GOVT. BILASA GIRLS (AUTONOMOUS) P. G. COLLEGE,
BILASPUR (C. G.)

SYLLABUS

B. Sc. SEMESTER-I& II

CHEMISTRY

2019-20

DEPARTMENT OF CHEMISTRY

NEW CURRICULUM OF B.Sc. CHEMISTRY

SEMESTER I (2019-20)

MM-60 : HOURS -45; CREDIT -3

INORGANIC CHEMISTRY

UNIT-I :

A. Atomic Structure **Hrs-9**

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

B. Periodic Properties

Atomic Radii ,Ionization energy, electron gain enthalpy and electro negativity trends in periodic table and application in predicting and explaining the chemical behavior.

C. Chemical Bonding

Covalent Bond-Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, ClF_3, ICl_2^- and H_2O.

UNIT II **Hrs-9**

A. Chemical Bonding

M.O. theory, homonuclear and heteronuclear (CO and NO), bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

B.Ionic Solids

Ionic structures, radius ratio and co-ordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born- Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions. Fajan's rule. Metallic bond-free electron, valence bond and band theories.

B. Chemistry of Noble Gases

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

ORGANIC CHEMISTRY

UNIT III : **Hrs-9**

A. Electronic Structure and Bonding

Resonance ,hyperconjugation, aromaticity, mesomeric, inductive and field effects, hydrogen bonding.

B. Mechanism of Organic Reactions

Homolytic and heterolytic bond breaking. Types of reagents- electrophiles and nucleophiles structure and reactivity of Reaction intermediates-carbocations , carbanions, free radicals, carbenes, arynes and nitrenes.

UNIT-IV Stereochemistry of Organic Compounds **Hrs-9**

A.Optical isomerism-enantiomers, diastereomers, threo and erythro, meso compounds, resolution of enantiomers, inversion retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S system of nomenclature

B. Geometrical isomerism-Syn and anti forms , E& Z system of nomenclature ,properties of cis and trans isomers.

C. Conformational Analysis of ethane, butane and cyclohexane.

PHYSICAL CHEMISTRY

UNIT V : **Hrs-9**

A. Mathematical Concepts for Chemist

Logarithmic relations, curve sketching, linear graphs and Properties of straight lines, Slopes and intercept, differentiation of functions, partial differentiation Integration of some useful and relevant functions; maxima and minima, permutations and combinations, probability.

B.Computer for Chemist

General introduction to computers, different components of a computer, hard ware and softtware , input-output devices: binary numbers and arithmetic, introduction to computer languages. Programming, operating system.

C .Molecular Velocities

Root mean square velocity, average and most probable velocities, Maxwell's law of distribution of molecular velocities of gases (graphical interpretation),effect of temperature on distribution of molecular velocities, collision frequency, mean free path.

NEW CURRICULUM OF B.Sc. CHEMISTRY

SEMESTER II (2019-20)

MM-60 : HOURS -45; CREDIT -3

INORGANIC CHEMISTRY

UNIT I : **Hrs-9**

A. *s*-Block Elements: Comparative study, salient features of hydrides, solvation and complexation tendencies including their function in bio systems, and introduction to alkyls and aryls, derivatives of alkali and alkaline earth metals.

B. *p*-Block Element: Halides hydrides, oxides and oxyacids of Boran , Aluminium, Nitrogen and phosphorus boranes, borazines, fullerenes and silicates, interhalogens ,pseudohalogens.

C. Inorganic Chemical Analysis : Chemical principle involved in the detection of acid and basic radicals including interfering radicals.

ORGANIC CHEMISTRY

UNIT II : **Hrs-9**

A:Alicyclic compound

Cycloalkanes-nomenclature, methods of formation, chemical reaction, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclo propane and cyclo butane);theory of strainless rings. The case of cyclopropane ring, banana bonds.

B Mononuclear and poly nuclear aromatic ring: Structure of benzene and naphthalene molecular formula and kekule structure, aromatic electrophilic substitution, general pattern of the mechanism, role of σ and π complexes. Electrophilic substitution in naphthalene

UNIT III. **Hrs-9**

Alkyl halide and aryl halides

Mechanism and stereochemistry of nucleophilic substitution reactions and alkyl halides and aryl halides with energy profile diagram SN^1,SN^2 and SN^i mechanism.

Mechanism and stereo chemistry of elimination reaction and alkyl halides, elimination Vs substitution.

PHYSICAL CHEMISTRY

UNIT IV: **Hrs-9**

A. Ideal and Non Ideal Solutions : Mode of representing concentration of solution , activity and activity coefficient.. Dilute solution: colligative properties, lowering of vapour pressure of solvent, Raoult law, osmosis ,Vant Hoff Theory of dilute solution, measurements of osmotic pressure, relationship between lowering of vapour pressure and osmotic pressure, elevation of boiling point, depression in freezing point, abnormal molar masses, degree of dissociation and association of solutes ,Van't Hoff factor.

B.Liquid Crystal: Difference between liquid crystal, solid and liquids. Classification, structure of nematic and cholestic phases Thermography and seven segment cell, application of liquid crystal.

C.Colloidal State : Classification kinetic, optical and electrical properties of Colloids, coagulation HardySchulze law, floculation value, protection, Gold number, emulsion, micelle, Gel, Syneresis and thixotrophy,application of collioids.

UNIT - V **Hrs-9**

A. Chemical Kinetics: Rate of a reaction, factors influencing the rate of a reaction, rate constant, Order and molecularity of reaction, zero order, first order, second order reaction, methods of determining the order of reaction, Introductory idea about complex reaction: consecutive, opposing and side reaction ,chain reactions . Temperature dependence of reaction rate, Arrhenius theory, physical significance of activation energy, collision theory, demerits of collision theory, non-mathematical concept of transition state theory.

