate (in $CDCl_3$ or CCl_4)
and show the presence of tautomeric structures.

2. Preparation of benzillic acid from benzaldehyde .

3. Separation of components of spinach using column chromatography.

4. Prepare p-nitroacetanilide and make comparison of ^{1}H NMR spectra data of aniline, acetanilide (starting material) and p-nitroacetanilide (product).

5.Compare the IR and ^{1}H NMR spectra of aspirin and salicylic acid.

FACULTY OF SCIENCES

SYLLABUS

of

Chemistry

For

Bachelor of Science (Medical and Non- Medical)

(Semester II)

(UnderContinuous Evaluation System)

(12+3 System of Education)

Session: 2020-21

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 (Medical and Non- Medical)

(Session: 2020-2021)

Bachelor of Science (Medical and Non- Medical) **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(Medical)	BSMM-2084	I	C	100	Inorganic Chemistry -I	30	-	20	3
			II			Physical Chemistry -II	30	-		3
	Bachelor of Science(Non. Medical)	BSNM-2084	P			Chemistry (Practical)	-	20		3 1/2

Bachelor of Science (Medical and Non Medical) SEMESTER–II

SESSION: 2020-21

COURSE CODE: BSMM/BSNM-2084(I)

COURSE TITLE: INORGANIC CHEMISTRY (I) (THEORY)

Course outcomes:

Students will be able to

CO1: explain the atomic, physical and chemical properties of alkali metals and alkaline earth metals

CO2:recognise the anomalous properties of Li and compares the properties Li with those other alkali metals

CO3: recognises the anomalous properties of Be and compares the properties of Be with those other alkaline earth metals

CO4: explains the trends in atomic and physical properties of group 13 ,14,15,16,17 elements

explains chemical properties of above group elements

CO5: describe allotropic forms of elements

CO6: Exhaustive understanding of d–block elements belonging to 4^{th},5^{th} and 6^{th} period.

CO7: Understand the simple concepts of pH and complete and balance simple acid-base reactions.

Bachelor of Science (Medical and Non Medical) SEMESTER–II

SESSION: 2020-21

COURSE CODE: BSMM/BSNM-2084(I)

COURSE TITLE: INORGANIC CHEMISTRY (I) (THEORY)

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 & 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 (Medical and Non Medical) SEMESTER–II

SESSION: 2020-21

COURSE CODE: BSMM/BSNM-2084(II)

COURSE TITLE: PHYSICAL CHEMISTRY(II)(THEORY)

Course outcomes:

Students will be able to

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

CO2: demonstrate an understanding of basic principles of colligative properties

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

CO4: explain various gaseous laws and their applications.

Bachelor of Science (Medical and Non Medical) SEMESTER–II

SESSION: 2020-21

COURSE CODE: BSMM/BSNM-2084(II)

COURSE TITLE: PHYSICAL CHEMISTRY(II)(THEORY)

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 & 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 (Medical and Non Medical) SEMESTER–II

SESSION: 2020-21

COURSE CODE: BSMM/BSNM-2084(P)

COURSE TITLE: CHEMISTRY PRACTICAL

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 (Medical and Non Medical) SEMESTER–II
SESSION: 2020-21
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 & 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 & 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 & Co.**
8. **Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghosh & Sons.**
9. **Experiments Physical Chemistry, J.C. Ghosh, Bharati Bhavan.**

FACULTY OF SCIENCES

SYLLABUS

of

Chemistry

For

Bachelor of Science (Medical and Non- Medical)

(Semester IV)

(Under Continuous Evaluation System)

Session: 2020-21

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 (Medical and Non- Medical)

(Session: 2020-2021)

Bachelor of Science (Medical and Non- Medical) **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(Medical)	BSMM-4084	I	C	100	Inorganic Chemistry–I	30	-	20	3
	Bachelor of Science(Non-Medical)	BSNM-4084	II			Organic Chemistry–II	30	-		3
			P			Chemistry (Practical)	-	20		3½

Bachelor of Science (Medical and Non- Medical) SEMESTER–IV
SESSION: 2020-21
COURSE CODE: BSMM/BSNM-4084(I)
COURSE TITLE: INORGANIC CHEMISTRY-I (THEORY)

Course outcomes:

Students will be able to

CO1: understand the key features of coordination compoundsviz. variety of structures, oxidation numbers and electronic configurations, coordination numbers and explain the bonding and stability of complexes

CO2: understand the magnetic properties of coordination compounds by using CFT.

