UNIVERSITYOFMYSORE

B.Sc.Degree–Chemistry Syllabus

NATIONAL EDUCATIONPOLICY(NEP)– 2020

2021-22

ISEMESTER

DSC-1:Chemistry-1

CLASS DURATION –THEORY:04HOURS/WEEK

TheoryandPracticals: TotalCredits-06(Theory-04,Practicals-02)

UNIT–I–Analyticalchemistry

Language of analytical chemistry: Definitions of analysis, determination, measurement, techniques andmethods. Classification of analytical techniques.Choice of an analytical method - accuracy, precision,sensitivity, selectivity, method validation.Figures of merit of analytical methods and limit of detection(LOD),Limit of quantification (LOQ), linear dynamicrange(workingrange).

Errors and treatment of analytical data: Limitations of analytical methods – Errors: Determinate andindeterminate errors, absolute error, relative error, minimization of errors. Statistical treatment of finitesamples -mean, median, range, standard deviation and variance. External standard calibration - regressionequation(leastsquares method), correlation coefficient (R2).

Numericalproblems

Basic laboratory practices, calibration of glassware (pipette, burette and volumetric flask), Sampling(solids and liquids), weighing, drying, dissolving, Acid treatment, Rules of work in analytical laboratory,General rule for performing quantitative determinations (volumetric and gravimetric), Safety in Chemicallaboratory, Rules of fire prevention and accidents, First aid. Precautions to be taken while handling toxicchemicals,concentrated/fumingacidsandorganicsolvents. **[14 Hours]**

UNIT-II:InorganicChemistry

Bohr's theory, its limitations and atomic spectrum of hydrogenatom. Wave mechanics: de Broglieequation,Heisenberg'sUncertaintyPrincipleanditssignificance,Schrödinger'swaveequation,significanceof ψ and $\psi 2$.Quantum numbersandtheirsignificance.

Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functionsfor hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Contourboundaryand probability diagrams.

Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations-Electronic configurations of the elements (Z=1-30), effective nuclear charge, shielding/screening effect,Slater'srules.Variationofeffectivenuclear chargeinPeriodicTable. **[14 Hours]**

UNIT-III:OrganicChemistry

Classification and nomenclature of organic compounds, Hybridization, Shapes of organic molecules,Influenceof hybridization on bond properties.

Natureofbonding inOrganicmolecules

Formation of Covalentbond, Types of chemical bonding, localizedanddelocalized, conjugation andcross conjugation, concept of resonance, electronic displacements: Inductive effect, Electromeric effect,Resonance and Hyper conjugation, cross conjugation explanation with examples. Concept of resonance,aromaticity, Huckel rule, anti-aromaticityexplanation with examples.Strengths of Organicacid andbases: Comparative study with emphasis on factors effecting pK values. Relative strength of aliphaticand aromatic carboxylic acids-Acetic acid and chloroacetic acid, acetic acid and propionic acid,aceticacidand Benzoicacid. Stericeffect-Relative stability oftrans and cis-2-butene.

MechanismsofOrganicReactions

Notations used to represent electron movements and directions of reactions- curly arrows, formal charges.Typesofbondsbreaking-homolyticandheterolytic.Typesofreagents-
Electrophiles,nucleophiles,nucleophilicityandbasicity.Typesoforganicreactions-
substitution,addition,elimination,rearrangementand pericyclicreactions, explanation with examples.
ChemistryofAliphatichydrocarbons,Carbon-CarbonSigmabonds
Chemistryofalkanes:Formationofalkanes,Wurtzreaction,Wurtz-Fittigreaction,Freeradicalsubstitution,Halogenation-relative reactivity and selectivity
Carbon-carbonpibonds
Formation of alkenes and alkynes by elimination reaction.Mechanism of E1, E2, E1cb reaction.SaytzeffandHofmanneliminations.AdditionofHBrtopropene,FreeradicaladditionofHBrtopropene.Addition of halogens to alkenes-carbocation and halonium ion mechanism.Stereospecificity of halogenaddition.Ozonolysismechanism-ozonolysisofpropene.Additionof hydrogenhalidestoalkenes,mechanism, regioselectivity and relative rates of addition. Hydrogenation, hydration, hydroxylation andepoxidation of alkenes, explanation with examples, 1,2 and 1,4- addition reactions in conjugated dienes.Diels-Alder reaction, Allylic and benzylicbromination and mechanism in propene, 1-butene, 1-tolueneandethylbenzene.

[14hours]

UNIT-IV:PhysicalChemistry

GaseousState

Elementary aspects of kinetic theory of gases, Ideal and real gases. Boyle temperature (derivation notrequired), Molecular velocity, collision frequency, collision diameter, Collision cross section, collisionnumber and mean free path and coefficient of viscosity, calculation of σ and η, variation of viscosity withtemperatureand pressure.
Maxwell's Boltzmann distribution law of molecular velocities (Most probable, average and root meansquare velocities).RelationbetweenRMS,average andmostprobablevelocityandaveragekineticenergies.(Mathematical derivation not required), lawof equipartition ofenergy.
Behaviour of real gases:Deviation from ideal gas behaviour. Compressibility factor (Z) and its variationwith pressure for different gases. Causes of deviation from ideal behaviour, vanderWaals equation of stat(Noderivation)andapplicationinexplainingrealgasbehaviour.Criticalphenomena-Andrewsisotherms of CO_2, critical constants and their calculation from van der Waals equation, Continuity ofstates,Law of corresponding states. Numerical problems.

LiquidState

Surface Tension: Definition and its determination using stalagmometer, effect of temperature and soluteonsurfacetension

Viscosity: Definition, Coefficient of viscosity.Determination of viscosity of a liquid using Oswaldviscometer.Effect oftemperature, size, weight,shapeof moleculesand intermolecularforces.

Refraction: Specific and molar refraction- definition and advantages. Determination of refractive indexbyAbbes Refractometer.Additiveand constitutiveproperties.

Parachor: Definition,Atomicandstructureparachor,Elucidationofstructureofbenzeneandbenzoquinone. Viscosity and molecular structure.Molar refraction and chemical constitution.NumericalProblems. **[14Hours]**

ISemesterPracticals

CHEMISTRY-DSC1LAB: 04HOURS/WEEK

ContentofPractical Course1: List ofExperiments

PART-AInorganicChemistry

1. Preparation of standard sodium carbonate solution and standardization of hydrochloric acidsolution (methyl orange indicator). Estimation of sodium hydroxide present in the solutionusingphenolphthaleinindicator.
2. Determinationofcarbonateandhydroxidepresentinamixture.
3. Determination of oxalic acid and sodium oxalate in a given mixtureusingstandard$KMnO_4$/NaOHsolution
4. Estimationofferrousandferricironinagivenmixtureusingstandardpotassiumdichromatesolution
5. Preparation of standard oxalic acid solution and standardization of potassium permanganatesolution.Estimation ofhydrogen peroxidepresent in thesolution.
6. Preparationofstandardoxalicacidsolutionandstandardizationofpotassiumpermanganatesolution.Estimation offerrousammonium sulphate presentin thesolution.

