Rajeev Gandhi Govt. P.G. College Ambikapur

Department of Chemistry

Syllabus
2023-2024

UG.NEP Semester I, II, III, IV, V& VI

ACADEMIC PROGRAMME AND SCHEME

B.Sc. CHEMISTRY (NEP) 2023-24

CLASS	COURSE TYPE	COURSE/PAPER	THEORY CREDIT/ Hrs.	PRACTICLE CREDIT/ Hrs.
SEMESTER I	DSC I	ATOMIC STRUCTURE, BONDING, FUNCTIONAL ORGANIC CHEMISTRY I	**3/45**	**1/30**
SEMESTER II	DSC II	SOLUTION, EQUILIBRIA AND FUNCTIONAL ORGANIC CHEMISTRY II	**3/45**	**1/30**
SEMESTER III	DSC III	CONDUCTANCE,ELECTROCHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY-III	**3/45**	**1/30**
SEMESTER III	DSE I	s, p, d AND f BLOCK	**3/45**	**1/30**
SEMESTER IV	DSC IV	CHEMICAL KINETICS, SURFACE CHEMISTRY AND THERMODYNAMICS	**3/45**	**1/30**
SEMESTER IV	DSE II	Molecules of Life	**3/45**	**1/30**
SEMESTER V	DSC V	COORDINATION CHEMISTRYFUNCTIONAL GROUP ORGANIC CHEMISTRY-IV	**3/45**	**1/30**
SEMESTER V	DSE III	Organometallic Chemistry	**3/45**	**1/30**
SEMESTER VI	DSC VI	QUANTUMCHEMISTRY&PHOTOCHEMISTRY	**3/45**	**1/30**
SEMESTER VI	DSE IV	Solid State and Molecular Spectroscopy	**3/45**	**1/30**

ACADEMIC PROGRAMME AND SCHEME

B.Sc. CHEMISTRY (NEP) 2023-24

CLASS	COURSE TYPE	PAPER CODE	COURSE/PAPER	THEORY CREDIT/ Hrs.	PRACTICLE CREDIT/ Hrs.
SEMESTER I	DSC I	DSCCHE01	ATOMIC STRUCTURE, BONDING, FUNCTIONAL ORGANIC CHEMISTRY I	**3/45**	**1/30**
SEMESTER-I	GE 1	GECHE01	FUNDAMENTAL CHEMISTRY INORGANIC AND PHYSICAL CHEMISTRY	**3/45**	**1/30**
SEMESTER II	DSC II	DSCCHE02	SOLUTION, EQUILIBRIA AND FUNCTIONAL ORGANIC CHEMISTRY II	**3/45**	**1/30**
SEMESTER III	DSC III	DSCCHE03	CONDUCTANCE,ELECTROCHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY-III	**3/45**	**1/30**
SEMESTER III	DSE I	DSECHE01	s, p, d AND f BLOCK	**3/45**	**1/30**
SEMESTER IV	DSC IV	DSCCHE04	CHEMICAL KINETICS, SURFACE CHEMISTRY AND THERMODYNAMICS	**3/45**	**1/30**
SEMESTER IV	DSE II	DSECHE02	MOLECULES OF LIFE	**3/45**	**1/30**
SEMESTER V	DSC V	DSCCHE05	COORDINATION CHEMISTRYFUNCTIONAL GROUP ORGANIC CHEMISTRY-IV	**3/45**	**1/30**
SEMESTER V	DSE III	DSECHE03	ORGANOMETALLIC CHEMISTRY	**3/45**	**1/30**
SEMESTER VI	DSC VI	DSCCHE06	QUANTUMCHEMISTRY&PHOTOCHEMISTRY	**3/45**	**1/30**
SEMESTER VI	DSE IV	DSECHE04	SOLID STATE AND MOLECULAR SPECTROSCOPY	**3/45**	**1/30**

Course Outcomes

B.Sc.ISemester(Chemistry)

DSC-1 ATOMIC STRUCTURE, BONDING FUNCTIONAL ORGANIC CHEMISTRY I

Aftercompletionofcourse,thestudentswillableto:-

CO1.Understandconceptofhybridizationandshapeofmoleculesbasedonhybridization.