CO3: describe the shapes and structures of coordination complexes with coordination numbers ranging from 4 to 12.

CO4: do nomenclature of coordination compounds.

CO5: write both reduction and oxidation half reactions for a simple redox reaction

CO6: identify the oxidation number (charge) on a neutral metal, metal and non-metal ion

CO7:carry out the common applications of the activity series of metals

CO8: understand the Latimer, Frost and Pourbaix diagram.

CO9: understand the positions,electronicconfigurations,relativestability,preparation, properties, structures and characteristics of the f-block elements in the periodic table;

CO10:understand the role of metal ions and other inorganic elements in biological systems.

CO11:understand theproperties and reactions of non-aqueous solvents.

Bachelor of Science (Medical and Non- Medical) SEMESTER–IV
SESSION: 2020-21
COURSE CODE: BSMM/BSNM-4084(I)
COURSE TITLE: INORGANIC CHEMISTRY-I (THEORY)

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 (Medical and Non- Medical)SEMESTER–IV
SESSION: 2020-21
COURSE CODE: BSMM/BSNM-4084(II)
COURSE TITLE: ORGANIC CHEMISTRY-II(THEORY)

Course outcomes:

Students will be able to

CO1: understand structure and bonding in carboxylic acids and carboxylic acid derivatives

CO2: Compare the acidity of alcohols,phenols and acids

CO3: understand the effect of various substituents on the acidity of acids

CO4: describe preparations, physical properties,and reactions of carboxylic acids and carboxylic acid derivatives

CO5: understand preparations and reactions of ethers and epoxides

CO6: understand various cleavages in ethers

CO7: understand the ring opening reactions of epoxides

CO8:understand preparation and reactions of nitroalkanes and nitroarenes

CO9: understand nomenclature, structural features, and methods of formation and chemical reactions of Organomagnesium, Organolithium, Organozinc and Organocopper compounds.

CO10: know the various methods of synthesis and compare electrophilic substitution,reactions of pyrrole, furan, thiophene and nucleophilic substitution reactions of pyridine.

CO11: compare the basicity of pyridine, piperidine and pyrrole.

Bachelor of Science (Medical and Non- Medical) SEMESTER–IV
SESSION: 2020-21
COURSE CODE: BSMM/BSNM-4084(II)
COURSE TITLE: ORGANIC CHEMISTRY-II (THEORY)

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 & 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 (Medical and Non- Medical) SEMESTER–IV
SESSION: 2020-21
COURSE CODE: BSMM/BSNM-4084(P)
COURSE TITLE: CHEMISTRY PRACTICAL

Course outcomes:

Students will be able to analyze the given organic compound through

CO1:detection of elements (N, S and halogens) in organic compounds.

CO2:detection of functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines,amides, nitro and anilide) in simple organic compounds

CO3: preparation of their derivatives

Bachelor of Science (Medical and Non- Medical) SEMESTER–IV
SESSION: 2020-21
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 & 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 (Biotechnology)

(Semester: IV)

(Under Continuous Evaluation System)

Session: 2020-2021

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: 2020-2021)

Chemistry Semester IV									
Course Name	**Program Name**	**Course Code**	**Course Type**	**Marks**					**Examination time (in Hours)**
				Total	**Paper**	**Ext.**		**CA**	
						L	**P**		
Physical Chemistry-B	Bachelor of Science(Biotechnology)	BBTM-4081	C	60	Physical Chemistry-B(Theory)	30	-	12	3
					Physical Chemistry-B (Practical)	-	18		3

Bachelor of Science (Biotechnology) Semester-IV
SESSION: 2020-21
COURSE CODE: BBTM-4081
COURSE TITLE: Physical Chemistry – B (Theory)

Course outcome:

Students will be able to

CO1: determine rate of reaction, order and molecularity of reaction, half life, activation energy of reaction

CO2: understand Complex reactions, consecutive reactions, parallel reactions, chain reactions and opposing reactions.