PART-BOrganicChemistry

1. Preparationof acetanilidefromanilineusingZn/aceticacid(Greenmethod).
2. Synthesisofp-nitroacetanilidefromacetanilideusingnitratingmixture.
3. Brominationofacetanilide
4. Hydrolysisofmethylm-nitrobenzoatetom-nitrobenzoicacid(Conventionalmethod)
5. Synthesisofdiazoaminobenzenefromaniline(conventionalmethod).
6. Preparationofdibenzalacetone(Greenmethod).

IISEMESTER

DSC-2:Chemistry-2

CLASS DURATION –THEORY:04HOURS/WEEK

TheoryandPracticals: TotalCredits-06(Theory-04,Practicals-02)

UNIT-I:AnalyticalChemistry

Titrimetricanalysis:Basicprincipleoftitrimetricanalysis.Classification,Preparationanddilutionofreagents/solutions.Normality, Molarity and Mole fraction. Use of N1V1= N2V2 formula, Preparation ofppmlevel solutions from sourcematerials (salts), conversion factors.

Acid-basetitrimetry: Titration curves for strong acid vs strong base, weak acid vs strong base and weak basevs strong acid titrations. Titration curves, Quantitative applications – selecting and standardizing a titrant,inorganicanalysis -alkalinity, acidity.

Complexometrictitrimetry:IndicatorsforEDTAtitrations-theoryofmetalionindicators,titrationmethodsemployingEDTA-direct,back,displacementandindirectdeterminations,Application-determinationofhardness of water.

Redox titrimetry: Balancing redox equations, calculation of the equilibrium constant of redox reactions,titrationcurves,Theoryofredoxindicators,calculationofstandardpotentialsusingNernstequation.Applications.

Precipitationtitrimetry:Titrationcurves,titrantsandstandards,indicatorsforprecipitationtitrationsinvolvingsilver nitrate-Volhard'sand Mohr'smethodsand theirdifferences.

GravimetricAnalysis:Requisitesofprecipitation,mechanismofprecipitation,Factorsinfluencingprecipitation, Co-precipitation, post-precipitation, Advantages of organic reagents over inorganic reagents,reagentsused in gravimetry(8-hydroxy quinoline(oxine)and dimethyl glyoxime(DMG).Numericalproblems [**14hours]**

Unit–IIInorganicchemistry

s,p,dandf-blockelements,thelongformofperiodictable.Detaileddiscussionof thefollowingpropertiesoftheelements, with referenceto sand p-block elements:

(a) Atomicradii(vanderWaals)

(b) Ionicand crystalradii.

(c) Covalentradii

(d) Ionizationenthalpy,successiveionizationenthalpiesandfactorsaffecting ionizationenergy.Applications of ionization enthalpy.

(e) Electrongainenthalpy,trendsofelectrongainenthalpy.

(f) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé'selectronegativityscales.Variationofelectronegativitywithbondorder,partialcharge,hybridization,group electronegativity.

Trendsinthechemistryofthe compoundsofgroups13to17(hydrides,carbides,oxidesandhalides) aretobediscussed.[14hours]

Unit–III Organicchemistry

Nucleophilicsubstitutionatsaturatedcarbon.MechanismofSN1andSN2reactionswithsuitableexamples.Energyprofile diagrams,Stereochemistryandfactorseffecting SN1andSN2 reactions.

AromaticElectrophilicsubstitutionreactions,Mechanisms,σandπcomplexes,Halogenation,Nitration,Sulphonation,FriedelCraftsalkylationandacylationwiththeirmechanism.Activatinganddeactivatinggroups.Orientation influence, Ortho-pararatio.

Aromaticnucleophilicsubstitutionreaction:SNArandBenzynemechanismwithsuitableexamples[14 hours]

Unit – IV Physical

Chemistry-

Liquid Crystals

Explanation,classificationwithexamples-

Smetic,nematic,cholesteric,dicsshapedandpolymeric.Structures of nematic and cholesteric phases-molecular arrangements in nematic and cholesteric liquidcrystals.Applications ofliquid crystals in LCDsand thermal sensing.

Solids

Formsofsolids:Unitcellandspacelattice,anisotropyofcrystals,sizeandshapeofcrystals,

Laws of Crystallography: Law of constancy of interfacial angles, Law of rational indices, Law of symmetry(Symmetryelements), Crystal systems,Bravais latticetypesand identification oflatticeplanes.

Miller indices and its calculation, X–Ray diffraction by crystals: Bragg's law and derivation of Bragg'sequation, Single crystal and powder diffraction methods. Defects in crystals, glasses and liquid crystals.Numericalproblems.

DistributionLaw

Nernst Distribution Law - Statement and its derivation. Distribution constant, factors affectingdistributionconstant,validityofDistributionLaw,Modificationofdistributionla wwhenmolecules undergo a) Associationb) Dissociation.Application of Distribution Law in Solventextraction. Derivation for simple and multiple extraction.Principles of distribution law in ParkesProcessof desilverisation oflead. Numerical Problems.**[14hours]**

IISemesterPracticals

CHEMISTRY-DSC2LAB:04HOURS/WEEK

PART-AAnalyticalChemistry

1. Preparationofstandardsodiumcarbonatesolution;standardizationofgivenHClsolutionandesti mationof alkali present in soap/detergent
2. Preparationofstandard $K_2Cr_2O_7$solutionandestimationofIron (II)inthe givensolution.
3. Preparation of standardoxalic acid solutionstandardization of given$KMnO_4$solutionand estimationofgivenoxalicacid solution.
4. PreparationofEDTAsolutionandestimation ofhardness($CaCO_3$)oftwodifferentsamples.
5. PreparationofstandardNa_2CO_3solution,standardizationofgivenHClsolutionandestimationof alkalipresent in given antacid.
6. Determinationofchlorineintwodifferentsamplesofbleachingpowderbyiodometry(standardso diumthiosulphatesolution to be supplied)

PART-BPhysicalChemistry

1. Determinationofdensityusingspecificgravitybottleandviscosityofliquidsusing Ostwald'sviscometer
2. Determinationofthedensityusingspecificgravitybottleandsurfacetensionofl iquidsusingStalagmometer
3. Determinationofthecompositionofliquidmixturebyrefractometry.(Toluene&Al cohol,Water&Sucrose)
4. Determinationofpartition/distributioncoefficient-i)Aceticacidinwaterand cyclohexane. ii)AceticacidinWaterandButanol.iii)Benzoicacidinwater andtoluene.
5. DeterminationofrateconstantofdecompositionofH_2O_2catalyzedby$FeCl_3$

6. DeterminationofpercentagecompositionofNaClsolutionbydeterminingmiscibil itytemperatureof phenol-watersystem.

III SEMESTER - DSC-3:Chemistry-III

(L:T:P=4:0:0) ContactHours:56 Credits:4 Workload:4Hours/Week

Unit-

I:Separationmethods:Fundamentalsofchromatography:Generaldescription,definition,termsandparameter susedinchromatography,classificationofchromatographicmethods,criteriaforselectionofstationaryandmobilep haseandnatureofadsorbents.Principlesofpaper,thinlayer,columnchromatography.Columnefficiency,factorsaff ectingthecolumnefficiency,vanDeemter'sequationanditsmodernversion. **3 Hrs.**

Paperchromatography:Theoryand applications

Thinlayerchromatography(TLC):Mechanism,Rfvalue,efficiencyofTLCplates,methodology– selectionofstationaryandmobilephases,development,sprayreagents,identificationanddetection,qualitativeap plications. **4**

Hrs.**SolventExtraction**:Types-

batch,continuous,efficiency,selectivity,distributioncoefficient,Nernstdistributionlaw,derivation,factorsaffec tingthepartition,relationshipbetween%extractionandvolumefraction,Numericalproblemsonsolventextractio n.Solventextractionofironand copper. **4Hrs**.