B.Catalysis: Homogeneous and heterogeneous catalysis, types of catalyst, characteristics of catalyst, enzyme catalysed reactions, micelle catalysed reaction, industrial application of catalysis.

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REFERENCE BOOKS:

Basic inorganic chemistry; F.A. Cotton, G. Willkinson and P. I. Gaus, J.wiley.

Concise inorganic chemistry; J. D. Lee, ELBS.

Concepts of Models of Inorganic Chemistry;B. Douglas, D. Medaniel and J. Alexander. J. Wley.

Inorganic Chemistry;D.E. Shriver, P. W. Atkins and C. H. Langford, oxford.

Inorganic Chemistry ; W.W. Porterfield, Addison-wesley.

Inorganic Chemistry ; A.G. Sharp, ELBS.

Inorganic Chemistry; G. L.Miessler and D. A. Tarr, Prentice Hall.

Advcence Inorganic Chemistry; SatyaPrakash.

Advance Inorganic Chemistry; Agrawal&Agrawal.

Advance Inorganic Chemistry ;Puri& Sharma , S. Naginchand.

Inorganic Chemistry ;Madan, S.Chand.

Selected Topics in Inorganic Chemistry ; Madan Malik &Tuli ,S. Chand

Organic Chemistry ; Morrison and Boyd, Prentice Hall.
Organic Chemistry; L. G.WADE,Prentice Hall.
Fundamental of Organic Chemistry; Solomons ,J. Wiley.
Organic Chemistry, Vol. I,II, &III; Mukharjee, Singh &Kapoor, WielyEstern(New Age).
Organic Chemistry ; F.A. Carey McGraw Hill.
Organic Chemistry ;P.L.Soni
Organic Chemistry; Bahal&Bahal.
Carbonic rasayan, jogindersingh
Physical Chemistry; G. M. Barrow, McGraw Hill.
University General Chemistry; C. N. Rao. Macmillan.
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Physical chemistry through problems;Droga&Droga,WileyEstern.
Physical Chemistry B.D. Khosla.
Physical Chemistry ;Puri&Sharma.
BhautikRasayan ; P. L. Soni.
BhautikRasayan; Bahal&Tuli.
Physical Chemistry; R.L. Kapoor, Vol. I-IV.
BautikRasayan;Puri&Sharma

NEW CURRICULUM OF B.Sc. CHEMISTRY

SEMESTER I &II (20119-20) MM 50; HOURS-60; CREDIT-4

Laboratory Course

The following experiments are to be conduct during the curriculum.

1. **Inorganic Chemistry**

   Semi micro/macro Analysis-

   (a) Cations analysis, separation and identification of ions form Pb, Bi, Cu, Cd, Sb, Sn, As, Fe, Al, Cr, Ni, Co, Zn, Mn, Ba, Sr, Ca, Mg, NH_4 and anions CO_3, S, SO_3, SO_4, NO_2, NO_3, Cl, Br, I, CH_3COO, C_2O_4, F, BO_3 .

   (b) Combination Mixture- two acid or basic radicals should be given from same group.

2. **Organic Chemistry**-

   (a) Laboratory Techniques-

   - Calibration of thermometer: Naphthalene (80-82), Acetanilide (113.5-114), Urea (132.5-133) and Distilled water (100).
   - Determination of melting point : Naphthalene(80-82),Benzoic acid (121.5-122),Urea, Succinic (184.5-185),Cinnamic acid (132.5-133), Salicylic acid (157.5-158), Acetanilide(113-114), m-dinitrobenzene 90,p-dichlorobenzene 52, and Aspirin 135.
   - Determination of boiling point: Ethanol 78, cyclohaxane 81, toluene 110.6 and benzene 80.
   - Mixed melting point determination: urea cinnamic acid mixture of various compositions (1:4, 1:1, 4:1).
   - Distillation (demonstration): simple distillation of water- ethanol mixture using water condenser.Distillation of nitrobenzene and aniline using air condenser.
   - Crystallization: phthalic acid from hot water, acetanilide from boiling water, naphthalene from alcohol and benzoic acid from water.
   - Decolorisation and recrystalization using charcoal; Brown sugar with animal charcoal using gravity filtration Crystalisation and decolorization of impure naphthalene (100 gm naphthalene mixed with 0.3gm of congo red using1gm of decolorizing carbon) from ethanol.
   - Sublimation: camphor, naphthalene, phthalic acid, succinic acid.

   (b) Qualitative analysis :

   Detection of N, S, and halogens and functional groups (phenolic, Alcoholic, carboxylic, carbonyl, esters.Carbohydrates.amines, amides, nitro and anilide) in simple organic compounds.

3. **Physical chemistry**-

   (a) Chemical kinetics;

   - To determine the specific rate of hydrolysis of methyl/ethyl acetate catalyzed by hydrogen ions at room temperature.

- To study the effect of acid strength on the hydrolysis of ester.
- To compare the strength of HCl & H_2SO_4 by studying the kinetic of hydrolysis of ethyl acetate.
- To study kinetically the reaction rate of decomposition of iodide by H_2O_2.

(b) Distribution law:

- To study distribution of iodine between water and CCl_4.
- To study distribution of benzoic acid between water and benzene.

(c)Viscosity and Surface Tension

- To determine the % composition of a given mixture (non interacting system) by viscosity method.
- To determine the viscosity of amyl alcohol in water at different concentration and calculate the excess viscosity of these solution.

- To determine the % composition of a given binary mixture of liquid by surface tension methods (acetone & ethyl methyl ketone).