CO2.Explaintheperiodicproperties.

CO3.Recallthestructureofatom.

CO4. Explaintheelectrondisplacementsandtheireffectonreactivityof organic molecules.`

CO5.Understandtheconceptofstereochemistry.

CO6.Differentiateconfigurationandconformation.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1	✓	✓	✓	✓	✓	✓
PO-2	✓	✓		✓		
PO-3	✓	✓			✓	
PO-4	✓	✓		✓		
PO-5			✓			✓
PO-6		✓				
PO-7	✓	✓	✓	✓	✓	✓
PO-8						
PO-9	✓				✓	
PO-10						
P0-11						

B. Sc. – I SEMESTER			
ATOMICSTRUCTURE,BONDING,F U N C T I O N A L ORGANICCHEMISTRY			
COURSECODE:UD2		**PAPER CODE:DSCCHE01**	
CREDIT: **THEORY:03**	**PRACTICAL:01**	**HOURS:** **THEORY:45**	**PRACTICAL:00**
MARKS: **THEORY:80PRACTICAL:**		**MARKS** **THEORY:**	**PRACTICAL:**

SCHEMEOFMARKS:

i. Objective typequestions (Multiple choice/true-false/fill in the blanks)

ii. Very shortanswertypequestions (Wordlimit70-100)

iii. Short answer type questions (Word limit200-250 words).

iv. Long answer type questions (Word limit500-600words).

Hours12	**UNIT-I** **SectionA:InorganicChemistry-1** **Atomic Structure:** Review of: Bohr's theory and its limitations, dual behaviour of matterand radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atomspectra.NeedofanewapproachtoAtomicstructure. Significance ofquantumnumbers, orbital angular momentum and quantum numbers m_l and m_s. Shapes of s, p and datomicorbitals,nodalplanes.Discoveryofspin,spinquantumnumber(s)andmagneticspinquantumnumber(m_s).Rulesforfillingelectronsinvariousorbitals,Electronicconfigurationsoftheatoms.Stabilityofhalf-filledandcompletelyfilledorbitals,conceptofexchangeenergy.Relativeenergiesofatomicorbitals,Anomalouselectronicconfigurations.
Hours12	**UNIT-II** **ChemicalBondingandMolecularStructure-II** Ionic Bonding: General characteristics of ionic bonding. lattice energy and solvation energy and their importance in the context of stabilityand solubility of ionic compounds. Statement of Born-Lande equation for calculation oflattice energy, Born-Haber cycle and its applications, polarizing power and polarizability.Fajan's rules, ionic dipole moment andpercentageioniccharacter.Covalentbonding:VBApproach:Shapesofsomeinorganicmoleculesandionsonthebasisof VSEPRandhybridizationwithsuitableexamplesoflinear,trigonalplanar,squareplanar,tetrahedral,trigonalbipyramidalandoctahedralarrangements. MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristicsfors-s,s-pandp-pcombinations ofatomicorbitals,nonbondingcombination of orbitals, MO treatment of homonuclear diatomicmolecules of 1st and 2nd periods(including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO andNO^+.ComparisonofVBandMOapproaches.
Hours12	**UNIT-III** **SectionB:OrganicChemistry- FundamentalsofOrganicChemistr** Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, ResonanceandHyperconjugation.CleavageofBonds:HomolysisandHeterolysis.Structure,shapeandreactivityoforganicmolecules:Nucleophilesandelectrophiles.ReactiveIntermediates:Carbocations,Carbanionsandfreeradicals.Strength of organic acids and bases: Comparative study with emphasis on factors affectingpKvalues.Aromaticity:BenzenoidsandHückel'srule.