Ionexchangechromatography:resins,typeswithexamples-cationexchangeandanion exchange resins, mechanism of cation and anion exchange process and applicationsofion-exchangechromatography(softeningofhardwater,separationoflanthanides,industrialapplications). **3Hrs**.

Unit-II:

Structure and Bonding-I: The ionic bond: Structures of ionic solids. Radius ratio rules,Calculation of some limiting radius ratio values, Coordination number 3 (planar triangle),Coordinationnumber4(tetrahedralandsquareplanar),Coordinationnumber6(octahedral),Closepacki ng. **3Hrs**.

Classificationofionicstructures:

IoniccompoundsofthetypeAX(ZnS,NaCl,CsCI),IoniccompoundsofthetypeAX$_2$(Calciumfluoride (fluorite) and Rutile structure Layer structures CdI2, Cadmium iodide structure.Limitationsofradiusratioconcept **2Hrs**.

LatticeenergyandBorn-Habercycle,DerivationofBorn-Landeequationanditsdrawbacks,Kapustinskii equation, solvation energy and solubility of ionic solids, polarizing power andpolarizability,Fajan'sruleswithapplications.Numericalproblems **5Hrs.**

Covalent bond: Valence bond theory, The Lewis theory, The octet rule, Exceptions to theoctet rule, Sidgwick- Powell theory. Valence shell electron pair repulsion (VSEPR) theory,Effectoflonepairs,electronegativity,isoelectronicprinciple,ExamplesusingVSEPRtheory:BF_3andBF_4^-,NH_3andNH_4^+,H_2O,PCl_5,ClF_3,SF_4,I_3^-andI_3^+,SF_6,andIF_7.LimitationsofVSEPR.**7Hrs**.

Unit-III:

ReactionIntermediates:Generation,structure,stabilityandreactionsinvolving;

i. **Carbocations**:Dienone-phenolandPinacol-PinacoloneRearrangement.
ii. **Carbanions**:PerkinReaction,Aldolcondensation,Claisen-Schmittcondensation.
iii. **FreeRadicals**:Chlorinationofmethane,formationofgammaxene(lindane).
iv. **Carbenes**:Singletandtripletstates,theirrelativestability.Riemer-Tieman,andWolffrearrangement.
v. **Nitrenes**:Singletandtripletstates,theirrelativestability.Hoffman&Curtiusreactions.
vi. **Arynes**:Formation,detection.Bromobenzenetoaniline,(4+2)cycloadditionreaction.**8Hrs.**

MethodsforIdentifyingReactionMechanism:Productanalysis,IsolationandIdentificationofIntermediates,S

tereochemicalEvidences,EffectofCatalyst,crossoverExperiments,Isotopicstudies,KineticStudies. **6Hrs.**

Unit-IV:

Chemical Kinetics: Introduction, rate of reaction, order and molecularity with examples.Rateconstant-definitionandexplanation.Differentialandintegratedformofrateexpressions up to second order reactions, Derivation of expression of rate constant ofsecondorderreaction(a=banda≠b),Problemsonrateconstant(a=b),Methodsofdetermination of order of a reaction (half-life method, isolation method), temperaturedependence of reaction rates; Arrhenius equation, activation energy, Numerical problemson Arrhenius equation in calculating energy of activation and rate constants. Collisiontheory of reaction rates, Lindemann's mechanism, qualitative treatment of the theory ofabsolute reaction rates. Experimental determination of kinetics of (i) inversion of canesugar by polarimetric method (ii) spectrophotometric method for the reaction betweenpotassiumpersulphateandpotassiumiodide. **7Hrs.**

Electrochemistry–I:Introduction,strongandweakelectrolytes,definitionwithexamples.Arrhenius theory of electrolytic dissociation.Merits and Demerits, Conductance, Specificconductance, equivalent and molar conductivity and their variation with dilution.Molarconductivityat infinitedilution.Numericalproblems.Kohlrausch's law of independent migration of ions and its applications, Debye-Hückel-Onsager equation.Ionic mobilities and their determinations, transference numbers andtheir relation to ionic mobility's, determination of transference numbers using Hittorf andMovingBoundarymethods.

Applicationsofconductancemeasurement:(i)Degreeofdissociationofweakelectrolytes (ii) ionic product of water (iii) solubility and solubility product of sparinglysoluble salts (iv) conductometric titrations (acid base titrations only) and (v) Hydrolysisconstantsofsalts.Numericalproblems. **7Hrs.**

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DSC-3:Chemistry-IIIPractical

(L:T:P=0:0:2) ContactHours:56 Credits:2 Workload:4Hours/Week

PartA:**InorganicChemistryPracticals**-Qualitativesemi-microanalysisofmixturescontaining2anionsand2cations.**Cations**:NH_4^+,Pb^{2+},Bi^{3+},Cu2+,Al^{3+},Fe^{3+},Co^{2+},Cr^{3+},Ni^{2+},Zn^{2+},Mn^{2+},Ba^{2+},Ca^{2+},Sr^{2+},Mg^{2+},Na^+,K^+andLi$^+$.

Anions:CO_3^{2-},CH_3COO^-,Cl^-,Br^-,I^-,NO_3^-,BO_3^{3-},SO_4^{2-},$C_2O_4^{2-}$andPO_4^{3-}.

PartB:**PhysicalChemistryPracticals**

1. Determinationoftheenthalpyofneutralizationofastrongacidwithstrongbase.
2. VerificationofFreundlichandLangmuirisothermsforadsorptionofaceticacidon activatedcharcoal.
3. Thestudy of kinetics of potassium persulphate and potassium iodidevolumetrically.
4. Determinationofvelocityconstantforacidcatalyzedhydrolysisofmethylacetatevolumetrically.
5. Determinationofvelocityconstantforthesaponificationofethylacetate(a=b)volumetrically.
6. Determination of equivalent conductivity of strong electrolyte and verification of DHOequationusingmeter bridge.
7. Determinationofdissociationconstantofweakacidbyconductivitymethod
8. Conductometrictitrationofstrongacidandstrongbase.
9. Conductometrictitrationofweakacidandstrongbase.
10. Determinationofthehydrolysisconstantofanilinehydrochlorideby conductometricmethod.
11. Determinationofsolubilityproductofsparinglysolublesaltbyconductometricmethod.

IV SEMESTER- DSC-4:Chemistry-IV

(L:T:P=4:0:0) ContactHours:56 Credits:4 Workload:4Hours/Week

Unit-I:

Quantitative analysis-Instrumental methods: Electromagnetic spectrum, absorption ofelectromagnetic radiation, Definition and units of frequency, wavelength, wave number,Beer'slaw,Beer-Lambertlawderivation,deviationsfromBeer'slaw,limitations,construction of calibration graph (Plot of absorbance versus concentration), EvaluationProcedures-standardaddition,Internalstandardaddition,validationparameters-detection limits, sensitivity, dynamic/linearity range, Instrumentation, single beam anddouble beam spectrophotometers, quantitative applications of colorimetry (determinationofFe,Mo,Cu,TiandPO4^{3-})andnumericalproblems on application of Beer's law.**10Hrs**.