Practical Examination

MM-50 **Duration - 4 hrs**

Four experiments are to be performed -

1. Inorganic mixture analysis, four radicals two acid and two basic (Combination of acid radical and basic radical any one to be given). [12-Marks]

2.(A) Detection of functional group of given organic compound and determine its MPt/BPt[05-Marks]

(B)crystallization of any one compound as given in the prospectus along with the determination of mixed MPt./decolorisation of brown sugar along with sublimation ofcamphor/naphthalene. [05-marks]

3. Physical experiment- Any one [12-marks]

4. Viva [10-marks]

5. Sessional [06-marks]

In case of Ex- students two marks will be added to each of the experiment

RFERENCE BOOKS:

- Vogel`s Text Book of Quantitative Inorganic Analysis; revised, ELBS.
- Vogel`s Qualitative Analysis ,revised; Longman.
- Standard Method for Chemical Analysis; W. W. Scott, the technical press.
- Experimental Organic Chemistry, Vol. I&II; P. R. Singh D. S. Gupta and K.S. Bajpai, Tata McGraw Hill.
- Laboratory Manual in Organic Chemistry; R.K. Bansal, WielyEstren.
- Experimental in General Chemistry; C.N.R. Rao& U. C. Agrawal,. East –West Press.
- Advanced Practical Physical Chemistry; J.B. Yadav, Goel Pub Hou.
- Vogel`s Text Book of Practical Organic; ELBS.

GOVT. BILASA GIRLS (AUTONOMOUS) P. G. COLLEGE, BILASPUR (C. G.)

SYLLABUS

CHEMISTRY

2019-20

B Sc –SEMESTER III & IV

DEPARTMENT OF CHEMISTRY

NEW CURRICULUM OF B.Sc. CHEMISTRY

SEMESTER III (2019-20) MM-60 : HOURS -45; CREDIT -3

INORGANIC CHEMISTRY

UNIT I : Chemistry of elements of first transition series **Hrs-9**

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

Chemistry of elements of second & third transition series

General characteristics, comparative treatment with their 3d analogues in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry..

UNIT II :(A) Oxidation and Reduction: **Hrs-9**

Use of redox potential data-analysis of redox cycle, redox stability in water, Frost, Latimer &Pourbaix diagrams, principles involved in the extraction of the elements.

(B) Co-ordination Compounds:

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

ORGANIC CHEMISTRY

UNIT III :Alcohol & Phenols **Hrs-9**

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

(B) Structure and bonding in phenols, physical properties and acidic character. Comparative acidic strength of alcohols and phenols, resonance stabilization of phenoxide ion, Reaction of phenols, acylation and carboxylation.

(C)Mechanism of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben- Hoesch reaction, Lederer Manasse reaction and Reimer-Tiemann reaction.

Aldehydes and Ketones

(A) Nomenclature and structure of the carbonyl group, general method of synthesis of aliphatic and aromatic aldehydes and ketones and synthesis using 1,3 dithianes, nitriles.Mechanism of nucleophilic addition to carbonyl group benzoin, aldol, Perkin and Knoevenagel condensations.Condensation with ammonia and its derivatives. Wittig reaction , Mannich reaction.

(B)Use of acetate as protecting group, Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmensen,Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions.Halogenation of enolizableketons. An introduction to α, β

unsaturated aldehydes and ketones.

UNIT IV : (A) Carboxylic Acids **Hrs-9**

Structure and bonding, physical properties, acidity of carboxylicacids, effect of substituents on acid strength. Hell-Volhard –Zeilinsky reaction, Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of unsaturated mono carboxylic acids. Di carboxylic acids, methods of formation and effect of heat and dehydrating agents.

(B)Substituted Carboxylic Acids

Hydroxyl substituted acids.

(C) Carboxylic acid Derivatives

Structure of acid chlorides, esters, amides (Urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversionof acid derivatives by nucleophilic acyl substitution .Mechanism of acid and base catalysed esterification and hydrolysis

PHYSICAL CHEMISTRY

UNIT V:(A)Thermodynamics-I **Hrs-9**

Definition of thermodynamic terms, system, surroundings etc. Types of systems, intensive and extensive properties, State and path functions .Thermodynamic operations internal energy, enthalpy, heat capacity of gases at constant volume and at constant pressure and their relationship.First Law ofThermodynamics: Statement, definition of internal energy and enthalpy, Heat capacity, heat capacities at constant volume and pressure and their relationship, Joule's law, Joule-Thomson coefficient and inversion temperature.

(B)Thermodynamics-II

Second law of Thermodynamics : Spontaneous process need of second law, statements of Carnot cycle , efficiency of heat engine, Carnot theorem, Thermodynamic state of temperature. Concept of entropy: entropy change in a reversible and irreversible process, entropy change in isothermal reversible expansion of an ideal gas,. Entropy change isothermal mixing of ideal gases, physical significance of entropy.

(C) Thermochemistry:

Standard state, Hess's law of heat summation Enthalpy at constant pressure and constant volume. Enthalpy of neutralization, enthalpy of combustion, enthalpy of formation, calculation of bond enthalpy .

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Basic inorganic chemistry; F.A. Cotton, G. Willkinson and P. I. Gaus, J.wiley.

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Organic Chemistry ; F.A. Carey, McGraw Hill.

Organic Chemistry ;P.L.Soni

Organic Chemistry; Bahl&Bahl.

Physical Chemistry; G. M. Barrow, McGraw Hill.

University General Chemistry; C. N. Rao. Macmillan

.

Physical Chemistry; R. A. Alberty, Wiley Estern.

The Element of Physical Chemistry; P. W. Atkin, Oxford

Physical chemistry through problems;Droga&Droga,WileyEstern.

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Physical Chemistry ;Puri&Sharma.

BhautikRasayan ; P. L. Soni.

BhautikRasayan; Bahal&Tuli.