Hours 9	**UNIT-IV** **Stereochemistry** Conformations with respect to ethane, butane and cyclohexane. Interconversion of WedgeFormula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto twocarbonatoms).Configuration:GeometricalandOpticalisomerism;Enantiomerism,DiastereomerismandMesocompounds).Threoanderythro;DandL;cis-transnomenclature;CIPRules:R/S(forupto2chiralcarbonatoms)andE/ZNomenclature(foruptotwoC=Csystems).
RECOMENDE READINGS:	**ReferenceBooks:** • Lee,J.D.ConciseInorganicChemistryELBS,1991. • Cotton,F.A.,Wilkinson,G.&Gaus,P.L.BasicInorganicChemistry,3rded.,Wiley. • Douglas,B.E.,McDaniel,D.H.&Alexander,J.J.ConceptsandModelsinInorganicChemistry,John Wiley&Sons. • Huheey,J.E.,Keiter,E.A.,Keiter,R.L.&Medhi,O.K.InorganicChemistry:PrinciplesofStructureandReactivity,PearsonEducationIndia,2006. • GrahamSolomon,T.W.,Fryhle,C.B.&Dnyder,S.A.OrganicChemistry,JohnWiley&Sons(2014). • McMurry,J.E.FundamentalsofOrganicChemistry,7thEd.CengageLearningIndiaEdition,2013. • Sykes,P.AGuidebooktoMechanisminOrganicChemistry,OrientLongman,NewDelhi(1988). • Eliel,E.L.StereochemistryofCarbonCompounds,TataMcGrawHilleducation,2000. • Finar,I.L.OrganicChemistry(Vol.I&II),E.L.B.S. • Morrison,R.T.&Boyd,R.N.OrganicChemistry,Pearson,2010. • Bahl,A.&Bahl,B.S.AdvancedOrganicChemistry,S.Chand,2010.

B. Sc. – I SEMESTER LAB

ATOMICSTRUCTURE,BONDING,FUNCTIONAL ORGANICCHEMISTRY

CREDIT: **PRACTICAL:01**	**HOURS:** **PRACTICAL:30**
MARKS: **THEORY-0**	**MARKS** **PRACTICAL:50**

SectionA:InorganicChemistry-VolumetricAnalysis

1. Estimationofsodiumcarbonateandsodiumhydrogencarbonatepresentinamixture.
2. Estimationofoxalicacidbytitratingitwith$KMnO_4$.
3. EstimationofwaterofcrystallizationinMohr'ssaltbytitratingwith$KMnO_4$.
4. EstimationofFe(II)ionsbytitratingitwith$K_2Cr_2O_7$usinginternalindicator.
   EstimationofCu(II)ionsiodometricallyusing$Na_2S_2O_3$

SectionB:OrganicChemistry

1. Detectionofextraelements(N,S,Cl,Br,I)inorganiccompounds(containinguptotwoextraelements)
2. SeparationofmixturesbyChromatography:Measuretheir$R_f$valueineachcase(combinationoftwocompoundstobegiven)

(a) Identifyandseparatethecomponentsofagivenmixtureof2aminoacids(glycine,asparticacid,glutamicacid,tyrosineoranyotheraminoacid)bypaperchromatography

(b) Identifyandseparatethesugarspresentinthegivenmixturebypaperchromatography.

REFERENCES

ReferenceBooks:

- Svehla,G.Vogel'sQualitativeInorganicAnalysis,PearsonEducation,2012.
- Mendham,J.Vogel'sQuantitativeChemicalAnalysis,Pearson,2009.
- Vogel,A.I.,Tatchell,A.R.,Furnis,B.S.,Hannaford,A.J.&Smith,P.W.G.,Textbookof PracticalOrganicChemistry,Prentice-Hall,5thedition,1996.
- Mann,F.G.&Saunders,B.C.PracticalOrganicChemistryOrient-Longman,1960.