NephelometryandTurbidimetry:Introduction,principle,instrumentationsofnephelometry and turbidimetry; effects of concentration, particle size and wavelength onscattering; choice between nephelometry, applications of nephelometry&turbidimetry(determinationofS04^{2-}andPO4^{3-}). **4Hrs.**

Unit-II:

StructureandBonding-II:

Concept of resonance, resonance energy, hybridization, types of hybridization, sp, sp^2, sp^{3}dsp^2, dsp^3, d^{2}sp^3, sp^{3}d^2 with one example each, and energetics of hybridization. Bent's rule,LimitationsofValenceBondTheory. **3Hrs.**

Molecular Orbital theory: LCAO concept: s-s,s-p,p-p,p-dandd-dcombinationsoforbitals,bonding,nonbondingandantibondingmolecularorbitals,non-bondingcombinationsoforbitals, Rulesforlinearcombination ofatomicorbitals.Examplesofmolecularorbitaltreatmentforhomonucleardiatomicmolecules:H2molecule,H$_2^+$ molecule ion, He2 molecule, He2$^+$ molecule ion, Li2 molecule, Be2 molecule, B2 molecule,C2molecule, N2molecule, N2$^+$moleculeion, O2molecule, O2$^-$andO2^{2-}moleculeions.M.O. Energy diagrams of heteronuclear diatomic molecules with examples (NO, NO+, COand HCl).Calculation of bond order, relationship between bond order, bond energy, andbondlength,magneticpropertiesbasedonMOT.**7Hrs.**

MetallicBonding:Generalpropertiesofmetals-conductivity,lustre,malleabilityandcohesiveforce.Crystalstructures of metalsand Bondlengths.

Theories of bonding in metals: Free electron theory, valence bond theory, molecularorbitalorbandtheoryofsolids.Predictionofconductingpropertiesofconductors,insulatorsandsemiconductors,extrinsicandintrinsicsemiconductorsusingM.O.theory.4Hrs.

Unit-III:

StructureandStereochemistryofOrganicCompounds:

Conceptofisomerism,typesofisomerism.Projectionformulaeofchiralmolecules-Fischer(glyceric acid), Newman (2,3-dibromobutane), Sawhorse (2,3-dibromobutane) and Fly-wedge(glycericacid)projectionformulae.Interconversionofprojectionformulae:Conversion of;FisherintoSawhorseprojection(tartaricacid),SawhorseintoFisherprojection (2,3-dibromobutane), Sawhorse to Newman to Fisher projection (3-amino-3-bromo-2-chlorobutan-2-ol),FishertoNewmantoSawhorse(3-chloro-2,4-dihydroxybutanal), Fisher into Fly-wedge formula and vice- versa (2-bromo propanoicacid), **4Hrs**.

Geometrical isomerism: Cause of geometrical isomerism. Cis-trans isomerism (cinnamicacid, but-2-enedioic acid) and syn-anti isomerism (benzaldoxime, ethyl methyl ketoxime),E/ZnotationswithexamplesfollowingC.I.P rules.

Optical Isomerism: Optical activity, conditions for optical activity-Elements of

symmetry(plane,centre,C2-axis,rotation-reflectionwithexamples).Specificrotation,Chirality/Asymmetry, Enantiomers-definition with examples, properties, Molecules withtwo or more chiral centres, Diasteroisomers-definition with examples (threo and erythoisomers), properties.Meso compounds-definition with examples. optical isomerism intartaricacid,andbiphenyls.Asymmetricsynthesis,Waldeninversion.Racemicmodification- Definition with examples.Resolution-definition with examples, chemical andbiochemical methods of resolution, Relative and absolute configuration, D/L convention,limitations,andR/Sdesignations-CIPruleswithexamples. **10Hrs**.

Unit-IV:

First Law of Thermodynamics: Introduction, system, surroundings, types of systems.ThermodynamicProcesses(isothermal,adiabatic,isochoric,isobaricandcyclic),NatureofHeatandWork,InternalEnergy,FirstLawofThermodynamics,EnthalpyofaSystem,Workdone in isothermal and adiabatic expansion of an ideal gas, Numerical problems, Joule -ThomsonExpansion,RelationbetweenJoule-Thomsoncoefficientandotherthermodynamicparameters.

Second law of Thermodynamics: Limitations of first law of thermodynamics. Reversibleand IrreversibleProcesses,Concept of entropy, thermodynamic scale of temperature,StatementsoftheSecondLawofThermodynamics,molecularandstatisticalinterpretationofentropy, Calculation of entropy change for reversible and irreversible processes, Free EnergyFunctions: Gibbs and Helmholtz energy, variation of S, G, A with T, V and P, Numericalproblems,Free energychange andspontaneity,Gibbs-Helmholtzequation.

ThirdLawofThermodynamics: Statement of third law, concept of residual entropy,calculationofabsoluteentropyofmolecules. **10 Hrs.Surface Chemistry Adsorption:** Introduction, types of adsorptions with examples. Types ofadsorption isotherms.Freundlich adsorption isotherm (only equation), itslimitations.Langmuir adsorption isotherm (derivation to be done) and BET equation (derivation notincluded).

Catalysis: Types of Catalysis (positive, negative, auto and induced), characteristics ofcatalysis, and theories with examples (intermediate compound theory and adsorptiontheory),Theoryofacidbasecatalysis,Michaelis-Mentenmechanism.Heterogeneouscatalysis: surface reactions, unimolecular, bimolecular surface reactions. Autocatalysis withexamples. Applications: Design process to removal of toxic compoundsfrom industrialwastewaterandtreatmentofportablewaterrequirements. **4 Hrs.**

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DSC-4:Chemistry-IVPractical

(L:T:P=0:0:2) ContactHours:56 Credits:2 Workload:4Hours/Week

PART-A:AnalyticalChemistryPracticals

1. Colorimetricdeterminationofcopperusingammonia solution.
2. Colorimetricdeterminationofironusingthiocyanate solution.
2. ColorimetricdeterminationofnickelusingDMGsolution.
3. Colorimetricdeterminationoftitaniumusinghydrogenperoxide.
4. Colorimetricdeterminationofnitriteinawatersample(diazocouplingReaction/Griess reagent.
5. Colorimetricdeterminationofphosphateasammoniumphosphomolybdate.
6. DeterminationofRfvaluesoftwoorthreecomponentsystemsbyTLC.
7. Separationofdifferentmetalionsbypaperchromatography/Solventextractionofironusingoxine solution (demonstration).

PART-B:OrganicChemistryPractical

Qualitative analysis of mono and bifunctional Organic compounds: Benzoic acid, Salycilicacid,*p*-Nitrobenzoicacid,Anthranilicacid,p-Chlorobenzoicacid,*o*-Cresol,*p*-Cresol,Resorcinol, *o*- Nitrophenol, *p*-nitophenol, *o*-Nitro aniline, *p*-Nitroaniline, *p*-Toluidine, *p*-Chloroaniline,*p*-Bromoaniline,EthylSalicylate,Salicylaldehyde,Acetophenone,Urea,Thiourea,Aniline,Benzldehyde,acetanilide,Naphthalene,Chlorobenzene,*p*-Dichlorobenzene, *p*-Nitro toluene, Benzamide etc. (At least 6-8 compounds to be analyzedin asemester).