Physical Chemistry; R.L. Kapoor, Vol. I-IV.

BautikRasayan;Puri&Sharma

NEW CURRICULUM OF B.Sc. CHEMISTRY

SEMESTER IV (2019-20) MM-60 : HOURS -45; CREDIT -3

INORGANIC CHEMISTRY

UNIT I : (A) Chemistry of Lanthanide Elements: Hrs -9

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

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(B) Chemistry of Actinides:

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

UNIT II: (A) Acid and Bases: Hrs -9

Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concept of Acids and bases**.**

(B)Non-aqueous Solvents:

Physical properties of a solvent, types of solvents and their general characteristics reaction in non-aqueous solvents with reference to liquid ammonia and liquid sulphur dioxide.

(C)Hard and Soft Acids and Bases(HSAB)

Classification of acids and bases as hard and soft. Pearson, HSAB concept.

ORGANIC CHEMISTRY

UNIT-III :(A)Organic Compounds of Nitrogen Hrs -9

Mechanism of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline medium. Reactivity, Structure and nomenclature of amines, physical properties. Stereochemistry of amines. Separation of mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amine of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds, Gabriel-pthalimide reaction, Hoffmann bromamide reaction. Reaction of amines, electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, azo coupling.

(B)- Heterocyclic Compounds

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine.Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reaction in pyridine derivatives.Comparision of basicity of pyridine, piperidine and pyrrole.

PHYSICAL CHEMISTRY

UNIT IV: Phase Equilibrium **Hrs -9**

(A) Gibbs phase rule, phase, component and degree of freedom, limitation of phase rule. Application of phase rule to one component system-water system and Sulphur systems. Application of phase rule to two component systems:Pb-Ag systems, Zn-Mg system, water-ferric chloride, desilverisation of lead, congruent and incongruent melting point, eutectic point.
Three component system- solid solution liquid pairs, Liquid- liquid mixture (Partially miscible liquids)- phenol-water, Triethylamine-water, nicotine water system. consolute temperature. Azeotrops.

(B) Nernst distribution law- Henry law, applications, solvent extraction

UNIT V : Electrochemistry- I **Hrs -9**

(A) Electrolyte conductance: specific and equivalent conductance, measurement of equivalent conductance, effect of dilution on conductance, Migration of ions and Kohlrausch law, application of Kohlraush law in determination of dissociation constant of weak electrolyte, solubility of sparingly, absolute velocity of ions, ionic product of water, conductometric titrations.
Migration of ions : Transport number-definition and determination by Hittorf method and moving boundary method.

(B) EMF of a cell, Nernst equation, calculation of ΔG, ΔH and ΔS for cell reaction. Single electrode potential: standard hydrogen electrode, calomel electrode, Concentration cell with and without transport, liquid junction potential, application of concentration cells, valence of ions, solubility product and activity coefficient.

(C) Determination of pH and pK_a, using hydrogen and quinhydrone electrodes, potentiometric titrations. Buffers- mechanism of buffer action, Handerson-Hazel equation, Hydrolysis of salts. Corrosion- types, theories and prevention.

***REFERENCE BOOKS*:**

- Physical Chemistry; G. M. Barrow, McGraw Hill.
- University General Chemistry; C. N. Rao. Macmillan.
- Physical Chemistry; R. A. Alberty, Wiley Estern.
- The Element of Physical Chemistry; P. W. Atkin, Oxford
- Physical chemistry through problems;Droga & Droga, Wiley Estern.
- Physical Chemistry; K.L. Kapoor, Vol. I-I4 Physical Chemistry B.DKhosla.
- Physical Chemistry ;Puri&Sharma.
- Bhautik Rasayan ; P. L. Soni.
- Bhautik Rasayan; Bahal &Tuli.
- Physical Chemistry; R.L. Kapoor, Vol. I-IV.
  Bautik Rasayan; Puri &Sharma

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NEW CURRICULUM OF B.Sc. CHEMISTRY

SEMESTER III &IV (2019-20) MM 50; HOURS-60; CREDIT-4

Laboratory Course

INORGANIC CHEMISTRY

Laboratory Techniques:
Calibration of fractional weight, pipette, burettes, preparation of slandered solutions.Dilution 0.1M to 0.001M solution.
Quntitative Analysis: volumetric analysis-

- Determination of acetic acid in commercial vinegar using NaOH.
- Determination of alkali content in antacid tablet using HCl.
- Estimation of calcium content in chalk as calcium oxalate by permanganometry.
- Estimation of hard ness of water by EDTA.
- Estimation of ferrous/ ferric by dichromate method.
- Estimation of copper using thiosulphate.

Instrumentation:
Colorometry: (a) job`s method (b) Mole- Ratio method; Adultration – foodstuff, effluent analysis, water analysis.
Solvent extraction: separation and estimation of Mg (II) and Fe (II) .
Ion exchange method : Separation and estimation Mg(II)and Zn(II).

ORGANIC CHEMISTRY

Laboratory Technique:
A.Thin layer chromatography: determination of R_f values and identification of organic compounds; separation of green leaf pigment (spinach leaves may be used), preparation and separation of 2, 4-dinitrophenylhydrazone of acetone, 2-butanone, hexan-2-and 3-one using toluene and light petroleum (40:60), separation of a mixture of dyes using cyclo hexane and ethyl acetate (8.5:1.5).

B.Paper chromatography (ascending and circular); separation of a mixture of phenylalnine and glycine, alanine and aspartic acid, leucine and glutamic acid,spray reagent ninhydrin.separation of a mixture of D, L – alanine,glycine and L-leucine using n-butanol+acetic acid + water (4:1:5) spray reagent

ninhydrin.separation of monosccharides a mixture of D-glucose and-fructose using n-butanol+acetone+ water (4:1:5)spray reagent aniline hydrogen phthalate.
C.*Qualitative analysis:* Identification of organic compounds through the functional group analysis, determination of melting points and preparation of derivatives.