B.Sc.I Semester
Course Outcome

GE-I FUNDAMENTAL CHEMISTRY (INORGANIC AND PYSICAL CHEMISTRY)

Aftercompletionofcourse,thestudentswillableto:-

CO1. To learn basic concept of atomic structure and the periodic properties of elements.
CO2. To understand about periodic table and periodicity in properties.
CO3. To Understand chemical bonding in covalent compound.
CO4.Fundamental of Gaseous state, Kinetic Theory of gases.
CO5.Gas laws,Vanderwaal`s equation

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓
PO-3					
PO-4				✓	
PO-5			✓		
PO-6		✓			
PO-7	✓	✓	✓	✓	✓
PO-8					
PO-9	✓			✓	
PO-10					
P0-11					

B. Sc. – I SEMESTER	
GE: FUNDAMENTAL CHEMISTRY (INORGANIC AND PHYSICAL CHEMISTRY)	
COURSE CODE:UD2	**PAPER CODE:GECHE:01**
CREDIT: **THEORY-03**	**HOURS:** **THEORY:45 PRACTICAL:00**
MARKS: **THEORY-80**	**MARKS** **THEORY: PRACTICAL:**

Inorganic Chemistry

Atomic Structure-

Idea of de Quantum numbers, atomic orbital`s shapes of s,p,d orbital. Aufbau andpauli`s exclusion principals, Hund`s multiplication rule Electronic configuration of the elements**.**

(12 Hours)

Classification of Elements :- Long form of the periodic table , Classification of elem ents (s,p,d orbital) Elementary idea of periodic properties of elements. .

(11Hours)

Chemical Bonding – Ionic, Covalent & Coordinate Bond, hybridization and shape of simple molecules.

(11Hours)

Physical Chemistry

Gaseous State- Kinetic molecular model of a gas : Postulate and derivation of the kinetic gas equation, Gas laws, Ideal and Real gas,Behaviour of real gases: Deviations from ideal gas behavior ,van der Waals equation of state, its derivation

(11Hours)

ReferenceBooks:

- Basic inorganic chemistry,F.A. Cotton, G.Willkinson and P.I. Gaus,J Willey.
- Concise inorganic chemistry ,J.D.Lee, ELBS.
- Advcence Inorganic Chemistry:SatyaPrakash.
- Physical Chemistry B.D. Khosla.
- Physical Chemistry; Puri& Sharma.
- BautikRasayan;Bahal&Tuli.
- BautikRasayan;Bahal& Sharma.

B. Sc. – I SEMESTER LAB	
GE. : FUNDAMENTAL CHEMISTRY (INORGANIC AND PHYSICAL CHEMISTRY)	
CREDIT: **PRACTICAL:01**	**HOURS:** **PRACTICAL:30**
MARKS: **PRACTICAL: 50**	

- **Idea Safety Measures in Laboratory**
- **Important Chemistry & Apparatus and Their uses in laboratory.**
- **Volumetric Analysis (Single & Double Titration)**

ReferenceBooks:

- **Vogel`s Text Book of Quantitative Analysis; revised ELBS.**
- **Vogel`s Qualitative Analysis, revised Longman.**
- **Standard Method for Chemical Analysis; W.W. Scott, the Technical Press.**
- **Advanced practical Physical Chemistry; J.B. YadavGoel pub House.**
- **Vogel`s Text Book of practical Organic Chemistry ; ELBS**

CourseOutcomes

B.Sc.II Semester

DSC-2 SOLUTION, EQUILIBRIA FUNCTIONAL ORGANIC CHEMISTRY-II

Aftercompletionofcourse,thestudentswillableto:-

CO1. ComparethepropertiesofSandPblockelements..

CO2.Analysetheinorganicmixturecontaininginsolublesandinterferingradicals.

CO3.Describethemechanismoforganicreaction.

CO4. Apply their knowledge to problem solve, deduce structure and synthesicesimpleorganicmoleculesusingthestudiedreaction.

CO5.Solvethenumericalproblemsbasedonchemicalkinetics.

CO6.Explainpropertiesofliquidsvizviscositysurfacetensionetc.