CO3:know the variation of equivalent conductance with dilution of weak and strong electrolytes

CO4: determine of degree of ionisation of weak electrolyte, solubility, solubility product of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt

CO5: calculate hydrolysis constant

CO6: to select indicators in different acid base titration

Bachelor of Science (Biotechnology) Semester-IV
SESSION: 2020-21
COURSE CODE: BBTM-4081
COURSE TITLE: Physical Chemistry – B (Theory)

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

Electrochemical Cells:

Electrode poential, Electromotive force (EMF).Reversible and irreversible cells, measurement of EMF of a cell.Nernstequation.Reference electrodes and other electrodes, standard electrode potential.Activity and activity coefficient determination from EMF results. Concentration cells with transference and without transference, liquid function potential, pH, glass electrode, quinone-hydroquinone electrode, Potentiometrictitrations.

Unit-II

Chemical Kinetics:

Rate of reaction, rate constant, factors influencing rate of reaction, order, molecularity. Rate equations for Ist order, IInd order &IIIrd order reactions. Methods for determining order of reaction. Half Life, Complex reactions, consecutive reactions, parallel reactions, chain reactions and opposing reactions.Activation energy and calculation from Arrhenius equation. Theories of reaction rates collision theory and transition state theory of biomolecular processes. Catalysis, acid base catalysis, enzyme catalysis including their mechanisms, Michaelis Menten equation for enzyme catalysis.Heterogeneous catalysis and its mechanism. Surface reactions with special reference to Unimolecular surface reaction.

Unit-III

Ionic Equilibria and Conductance: Conductivity, equivalent and molar conductance. Variation of equivalent conductance with dilution of weak and strong electrolytes. Arrhenius and Debye Huckeltheory.Kohlraush law of independent migration of ions.Transference number and their experimental determination using Hittorf and moving boundary methods.Ionicelocity, ionic mobility.Applications of conductance measurements. Determination of degree of ionisation of weak electrolyte, solubility, solubility product of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt, conductometric titrations.

Unit-IV

. Ionic strength.DebyeHuckel theory of activity coefficients.Mathematical treatment of multistage equilibria of acids and bases.Salt hydrolysis, calculation of hydrolysis constant, Buffer solutions, Buffer index, Buffer capcity universal buffer preparation.Acid base indicators.Theory of acid base indicators.pH change and selection of indicators in different acid basetitrations.

Books recommended:

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. 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; 1st edition, Pubs: John Wiley & Sons Inc., 1992.
7. Levine, I.N., Physical Chemistry; 5th edition, Pubs: Tata McGraw Hill Publishing Co. Ltd, 2002.
8. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd, 1983.

Bachelor of Science (Biotechnology) Semester-IV
SESSION: 2020-21
COURSE CODE: BBTM-4081(P)
COURSE TITLE: Physical Chemistry – B (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: 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 (Biotechnology) Semester-IV
SESSION: 2020-21
COURSE CODE: BBTM-4081(P)
COURSE TITLE: Physical Chemistry – B (Practical)

Time: 3 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.

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 (NaCl andHCl).
   c) Precipitation titration of Na_2SO_4vs.$BaCl_2$.
   d) Neutralization titrations NaOH vs. HCl and NaOH vs.CH_3COOH.

5. Determination of adsorption isotherm of oxalic acid oncharcoal.

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 & Co.
5. Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghosh & Sons.
6. Experiments Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

FACULTY OF SCIENCES

Syllabus of Chemistry

For

Bachelor of Science (Home Science)

(Semester IV)

(Under Continuous Evaluation System)

Session: 2020-2021

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: 2020-2021)

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

Bachelor of Science (Home Science) Semester-IV
SESSION: 2020-21
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.

CO1: to do the naming of various Organic Compound.

CO2: to draw the structure of the given Molecular Formula.

CO3: understand the structure and properties of Soaps and Detergents.

CO4: prepare Soaps and Detergents by different Chemical methods.

CO5: differentitate between Soaps and Detergents.

CO6: understand the structure and importance of rubbers and plastics.

CO7:have an elementary idea about composition of cosmetics.

Bachelor of Science (Home Science) Semester-IV
SESSION: 2020-21
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. BillmeyerJr.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: 2020-21
COURSE CODE: BHSM-4087(P)
COURSE TITLE: Applied Chemistry (Practical)

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: 2020-21
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. N.C.E.R.T. Books for XI & XH.
5. Modern Approach to Chemistry by S. P. Johar Vol. I & Vol. II.