PHYSICAL CHEMISTRY

Transition Temperature: determination of the transition temperature of the given substance by thermometric / dialometric method (e.g. $MnCl_2.4H_2O$, $SrBr_2.2H_2O$)

Phase Equilibrium:

- To study the effect of solute (e. g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquid (e.g. phenol – water system)and to determine concentration of that solute in the given water – phenol system.
- To construct the phase diagram of two component (e. g. diphenylamine- benzophenone system) by cooling curve method.

ThermoChemistry:

- To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process. .
- To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

PRACTICAL EXAMINATION

MM-50, DURATON- 05Hrs.

Three experiments are to be preformed:

1. Inorganic; one experiment from synthesis or analysis by preparing standard solution be given OR One experiment from instrumentation either by colorometry/solvent extraction/ion exchange method. [12- marks]

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2.(a)Identification of the given organic compound and determine its MPt/BPt [06-marks].

(b) Determination of $R_f$value and identification of organic compound by paper chromatography. [06- Marks]

3. Any one physical experiment that can be completed in two hours including Calculation .[12- Marks]
4. Viva [10- marks]
5. Sessional [04 -marks]

In case of Ex-student one mark will be added to each of the experiments.

RFERENCE BOOKS:

- Vogel`s Text Book of Quantitative Inorganic Analysis; revised,ELBS.
- Vogel`s Qualitative Analysis ,revised; Longman.
- Standard Method for Chemical Analysis; W. W. Scott, the technical press.
- Experimental Organic Chemistry, Vol. I&II; P. R. Singh D. S. Gupta and K.S. Bajpai, Tata McGraw Hill.
- Laboratory Manual in Organic Chemistry; R.K. Banasal, Wiley Estren.
- Experimental in General Chemistry; C.N.R. Rao& U. C. Agrawal,. East –West Press.
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- Vogel`s Text Book of Practical Organic; ELBS.

GOVT. BILASA GIRLS (AUTONOMOUS) P. G. COLLEGE, BILASPUR (C. G.)

SYLLABUS

CHEMISTRY

2019-20

B Sc –SEMESTER V & VI

DEPARTMENT OF CHEMISTRY

NEW CURRICULUM OF B.Sc.CHEMISTRY

SEMESTER V (2019-20)

Choice Based Elective paper-I

SYNTHETIC ORGANIC CHEMISTRY

MM-60 ; HOURS-45; CREDIT -3

UNIT I : POLYMER **Hrs-9**

Classification of polymer ,Basic concept ,Monomers, Various structure of copolymer (linear branched and cross linked copolymers) Polymerisation reactions Addition or chain growth polymerization Mechanism of cationic ,anionic and . Free radical polymerization, Ziegler-Natta polymerization . Condensation or step growth polymerization.

UNIT II:(A) ORGANIC POLYMER **Hrs-9**

Preparation and uses of Polythene , Polyvinyl chloride ,Polyesters, polyamides, phenol-formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.-Buna- S ,Chloroprene and Neoprene ; Vulcanization.

(B) INORGANIC POLYMER

Silicones and phosphazenes as examples of inorganic polymers, nature of bonding in tri-phosphazenes.

UNIT-III : SYNTHETIC DRUGS:- **Hrs-9**

Introduction & Classification of drugs, synthesis and uses of following classes of drugs Sulpha drugs : sulphanilamide, sulphadizine

Antipyretic and Analgesic- paracetamol, Aspirin

Antimalarial-chloroquine , Pamaquine

Antiseptic -Chloramine, iodoform

UNIT-IV **Hrs-9**

SYNTHETIC DYES –I

Introduction, nomenclature and classification according to chemical constitution and application, Colour and chemical constitution:- relation between colour and constitution- Witt's theory, Armstrong theory, modern theories- V.B.T., M.O.T.

UNIT-V **Hrs-9**

SYNTHETIC DYES-II-

Synthesis and uses of following class of dyes:- Azo dyes (methyl orange, methyl red, Congo red),triphenyl methane dyes- (malachite green, pararosaniline' Crystal violet), Thalein dyes (phenolphthalein), xanthenes dyes(Fluorescein,rhodamine), Anthraquinone (Alizarine), Indigoids (Indigotin)

Reference Books:

- T. W. Graham Solomons: *Organic Chemistry, John Wiley and Sons*.
- Peter Sykes: *A Guide Book to Mechanism in Organic Chemistry,* Orient
- Longman.AN
- I.L. Finar:*Organic Chemistry* (Vol. I & II), E. L. B. S.
- R. T. Morrison & R. N. Boyd: *Organic Chemistry*, Prentice Hall.
- Arun Bahl and B. S. Bahl: *Advanced Organic Chemistry,* S. Chand.
- G. M. Barrow:*Physical Chemistry* Tata McGraw---Hill (2007).
- G. W. Castellan:*Physical Chemistry* 4th Edn. Narosa (2004).
- J. C. Kotz, P. M. Treichel & J. R. Townsend: *General Chemistry* Cengage Lening
- India Pvt. Ltd., New Delhi (2009).
- B. H. Mahan:*University Chemistry* 3rd Ed. Narosa (1998).
- R. H. Petrucci: *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York

NEW CURRICULUM OF B.Sc. CHEMISTRY

SEMESTER V (2019-20)

Choice Based Elective (CBE) paper -II

Selected Topics in Chemistry

MM 60; HOURS-45; CREDIT -3

UNIT I :Organometallic Chemistry **Hrs-9**

Definition , nomenclature and classification of organometallic compounds. Preparation-properties, bonding and applications of alkyls and aryls of Li, Al, Hg,Sn& Ti.A brief account of metal- ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and nature of bonding in metal carbonyls.