CO7. Analysepropertiesofcolloidsandphenomenaofvariousadsorption

CO8. Applycatalysisinindustriestomanufacturedifferentkindsof products.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7	CO-8
PO- 1	✓	✓	✓	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓	✓	✓	✓
PO-3					✓			✓
PO-4				✓	✓			
PO-5			✓		✓	✓		✓
PO-6		✓			✓	✓		
PO-7	✓	✓	✓	✓	✓	✓	✓	✓
PO-8				✓				✓
PO-9								
PO-10								
P0-11								✓

B. Sc. – II SEMESTER

CHEMISTRY-DSC2:SOLUTION,EQUILIBRIA &FUNCTIONAL ORGANIC CHEMISTRY

COURSE CODE: UD2	**PAPER CODE:DSCCHE02**
CREDIT: **THEORY:03**	**HOURS:** **THEORY:45** **PRACTICAL:00**
MARKS: **THEORY-80**	**MARKS** **THEORY:** **PRACTICAL:**

Solutions: Thermodynamicsofidealsolutions:Ideal solutionsandRaoult'slaw,deviationsfrom Raoult'slawnon idealsolutions. Azeotropes.

Colligative properties:Relative lowering in Vapour pressure, Osmotic Pressure, Elevation in Boiling Point, depression in Freezing Point

(7 Hours)

Chemical and IonicEquilibria:

Equilibrium in physical and chemical process. Dynamic Nature of Equilibrium. Law of mass action. Equilibrium constant. Factors affecting Equilibrium constant. Le Chatelier Principle.

Strong and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. (10**Hours)**

Aromatichydrocarbons

Preparation (Case benzene): from phenol, by decarboxylation, from acetylene,
Reactions:(Casebenzene):Electrophilicsubstitution:nitration,halogenationand sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene).

(10Hours)

AliphaticHydrocarbons

Alkanes: (Upto 5 Carbons). *Preparation:* Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. *Reactions:* Free radical Substitution: Halogenation.

Alkenes: (Upto 5 Carbons) *Preparation:* Elimination reactions: Dehydration of alcohol and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation)andtransalkenes(Birchreduction).*Reactions:*cis-addition(alk.$KMnO_4$) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation.

Alkynes: (Upto 5 Carbons) *Preparation:* Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.

(10Hours)

Organic Halides:

Alkyl Halides: Method of preparation. Nucleophilic substitution reaction – SN1, SN2 and SNi mechanism with stereochemical aspects and effect of solvent etc. Elimination reactions.

Aryl Halides :**Preparation.Reactions (Electrophilic and nucleophilic substitution.) Benzyne mechanism.(08Hours)**

ReferenceBooks:

- GrahamSolomon,T.W.,Fryhle,C.B.&Dnyder,S.A.*OrganicChemistry*,John Wiley & Sons (2014).
- McMurry,J.E.*FundamentalsofOrganicChemistry*,7thEd.CengageLearningIndia Edition, 2013.
- Sykes,P.*AGuidebooktoMechanisminOrganicChemistry*,OrientLongman,New Delhi (1988).
- Finar,I.L.*OrganicChemistry*(Vol.I&II),E.L.B.S.
- Morrison,R.T.&Boyd,R.N.*OrganicChemistry*,Pearson,2010.
- Bahl,A.&Bahl,B.S.*AdvancedOrganicChemistry*,S.Chand,2010.
- Barrow,G.M.*PhysicalChemistry*TataMcGraw-Hill(2007).
- Castellan,G.W.*PhysicalChemistry*4thEd.Narosa(2004).
- Kotz,J.C.,Treichel,P.M.&Townsend,J.R.*GeneralChemistry*CengageLearning India Pvt. Ltd., New Delhi (2009).
- Mahan,B.H.*UniversityChemistry*3rdEd.Narosa(1998).
- Petrucci,R.H.*GeneralChemistry*5thEd.MacmillanPublishingCo.:NewYork(1985).