V SEMESTER- CHDSC-5:Chemistry-V

(L:T:P=4:0:0) ContactHours:60 Credits:4 Workload:4Hours/Week

Unit-I:InorganicChemistry 15Hrs.

Coordinationcompounds:Ligands,classificationofligands,andchelation,physicalmethodsinthestudyofcomplexes–changeinconductance,colorandpH.Nomenclatureofco-ordinationcompounds,Innermetallicpolynuclearandbridgedcomplexes,Preparationofcomplexes-bysimpleadditionreactions,substitutionreactionsandoxidation-reductionreactions.Geometriesofcomplexeswithcoordinationnumber3to8. **05 Hrs.Metal-Ligand equilibriainsolution**: Stabilityof complexes-kinetic andthermodynamicstabilityofmetalcomplexes,step-wiseandoverallformationconstantandtheirrelationship,trendsinstep-wiseconstant.Factorsaffectingthestabilityofmetalcomplexeswithreferencetothenatureofthemetalionandligand,chelateeffect,macrocycliceffectandtheirthermodynamicorigin.Determinationofformationconstantbypotentiometric,andspectrophotometricmethods. **06Hrs.**

Isomerisminco-ordinationcomplexes: Structuralisomerism-Ionization,Hydrate,linkage,Ligandisomerism.Stereoisomerism–Geometricalandopticalisomerismexhibitedbyco-ordinationcompoundsofco-ordinationnumber4and6. **04Hrs.**

Unit-II:OrganicChemistry 15Hrs.

Aromaticity,Homo-aromaticityofazulene,tropone,tropolone,annulenes,benzenoids,meso-ionic compounds.Alternant and non-alternant hydrocarbons, Energy levels in oddandeven-alternanthydrocarbons. **02Hrs.**

Stereochemistry: Chiralityinallenes,alkylidenecycloalkanesandspiranes(withastereogenicaxis).Cram'sandPrelog'srules.Conformationalanalysisofsubstitutedcycloalkanes(Methyl,iso-propyl,tert-butyl,dialkyl,dihalo,diols),andcycloheptane.Nomenclature and conformations of fused rings and bridged ring systems. Prochirality:Enantiotopicanddiastereotopicatoms,groupsandfaces. **06 Hrs**.**Vitamins:**Definition,classification.Structureelucidation,synthesisandbiologicalimportance of Vitamin A, and Vitamin C. Structural formulae and biological importance ofthiamine,pyridoxine,folicacid,pantothenicacid,riboflavin,α-tocopherol,biotin,vitaminK1andvitamin K2. **07Hrs**.

Unit-III:PhysicalChemistry 15Hrs.

Photochemistry: Laws of photochemistry: Grothus-Draper's law, Stark-Einstein law ofphotochemical equivalence. Quantum efficiency: definition, reasons for low quantum yieldandhighquantumyieldwithexamples(formationofHBrandformationofHCl).Actinometers: Uranyl oxalate actinometer, Potassium ferrioxalateactinometer (Qualitativestudy).(Numerical problems).

Photophysicalprocesses: Jabolonskidiagram,photosensitization(mercuryasanexample),photoinhibition,fluorescenceandphosphorescence,chemiluminescenceandbioluminescence(explanation withexamples),mechanism (qualitative).

RadiationChemistry:Definition,primaryandsecondarystagesinradiochemicalreactions,ionic yield, energy yield, comparison with photochemistry. Units of radiation-rad,

gray,Roentgen.Dosimeters-Frick-dosimeter,cericsulphatedosimeter(qualitativestudy)theories of radiolysis – Lind's and EHT theories.Radiolysis of water (qualitative study) andaceticacid. **10Hrs.**

Phase equilibria: Definition of the terms-phase, component and degree of freedom withexamples. Statement of Gibb's phase rule and thermodynamic derivation. Applications: (a)one component system (water system); (b) reduced phase rule and reduced system, twocomponentsystem(Silver-leadsystem,eutectictype),desilverizationofleadandFeCl3-H2Osystem(congruentmeltingpoint).Freezingmixtures:Definitionandexamples,explanationbasedonKI-watersystem. **05Hrs.**

Unit-IV:MolecularSpectroscopy **15Hrs.**

Electromagneticradiation:Regionsofelectromagneticradiations(spectra),molecularenergylevels, absorptionandemissionspectra,Born-Oppenheimerapproximation.

Rotationspectroscopy: Selectionrules,expressionforrotationalspectraofdiatomicmoleculesforrigid rotatormodel,momentofinertia(expressiontobederived)rotationalenergyrotationalspectrallines,determinationofbondlengthsofdiatomicmolecules,isotopicsubstitutioneffectonrotationallines. **05 Hrs.**

Vibrationalspectroscopy: Selectionrules,classicalequationofvibration,computationofforceconstant,expressionforvibrationalenergylevelsandpotentialenergyofsimpleharmonicoscillator,zero-pointenergy,determinationofforceconstantbonddissociationenergies,fundamentalfrequencies,overtones.Thenumberofdegreesoffreedomofvibrationspolyatomicmolecules,modesofvibration(CO2and H2O). **05 Hrs.**

Raman spectroscopy-

Selectionrules,originofRamanspectrum,quantummechanicaltheory,stokesandanti-stokeslines.PurerotationalRamanspectraofdiatomicmolecule(derivation),andvibrationalrotational Ramanspectrafordiatomicmolecule(explanationwithequation).

Electronicspectra: Conceptsofpotentialenergycurvesforbondingandanti-bondingmolecularorbitals,Franck-Condonprinciple. **05Hrs.**

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CHDSCP-5:Chemistry-VPractical

(L:T:P=0:0:2) ContactHours:60 Credits:2 Workload:4Hours/Week

PART-A:OrganicPreparations(Multistepsynthesis):

1. Preparationof*p*-bromoanilinefromacetanilide.
2. Preparation ofanthranilicacidfromphthalicacid.
3. Preparationofbenzanilidefrombenzophenone.
4. Preparationof2,4-dinitrophenylhydrazinefromchlorobenzene.
5. Preparationofacridonefrom2-chlorobenzoicacid.
6. Preparationofbenzocainefromp-nitrobenzoicacid
7. PechmannReaction:Preparationofcoumarinfromresorcinolandethylacetoacetate.
8. Sandmeyerreaction:Preparationof4-chlorotoluenefrom4-toluidine.

PART-B:OrganicEstimations:

1. Estimationofglucosebycolorimetricmethod.
2. Estimationofaspirinbycolorimetricmethod.
3. Estimationofascorbicacidbyiodometricmethod.
4. Estimationofaminoacidsbyformylationmethod.
5. Estimationofcarboxylicacid.
6. Estimationofaminogroup.
7. Determinationofsaponificationvalueofoil.

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CHDSC-6:Chemistry-VI

(L:T:P=4:0:0) ContactHours:60 Credits:4 Workload:4Hours/Week

Unit-I:InorganicChemistry 15Hrs.