UNIT- II : Bio-inorganic Chemistry **Hrs-9**

Essential and trace elements biological processes, metalloporphyrins with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metals with special reference to Ca^{2+}, nitrogen fixation.

UNIT-III **Hrs-9**

A- Amino Acids & Peptides

1-Classification,Structure and stereochemistry of amino acids. Acid base behavior isoelectric point and electrophoresis, Preparation and reaction of α-amino acids
2-Structure and nomenclature of peptides Classical peptides synthesis, solid-phase peptide synthesis.

B- Proteins and Nucleic acids

Classification and structure of protein levels of proteins structure, protein denaturation /renaturation, constituents of amino acids Ribonucleosides andRibonucleotides, double helical structure of DNA.

UNIT-IV **Hrs-9**

(A) Physical Properties and Molecular Structure

Polarisation of molecules (Classius-Mossotti equation), orientation of dipole in an electric field, dipole moment, induced dipole moment, measurement of dipole moment- temperature method and refractivity method, dipole moment and structure of molecules.

(B**)Magnetic properties**-

Paramagnetism, diamagnetism and ferromagnetism , determination of magnetic susceptibility, elucidation of molecular structure.

UNIT-V **Hrs-9**

(A)Raman Spectra : Concept of polarizability, quantum theory of Raman spectra, stokes and antistokes lines, pure rotational and vibrational Raman spectra. Application of Raman spectra.

(B)Photochemistry

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

***REFERENCE BOOKS*:**

- .Basic inorganic chemistry; F.A. Cotton, G. Willkinson and P. I. Gaus, J.wiley.
- Concise inorganic chemistry; J. D. Lee, ELBS.
- Concepts of Models of Inorganic Chemistry;B. Douglas, D. Medaniel and J. Alexander. J. Wiley.
- Inorganic Chemistry;D.E. Shrver, P. W. Atkins and C. H. Langford, oxford.
- Inorganic chemistry ; W.W. Porterfield, Addison-wesley.
- Inorganic chemistry ; A.G. Sharp, ELBS.
- Inorganic chemistry; G. L.Miessler and D. A. Tarr, Prentice Hall.
- Advcence inorganic chemistry; SatyaPrakash.
- Advance inorganic chemistry; Agrawal&Agrawal.
- Advance inorganic chemistry ;Puri& Sharma , S. Naginchand.
- Inorganic chemistry ;Madan , S. Chand.
- Selected topics in inorganic chemistry ;madanmalik&tuli ,S. Chand.
- Organic Chemistry ; Morrison and Boyd, Prentice Hall.
- Organic Chemistry; L. G.WADE,Prentice Hall.
- Fundamental of Organic Chemistry; Solomons ,J. Wiley.
- Organic Chemistry, Vol. I,II, &III; Mukharjee, Singh &Kapoor, Wiley Estern (New Age).
- Organic Chemistry ; F.A. Carey McGraw Hill.
- Organic Chemistry ;P.L.Soni
- Organic Chemistry; Bahal&Bahal.
- Physical Chemistry; G. M. Barrow, McGraw Hill.
- University General Chemistry; C. N. Rao. Macmillan.
- Physical Chemistry; R. A. Alberty, Wiley Estern.
- The Element of Physical Chemistry; P. W. Atkin, Oxford
- Physical chemistry through problems;Droga&Droga,WileyEstern.
- Physical Chemistry B.D. Khosla.
- Physical Chemistry ;Puri&Sharma.
- BhautikRasayan ; P. L. Soni.
- BhautikRasayan; Bahal&Tuli.
- Physical Chemistry; K.L. Kapoor, Vol. I-I4

NEW CURRICULUM OF B.Sc. CHEMISTRY

SEMESTER V (2019-20)

Choice Based Elective (CBE) Paper- III

ANALYTICAL CHEMISTRY

MM 60; HOURS- 45; CREDIT -3

UNIT I: Hrs- 9

A. Error in chemical analysis

Accuracy, precision, Types of error-absolute and relative error, methods of eliminating or minimizing errors. Methods of expressing precision: mean, median, deviation, average deviation and coefficient of variation. Significant figures and its application.

B. Chromatography

Principle of adsorption and partition chromatography. Column chromatography: adsorbents, classification of adsorbents, solvents, preparation of column, adsorption andapplications. Thin Layer Chromatography: choice of adsorbent, choice of solvent, preparation of chromatogram, sample, Rf value and its applications. Paper chromatography,solvent used, Rf value, factors which affect Rf value. Ion exchange chromatography, resins used, experimental techniques, applications.

UNIT II : Hrs- 9

Analysis of Water

Analysis of parameter : colour, turbidity, total solids, conductivity, acidity, alkalinity, hardness , choride, sulphate, fluoride, silica, phosphates and different forms of nitrogen. Measurements of DO, BOD and COD. Pesticides as water pollutants and analysis. Water pollution laws and standards. . Water treatment and purification

UNIT III : TITRIMETRIC METHODS OF ANALYSIS Hrs-9

A. General Introduction

General principle. Types of titrations. Requirements for titrimetric analysis. Concentration systems. Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions. Limitation of volumetric analysis, end point and equivalence point.

B. Titrimetric Analysis

1- Acid Base Titration-theory of indicators, choice of indicators. Use of phenolphthalein and methyl orange.

2-Redox Titration -Principle of redox tritimetric estimation based on the use of the following reagents: $KMnO_4$, $K_2Cr_2O_7$, I_2 ,$Na_2S_2O_3.5H_2O$

3-Complexometric titrations

Titration involving EDTA. Metal ion indicators and characteristics.

UNIT IV: SOLUBILITY EQUILIBRIA **Hrs- 9**

A- **General Separation Techniques**
Solubility and solubility products, expressions for solubility products. Determination of solubility from solubility products.

B- **Gravimetric methods of analysis**.
Requirements of gravimetry: properties of precipitates and precipitating regents, particle size and filterability of precipitates, colloidal and crystalline precipitates coprecipitation and post-precipitation drying and ignition of precipitates, principles of gravimetric estimation of chloride, phosphate, zinc, iron, aluminum and magnesium singly.

Unit V: Electro analytical methods: **Hrs- 9**
A- Classification of electroanalytical methods,
B-basic principle of pH metric, potentiometric and conductometric titrations.
C- Principle of spectrophotometric estimation

Text Books
1. D.A. Skoog, D.M. West and F.J. Holler, *Analytical Chemistry: An Introduction*, 5th edition, Saunders college publishing, Philadelphia, 1990.
2. U.N. Dash, *Analytical Chemistry: Theory and Practice*, Sultan Chand and sons Educational Publishers, New Delhi, 1995.
3. R.A. Day Jr. A.L. Underwood, *Quantitatives Analysis*, 5th edition, Prentice Hall of India Private Ltd., New Delhi, 1988.
4. R. Gopalan, *Analytical Chemistry*, S. Chand and Co., New Delhi

NEW CURRICULUM OF B.Sc. CHEMISTRY

SEMESTER VI (2019-20) MM-60 : HOURS -45; CREDIT -3

UNIT I -(A): Metal-Ligand Bonding in Transition Metal Complexes **Hrs-9**

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

(B):Thermodynamic and Kinetic Aspects of Metal Complexes

A brief outline of thermodynamic stability of metal complexes and

factors affecting the stability substitution reactions of square planar complexes.

(C)Electronic Spectra of Transition Metal Complexes

Types of electronic transitions, selection rules for *d-d* transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for d^1 - d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

UNIT II : (A) Organosulphur compounds: Hrs -9

Nomenclature, structural features, methods of formation and chemical reactions Of thiol, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.

(B)Organic Synthesis via Enolates:

Activemethylene group, alkylation of diethyl malonate and ethyl acetoacetate.

Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enoltautomerism of ethyl acetoacetate.

(C)Carbohydrates:

Configuration of monosaccharides. Erythro and threodiastereomers. Formationof glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D(+)-glucose..structure ofribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

UNIT III : Fundamentals of Spectroscopy Hrs-9

A.Introduction; characterization of electromagnetic radiation, regions of the spectrum, representation of spectra width and intensity of spectral transition, rotational spectra of calculated diatomic molecules, Energy levels of a rigid rotator, selection rules, , determination of bond length, qualitative description of non-rigid rotator, isotope effect.

B. Vibrational spectrum – Fundamental Vibrating diatomic molecules Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, determination of force constant, diatomic vibrating operator, An harmonic oscillator.

C Electronic Spectrum-electronic spectra of diatomic molecules,

Franck-Condon Principle, types of electronic transitions, application of electronic spectra.

UNIT IV : Spectroscopy of organic molecules **Hrs-9**

(A)UV- Visible spectroscopy :Beers-Lamberts law, effect of conjugation λmax,Wood ward fieser rule for calculating λ max of conjugated polyenes and carbonyl compounds

(B)Infra red spectroscopy: IR absorption band & their position and intensity,types of

Bending and stretching of molecules

(C)NMR Spectroscopy: Introduction to NMR, shielding and number of signal PMR, shielding , deshielding effect , chemical shift and characteristic values, splitting of signals and coupling constants, tau & delta scale

UNIT V: Quantum Mechanics **Hrs-9**

Black body radiation, Plank's radiation law, photoelectric effect, Compton effect. de Broglie`s idea of matter waves, experimental verification., Heisenberg's uncertainty principle, Sinusoidal wave equation, Operators Hamiltonian operator, angular momentum operator, laplacian operators ,postulate of quantum mechanics. Eigen values, Eigen function. Schrodinger's time independent, physical significance of ψ and ψ^2.application of Schrodinger wave equation , particle in a one dimensional box. Hydrogen atom (separation into three variables) radial wave function and angular wave function. Quantum mechanical approach of molecular orbital theory : basic ideas, criteria for forming M.O and A.O. LCAO approximation, formation of H_2^+ ion, calculation of energy levels from wave functions bonding and anti bonding wave functions .Concept of σ- σ^*, π- π^* orbitals and their characteristics, Hybrid orbitals-*sp*, sp^2, sp^3.

***REFERENCE BOOKS*:**

- Physical Chemistry; G. M. Barrow, McGraw Hill.
- University General Chemistry; C. N. Rao. Macmillan.
- Physical Chemistry; R. A. Alberty, Wiley Estern.
- The Element of Physical Chemistry; P. W. Atkin, Oxford
- Physical chemistry through problems;Droga&Droga,WileyEstern.
- Physical Chemistry B.D. Khosla.
- Physical Chemistry ;Puri&Sharma.
- BhautikRasayan ; P. L. Soni.
- BhautikRasayan; Bahal&Tuli.
- Physical Chemistry; R.L. Kapoor,Vol. I-IV.
- BautikRasayan;Puri&Sharma

NEW CURRICULUM OF B.Sc. CHEMISTRY

SEMESTER V&VI (2019-20) MM50; HOURS-60; CREDIT-4

Laboratory Course

GRAVIMETRIC ANALYSIS:

Analysis of Cu as CuSCN or CuO, Ni as Ni (DMG) $_2$, Ba as $BaSO_4$ and Fe as Fe_2O_3.