Modern conceptofacidsandbases:Lux-FloodandUsanovichconcepts,solventsystemandlevelingeffect.Hard-SoftAcidsandBases,ClassificationandTheoreticalbackgrounds.**Non-aqueoussolvents**:Classificationofsolvents,Propertiesofsolvents(dielectricconstant,donorandacceptorproperties)proticsolvents(anhydrousH_2SO_4,HFandglacialaceticacid)aproticsolvents(liquidSO_2,BrF_3andN_2O_4).Solutionsofmetalsinliquidammonia,hydratedelectron.Superacidsandsuperbases. **07 Hrs.**

Chemistryofmaingroupelements:Structureandbondinginboranes(B_2H_6,B_4H_{10},B_5H_9),carboranes($C_2B_{10}H_{12}$,$C_2B_9H_{13}$,$C_2B_6H_{12}$),Wadesrules,borazines,phosphazines,S,N-compounds.

M-Mbondandmetalatomclusters:Halideclusters,bondingin$[ReCl_8]^{2-}$.Metalcarbonylclusters-LNCC's and HNCC's. Electron counting in carbonyl clusters, Wades-Mingos andLauherrule. **08Hrs.**

Unit-II:OrganicChemistry 15Hrs.

Carbohydrates: Introduction.Monosaccharides-Openandringstructureofglucose,mutarotation, epimerization. Interconversion reactions (aldose to ketose, ketose to aldose,chainelongation-Killiani-Fischermethod,andchaindegradation-Ruff'smethod),Determinationringsizeofglucose(methylation).Determinationofconfigurationandconformational analysis of monosaccharides (glucose, galactose). Amino sugars: Structuralformulae andconformations of α- andβ- (glucosamine, galactosamine). Disaccharides-Structure elucidation of sucrose.Polysaccharides-partial structural formulae of starch andcellulose.Applicationofstarchintitrimetricanalysis. **08 Hrs.**

Heterocycliccompounds: Definition,classificationandnomenclature. Furan-synthesis(frompentasan),reactions(nitration,acylation).Thiophene-synthesis(from sodium succinate), reactions (sulphonation, chlorination).Pyrrole-synthesis (fromfuran),reactions(diazotization,Riemer-Tiemann).Pyridine-synthesis(fromacetylene),reactions (bromination, with $NaNH_2$).Aromaticity and basicity of pyrrole and pyrimidine.Indole:Synthesis(Fischer),reactions(Br_2/HOAc,$CHCl_3$/NaOH).Quinoline:Synthesis(Skraup), reactions (nitration, with $NaNH_2$, with $KMnO_4$/NaOH). Pyrazole: Synthesis (Fromacetylacetoneandhydrazine),reactions(nitration,bromination). **07Hrs.**

Unit-III:PhysicalChemistry 15Hrs.

QuantumMechanics:Introduction,blackbodyradiation,plankradiationlaw,photoelectriceffect,Comptoneffect,deBroglieconceptand uncertaintyprinciple. ConceptsofOperators:Laplacian,Hamiltonian,LinearandHermitianoperators.Commutativeandnon-commutativeofoperators.Eigenfunctionandeigenvalues.Postulates of quantum mechanics. Solutions of Schrödinger wave equation for a free particle,particleinaone-dimensionalbox. **05Hrs.**

Colligativeproperties:Definitionandexamples.

Lowering of vapour pressure: Raoult's law (to be derived), relationship between relativelowering of vapour pressure and molar mass (to be derived).Experimental determinationofmolarmassofthesolutebyDynamicmethod(Numerical problems).

Elevation in boiling point: Definition, its relation to lowering of vapour pressure andmolar mass (to be derived). Ebullioscopic constant of the solvent and its relation to theboilingpoint(onlyequation).Experimentaldeterminationofmolarmassofthesoluteby Walker–Lumsdenmethod(Numericalproblems).

Depression in freezing point: Definition, its relation to lowering of vapour pressure andmolar mass (to be derived). Cryoscopic constant and its relation to melting point (onlyequation), Determination of molar mass of non-volatile solute by Rast method (Numericalproblems).
Semipermeablemembrane:Definition,typeswithexamples.Preparationofartificialsemipermeable membrane (copperferrocyanide) byMorse-Frazer method.
Osmoticpressure: Definitionofosmosis,reverseosmosisandosmoticpressure.Determination of osmotic pressure by Berkely-Hartley's method (Numerical problems).Applicationsof osmoticpressure (mention only).
Osmotic laws and analogy with gas laws: Relationship between molar mass and osmoticpressure(tobederived).Isotonicsolutions,plasmolysisandhaemolysis.Abnormalmolecularm ass, causes,vantHoff'sfactor(Numericalproblems). **10Hrs.**

Unit-IV:UV-VisibleSpectroscopy **15Hrs.**
Introduction, measurement of absorption intensities, absorptionmaxima(λmax),instrumentation, types of electronic transitions, concept of chromophores andauxochromes.Absorptionandintensityshifts(bathochromic,hypsochromic, hyperchromicandhypochromic).Typesofabsorptionbands(K,R,BandE-bands).Theeffectofsolventstemperatureandconjugationonabsorption. **05 Hrs.**Woodward-Fieserrulesforcalculationofabsorptionmaximafor:Conjugateddienes(aliphatic,alicyclic,exocyclic,h omoannular,heteroannular,withand/orwithoutextendedconjugation,andpolyenes),α,β-Unsaturatedcarbonylcompounds(aldehydes,ketones,carboxylicacids,esterswithand/orwithoutexten dedconjugation)andAcylbenzenederivatives.AbsorptionincompoundswithN-Obonds,quinones,α-diketones,α-ketoaldehydes,benzeneanditsderivatives.Absorptionspectraofheterocyclicandcondensedringsyste ms(cata-condensedandperi-condensed).Effectofsterichindranceandcoplanarity (cis, trans isomers) on absorption. The electronic transitions in charge transfercomplexes,andketo-enoltautomers. 1**0Hrs.**

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CHDSCP-6:Chemistry-VIPractical

(L:T:P=0:0:2) ContactHours:60 Credits:2 Workload:4Hours/Week

PART-A:

1. Conductometrictitrationofweakacid(CH_3COOH/HCOOH)versusweakbase(Ammoniumh ydroxide).
2. ConductometrictitrationofamixtureofHClandCH3COOHversusNaOH.
3. Conductometrictitrationofstrongacid(HCl)withsalt($CuSO_4$)versusNaOH.
4. PotentiometrictitrationofFASversus$K_2Cr_2O_7$.
5. Potentiometricmethodofdeterminationofdissociationconstantof Formicacid.
6. PotentiometrictitrationofweakacidCH3COOHagainstastrongbaseNaOHusingquinhydron eelectrodeandcalculationofpKaandKa oftheweakacid.
7. ColorimetricestimationofFe^{2+}ionsconcentrationinthegivensolutionbytitrationofFASversu sKMnO4.
8. ColorimetricestimationofFe^{2+}ionsconcentrationusing1,10-phenanthroline.

PART-B:

1. Determinationoftheisoelectricpointofanaminoacidbyp Hmetry.
2. DeterminationofpHofaceticacidwithsodiumacetatebufferbyp Hmetry
3. PotentiometricdeterminationofpHofabufferbyusingquinhydroneelectrodeandcomparisonof thepHvaluesobtainedwith glasselectrode.
4. Colorimetricdeterminationofdissociationconstantofagivenindicator.
5. Potentiometric titrationofAgNO3versusKCl(demonstration).
6. Conductometrictitrationofweakacid(CH3COOH)withsalt(CuSO4)versusNaOH.
7. DeterminationofpKavalueofphosphoricacidbyp Hmeter.

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VI SEMESTER

CHDSC-7:Chemistry-VII

(L:T:P=4:0:0) ContactHours:60 Credits:4 Workload:4Hours/Week

Unit-I:InorganicChemistry 15Hrs.

Metal-ligand bonding: Valence bondtheory: Salient features,formationandmagneticproperties of octahedral complexes $[Fe(CN)_6]^{4-}$, $[Fe(CN_6)]^{3-}$, $[Co(CN)_6]^{3-}$,$[CoF_6]^{3-}$ $[Cr(H_2O)_6]^{3+}$and$[Fe(H_2O)_6]^{2+}$.Formationandmagneticpropertiesoftetrahedralandsquareplanarcomplexes$[Ni(CO)_4]$,$[Cu(NH_3)_4]^{2+}$,$[Ni(CN)_4]^{2-}$and$[Pt(Cl_4)]^{2-}$,limitationsofVBT. **04 Hrs.Crystalfieldtheory**: Salientfeatures,splittingofd-orbitalsinoctahedral,tetrahedral,andsquareplanargeometry.Applications-colorsoftransitionmetalcomplexes,magneticproperties of octahedral complex, CFSE and their uses. Factors affecting CFSE: Geometry ofcomplexes,natureofthecentralmetalion,natureofligand,andspectrochemicalseries.Limitations of CFT.Experimental evidence for metal-ligand covalent bonding in complexes,nephelauxeticeffect.MOtheory:tetrahedralandoctahedralcomplexes(includingp-bonding). **08Hrs.**

Magneticpropertiesofcoordinationcompounds: Introduction,magneticsusceptibilityand its determination- Gouy and Faraday method, the effects of temperature on µeff,ferromagnetism,anti-ferromagnetismandferrimagnetism. **03Hrs.**

Unit-II:OrganicChemistry 15Hrs.

AromaticElectrophilicSubstitutionReactions:Quantitativetreatmentofreactivityinsubstratesandelectrophiles.Amination,sulfonylation,diazoniumcoupling,Vilsmeier-Haackreaction,Gattermanreaction,Gatterman-KochreactionandHoeschreaction.

AromaticNucleophilicsubstitutionreactions:TheGoldbergreaction,Buchererreaction,Schiemannreaction,vonRichterreaction,andSommelet-Hauserreactions. **07 Hrs.AdditionReactions:**Additionreactionsofcyclopropanering.Additionreactionsofcarbon-heteroatommultiplebonds:Mechanismofmetalhydridereduction(NaH,LiH,LiAlH4,NaBH4),Grignardreagent(CH3MgBr)andorganolithium(CH3Li)ofsaturatedandunsaturatedcarbonylcompounds.Hydrolysisofnitrileswithmechanism.Wittig,MannichandStobbe reactions.

EliminationReactions: Effectsofsubstratestructure,attackingbase,theleavinggroupandthemediumoneliminationreactions.Chugaevreaction. **08Hrs.**

Unit-III:PhysicalChemistry 15Hrs.

Ionicequilibria: Ionicequilibriainaqueoussolutions,strongandweakelectrolytes-definition and examples. Ostwald's dilution law (to be derived) and its limitations.Debye-Huckel theory of strong electrolytes (relaxation time, electrophoretic effect and viscouseffect).Activity and activity coefficient–definition and their relation. Hydrolysis of salts-Derivationofhydrolysisconstantanddegreeofhydrolysisofthesaltofweakacidandweakbase (ammonium acetate as an example), effect of temperature on degree of hydrolysis.(Numericalproblems). **05Hrs**.

Electrochemistry-II: Electrolytic and Electro chemical cells (galvanic cells)-Daniel cell(construction,workingandcellreaction).Reversibleandirreversiblecells,rulesforrepresentationofacell,singleelectrodepotential,Standardelectrodepotential,signconventionforelectrodepotential,Nernstequationforsingleelectrodepotential(Derivation).

Referenceelectrodes: Calomelelectrode,Ag-AgClelectrode**.**Westonstandardcell

(Construction, working, reaction and standard emf). Equilibrium constant and free energyof a cell reaction, Concentration cell with transport (example) concentration cell withouttransport, EMF of concentration cell (derivation). Liquid junction potential.Salt bridge.Applicationofconcentrationcell:Valencyofionsandsolubilityproductofsparinglysolublesalt. Applications of EMF measurements in (a) Determination of pH of a solution using - (i)quinhydroneelectrode,(ii)glasselectrode.(b)Potentiometrictitration-principleandlocation of end point in (i) Oxidation - reduction reaction, (ii) Precipitation reaction, iii)acid-basereaction. **10Hrs**.

Unit-IV:InfraredSpectroscopy **15Hrs.**

Introduction,principle,modesofvibrations,vibrationalfrequency.Factorsinfluencingvibration frequencies (coupled vibration, electronic effects, and bond angles).Finger printregionanditssignificance.EffectsofH-bonding,conjugation,resonance,andringsizeonIRabsorptions. **04Hrs.**

IRabsorptionfrequencypositionsin;Hydrocarbons(alkanes,alkenes,alkynes,cycloalkanes,aromatic),halogencompounds,alcoholsandphenols,ethers,aldehydesandketones(aliphatic,alicyclic,andaromatic),estersandlactones,carboxylicacids,acidhalides,acidanhydrides,amides,lactams,amines,aminoacids,nitrocompounds, anilides,nitriles,thiols, thiophenols, sulphonicacids,sulphonamides,andheteroaromaticcompounds. **07 Hrs.**Coordinationcompounds:Changesininfraredspectraofdonormoleculesuponcoordination(*N*,*N*-dimethylacetamide,urea,DMSO,pyridineN-oxide,ammine,cyano,cyanatoandthiocyanatocomplexes),monoandmultinuclearcarbonylcomplexes, nitrosyls,andphosphinecomplexes. **04Hrs.**

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CHDSCP-7:Chemistry-VIIPractical

(L:T:P=0:0:2) ContactHours:60 Credits:2 Workload:4Hours/Week

PART-A:GravimetricandVolumetricAnalysis

1. GravimetricdeterminationofFeinironoreasFe2O3.
2. Gravimetricestimationofcalciumascalciumoxide.
3. Gravimetricestimationofaluminumasaluminumoxide.
4. Gravimetricestimationofmagnesiumasmagnesium8-hydroxyoxinate.
5. Gravimetricestimationofleadas leadchromate.
6. GravimetricdeterminationofNiusingDMGinCuandNisolution.
7. GravimetricdeterminationofFeusingNH4OHinFeandCrsolution.
8. GravimetricestimationofCuusingNH4SCNinCuandZnsolution.
9. VolumetricestimationofCaand Mgindolomitesolution.
10. VolumetricestimationofFeinCuandFesolution.
11. VolumetricestimationofZninCuandZnsolution.
12. VolumetricestimationofNiinNiandZnsolution.