ORGANIC CHEMISTRY

(A)Qualitative analysis:

Analysis of an organic mixture containing two solid components using water, $NaHCO_3$,

NaOH for separation and preparation of suitable derivatives.

PHYSICAL CHEMISTRY

Electrochemistry:

(i) To determine the strength of the given acid conductometrically using standard alkali solution.
(ii) To determined the solubility and solubility product of sparingly soluble electrolyte by conductometrically.
(iii) To study the saponification of ethyl acetate conductometrically.
(iv) To determine the ionization costant of weak acid conductometrically.
(v) To titrate potentiometrically the given solution of ferrous ammonium sulphate with $KMnO_4$/$K_2Cr_2O_7$as titrant and calculate the redox potential of Fe^{++} / Fe^{+++} system on hydrogen scale.

Refractrometry and polarimetry:

(i) To verify law of refraction of mixture (glycerol and water) using Abbe`s refractometer.
(ii) To determine the specific rotation of a given optically active compounds.

Molecular weight determination:

(i) Determination of molecular weight of a non-volatile solute by Rast methods/ Backmann freezing point method.
(ii) Determination of the apparent degree of dissociation of an electrolyte (e. g. NaCl) in aqueous solution at different concentration by ebullioscopy.

Colorimetry :

To verify Beer-Lambert law for $KMnO_4$ / $K_2Cr_2O_7$and determine the concentration of the given solution of the substance.

LABORATORY COURSE - CBE -I

(SYNTHETIC ORGANIC CHEMISTRY)

Synthesis of organic compounds:

1. Acetylation of salicylic acid, aniline, glucose and hydroquinone. Benzoylation of aniline and phenol.
2. Aliphatic electrophilic substitution, preparation of iodoform from ethanol and acetone.
3. Aromatic electrophilic substitution.Nitration- preparation of m-dinitro benzene and p-nitro acetanilide. Halogenations: preparation of p- bromo acetanilide and2, 4 ,6-tribromophenol.
4. Diazotization/coupling: preparation of methyl orange and methyl red.
5. Oxidation: preparation of benzoic acid from toluene.
6. Reduction: preparation of aniline from nitro benzene and m-nitroaniline from m-dinitrobenzene.
7. Synthesis of Phenolphthalein, fluorescein

LABORATORY COURSE FOR CBE-II

(Selected Topics in Chemistry)

1.Paper chromatography (ascending and circular); separation of a mixture of phenylalnine and glycine, alanine and aspartic acid,leucine and glutamic acid,spray reagent ninhydrin.separation of a mixture of D, L – alanine,glycine and L-leucine using n-butanol+acetic acid + water (4:1:5) spray reagent ninhydrin.separation of monosccharides a mixture of D-glucose and-fructose using n-butanol+acetone+ water (4:1:5)spray reagent aniline hydrogen phthalate

2.Separation of fluorescein/ methyl orange and methylene blue

3. Separation of leaf pigments from spinach

4. Estimation of Protein

5. Preparation of Ni- DMG Complex

6. Determination of enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/ weak base.

LABORATORY COURSE - CBE -III:

(ANALYTICAL CHEMISTRY)

1. Determination of dissolved oxygen in water.

2. Determination of Chemical Oxygen Demand (COD)

3. Determination of Biological Oxygen Demand (BOD)

4. Measurement of chloride, sulphate and salinity of water sample by simple titration

method ($AgNO_3$ and potassium chromate).

5. Estimation of total alkalinity of water sample (CO_3^{--}, HCO_3^{-}) using double titration method.

6. Estimation of hardness of water sample.

7.To determine the solubility and solubility product of sparingly soluble electrolyte by conductometrically.

8.Steam distillation**-**Naphthalene from its suspension in water, Clove oil from cloves and Separation of o- and p- nitrophenols.

9.Thin layer chromatography***:***determination of R_f values and identification of organic compounds; separation of green leaf pigment (spinach leaves may be used), preparation and separation of 2, 4- dinitrophenylhydrazone of acetone, 2-butanone, hexan-2-and 3-one using toluene and light petroleum (40:60), separation of a mixture of dyes using cyclo hexane and ethyl acetate (8.5:1.5).

Recommended Texts:

- Furniss, B.S.; Hannaford, A.J.; Rogers, V.; Smith, P.W.G.; Tatchell, A.R. *Vogel's*
- *Textbook of Practical Organic Chemistry*, ELBS.
- Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry,*
- Universities Press
- To calculate acidity/alkalinity in given sample of pesticide formulations as per
- BIS specifications.
- Preparation of simple organophosphates, phosphonates and thiophosphates
- R. Cremlyn: *Pesticides*, John Wiley.
- E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.42
- R.M. Felder, R.W. Rousseau: *Elementary Principles of Chemical Processes*,
- Wiley Publishers, New Delhi.
- J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New
- Delhi.
- S. S. Dara: *A Textbook of Engineering Chemistry*, S. Chand & Company Ltd.
- New Delhi.
- K. De, *Environmental Chemistry*: New Age International Pvt., Ltd, New Delhi.
- S. M. Khopkar, *Environmental Pollution Analysis*: Wiley Eastern Ltd, New Delhi.

PRACTICAL EXAMINATION

MM -50, **08- Hrs**

Four experiments to be preformed.

1.Inorganic :- Gravimetric estimation carrying 10 marks.(manipulation 03 marks).

2.Organic Qualitative analysis of organic mixture containing two solid components.

10 marks (04 marks of each compound and 02 marks for separation).

3.Physical; one physical experiment carrying 10 marks

4.One experiment from CBE lab course 06- marks

5. Sessional - 04 marks

6. Viva - 10 marks

In case of Ex-students one mark each will be added to gravimetric analysis and qualitative analysis of organic mixture and two marks in physical experiment.