PART-B:Preparationofco-ordinationcomplexes

1. Preparationofhexamminenickel(III)chloride.
2. Preparationofchloropentaminecobalt(III)chloride.
3. Preparationoftris(oxalato)ferrate(III)andestimatetheiron.
4. Preparationofhexamminecobalt(III)chloride(demonstration).
5. Preparationofmercurytetrathiocyantocobaltate(II)(demonstration).

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CHDSC-8:Chemistry-VIII

(L:T:P=4:0:0) ContactHours:60 Credits:4 Workload:4Hours/Week

Unit-I:InorganicChemistry 15Hrs.

Paints: Constituentsandtheirfunctions,manufactureoflithoponeandtitaniumdioxide.

Propellants: Definition,characteristics,classificationandapplications.

Abrasives: Definition, classification with examples, hardness, manufacture andapplicationsofcarborundum, alundumand tungstencarbide.

Refractories: Definition, properties, classificationwithexamples.Differentstepsinvolvedinthemanufactureofrefractories.Applicationsof refractories. **05 Hrs.Ceramics:**Introduction, types, manufacturingprocess, applications.

Explosives: Origin of explosive andclassification. preparationandexplosivepropertiesofleadazide,PETN,cyclonite(RDX).

Fertilizers: Economicimportanceandsynthesisofnitrogenousfertilizers-CAN,ammoniumsulfate,ammoniumnitrateandurea.Phosphatefertilizers-calciumdihydrogenphosphate,superphosphate. **05Hrs.**

Silicates: Structure,classification-silicateswithdiscreteanions,silicatescontainingchainanion, silicates with layer structure, silicones with three dimensional net-work andapplications. **02Hrs.**

Nanotechnology: Definition,usesandnatureofnanotechnology.Nanomaterials:Definition, properties and applications. Carbon nanotubes: Definition, types, methods ofpreparation(mention),propertiesandindustrialapplicationsofcarbonnanotubes,Nanowires: Definition, types, production of crystalline nanowires by vapour-liquid-solidsynthesismethod,applicationofnanowires. **03Hrs.**

Unit-II:OrganicChemistry 15Hrs.

Rearrangements: ReactionandmechanismofWagner-Meerwein,Fries,Beckmann,Hofmann, Benzil-benzilic acid, Favorskii, Dienone-phenol, and Benzidine rearrangement.Baeyer-Villigeroxidation,Arndt-Eistertreaction. **07 Hrs.AminoacidsandPeptides:Aminoacids:**Synthesis(fromα-halogenacids,Gabrielphthalimide, malonic ester), reactions (alkyl halides, nitrous acid, acid halide, NH3, LiAlH4).Classification and nomenclature of peptides.Sanger and Edman methods of sequencing.Cleavageofpeptidebondbychemicalandenzymaticmethods.Peptidesynthesis-Protectionof amino group (Boc-) and carboxyl group as alkyl esters. Use of DCC, and HOBt in peptidebondformationreactions.Deprotectionandracemizationinpeptidesynthesis.Solutionandsolid phasetechniques.Synthesisofoxytocin.Introductiontopeptidomimetics.**08Hrs.**

Unit-III:PhysicalChemistry 15Hrs.

ChemicalDynamics: Arrheniusequation-characteristics,Significanceofenergyofactivation, Temperature coefficient and its evaluation. Thermodynamical formulation ofreactionrates (Thermodynamicparameters).

Reaction between ions in solutions - Influence of ionic strength on reaction rates - primaryandsecondarysalteffects,Effect ofdielectricconstant(single spheremodel).

Complexreactions: Kineticsofparallelreactions,consecutivereaction,reversiblereactions(qualitativ etreatment). **07Hrs.**

Kineticsofhomogeneouscatalysis-kineticsofacid-basecatalyzedreactions-specificacidandspecificbasecatalysis,generalacidbasecatalysis.Enzymecatalyzedreactions,Mechanism(LockandKeytheory),Kineticsofenzymecatalyzedreactions-Henri-Michaelis-Mentenmechanism,SignificanceofMichaelis-Mentenconstant,Lineweaver-

Burk plot.Effects of enzyme concentration, pH, Temperature, catalysts and Inhibitors onenzymeactivity.

Kineticsoffastreactions: Introduction,Studyofreactionsbyrelaxationmethod(Temperatureandpressurejump),flowmethod(continuousflowmethodandstoppedflowmethod),Flashphotolysisand Shocktubemethod. **08Hrs.**

Unit-IV:NuclearMagneticResonanceSpectroscopy 15 Hrs.^{1}HNMRspectroscopy:Introduction(includingmagneticpropertiesofnuclei,spinpopulation),relaxationprocess(spin-spin,spin-lattice,quadrupole),numberofsignals.Instrumentation,chemicalshifts,internalstandards,shieldinganddeshieldingeffects.Factorsaffectingchemicalshift(inductive,VanderWaals,anisotropic,H-bonding).Solventsused.Peak areaandprotoncounting,splittingof thesignals,spin-spincoupling,equivalentandnon-equivalentprotons.Chemicalexchange(protonexchangereactions).Calculationofatomsratiofromtheheightofsignals.couplingconstant(geminal,vicinal,long-rangecoupling).Restrictedrotation.Doubleresonance(spindecoupling),nuclearoverhausereffect. **09Hrs.**

Structuredeterminations/interpretationofspectraof;ethane,propane,1-bromopropane,2-bromopropane, ethylene, propene, acetylene, propionamide, methylamine, dimethylamine,trimethylamine,ethylacetate,methylcyanide,ethylbenzene,o-cresol,p-cresol,benzoicacid,anisole,benzaldehyde,acetaldehyde,benzophenone,acetophenone,thiophenol.**06 Hrs.**

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CHDSCP-8:Chemistry-VIIIPractical

(L:T:P=0:0:2) ContactHours:60 Credits:2 Workload:4Hours/Week

PART-A:

1. HydrolysisofmethylacetateinpresenceoftwodifferentconcentrationsofHClanddeterminationoftherelative strength.
2. DeterminationofenergyofactivationforthereactionbetweenK2S2O8versusKI(first order)in twodifferent temperatures.
3. Determinationofrateconstantforthereactionbetweenchloramine-Tandindigocaraminedye inpH10buffermediumspectrophotometrically.
4. ConductometricdeterminationofstrengthofHCl,CH3COOHandCuSO4versusNaOH.
5. ConductometrictitrationofsodiumsulphateversusBaCl2.
6. Conductometricdeterminationsecondorderrateconstantforthesaponificationofethylacetate.
7. Determinationofpartialmolarvolumeof$NaCl$-H_2Osystembyapparentmolarvolumemethod.
8. Potentiometrictitrationofacidmixture($CH_3COOH$and$ClCH_2COOH$)versusNaOH.

PART-B:OrganicPreparations:

1. Cannizarroreactionofbenzaldehyde.
2. Friedel-Craftsreactionofbenzeneandacetylchloride.
3. Oxidationofcyclohexanol.
4. Preparationofp-iodonitrobenzene
5. Preparationof*N*-phenyl-2,4-dinitroaniline.
6. Preparationof2,4,6-tribromoaniline.
7. Preparationof2,4-dichlorophenoxyaceticacid.

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