B. Sc. – III SEMESTER LAB.

SOLUTION,EQUILIBRIA&FUNCTIONAL ORGANIC CHEMISTRY

CREDIT: **PRACTICAL:01**	**HOURS:** **PRACTICAL:30**
MARKS: **PRACTICAL:50**	

SectionA:PhysicalChemistry

Ionicequilibria

pHmeasurements

a) Measurement of pHofdifferent solutionslike aerateddrinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
b) Preparationofbuffersolutions:
(i) Sodiumacetate-aceticacid
(ii) Ammoniumchloride-ammoniumhydroxide

MeasurementofthepHofbuffersolutionsandcomparisonofthevalueswiththeoretical values.

SectionB:OrganicChemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. CriteriaofPurity:Determinationofmeltingandboilingpoints.
3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yieldsto be done.

(a) BrominationofPhenol/Aniline
(b) Benzoylationofamines/phenols
(c) Oximeand2,4-dinitrophenylhydrazoneofaldehyde/ketone

4. Identification of functional gp.in organic in organccompoumd.

ReferenceBooks

- Vogel,A.I.,Tatchell,A.R.,Furnis,B.S.,Hannaford,A.J.&Smith,P.W.G.,*Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
- Mann,F.G.&Saunders,B.C.*PracticalOrganicChemistry*Orient-Longman,1960.
- Khosla,B.D.;Garg,V.C.&Gulati,A.*SeniorPracticalPhysicalChemistry*,R. Chand & Co.: New Delhi (2011).

Course Outcomes

B.Sc.IIISemester

DSC-3 CONDUCTANCE,ELECTRO CHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY II

Aftercompletionofcoursethestudentswillableto:-

CO1.Recallthefundamentalconceptsofelectrochemistry and its application.

CO2.

Explainthemechanismofdifferentorganicreactionsuchasnucleophilicaddition,Substitutioneliminationrearrangementreactions.

CO3.Compare reactivity of aldehyde & Ketones.

CO4.Applythecondencetoexplainenthalpydifferent Conductometric titrations.

CO5 . Designneworganicreactioninordertoachievetherequiredproducts.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓
PO-3				✓	
PO-4		✓		✓	
PO-5		✓			✓
PO-6					✓
PO-7	✓	✓	✓	✓	✓
PO-8					
PO-9					
PO-10					
PO-11					

B. Sc. – III SEMESTER	
DSC:CONDUCTANCE,ELECTROCHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY-III	
COURSE CODE:UD2 PAPER CODE:DSCCHE03	
CREDIT: **THEORY- 03**	**HOURS:** **THEORY:45** **PRACTICAL:00**
THEORY **MARKS: 80**	**MARKS** **THEORY:** **PRACTICAL:**

Conductance

Conductivity,equivalentandmolarconductivityandtheirvariationwithdilutionforweak and strong electrolytes. Kohlrausch law of independent migration of ions.

Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. Applications of conductance measurements: determination of degreeof ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid-base).

(10Hours)

Electrochemistry

Reversible and irreversible cells. Electrochemical series and it's applications. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: ΔG, ΔH and ΔS from EMF data.

(10Hours)

Alcohols and Phenols:

Introduction.Classification.Structure of Functional group.Physical properties.Preparation of Alcohol.Reactions of Alcohol.Preparation of Phenol.Reactions of Phenol.

(12Hours)

Carbonyl Compounds:

Preparation of Aldehydes and Ketones: Oxidation of Alcohols, Ozonolysis of Alkenes, Friedal Craft acylation. Reactions of Aldehydes and Ketones: Oxidation, Addition of Grignard Reagent, Addition of amine derivatives.Acidity of alpha hydrogen, Condensation reactions (Aldol, Knoevenagel, Perkin, Benzoin)Wittig Reaction. Mannich Reaction.

(13Hours)

ReferenceBooks:

- Barrow,G.M.*PhysicalChemistry*TataMcGraw-Hill(2007).
- Castellan,G.W.*PhysicalChemistry*4thEd.Narosa(2004).
- Kotz,J.C.,Treichel,P.M.&Townsend,J.R.*GeneralChemistry*,CengageLearning India Pvt. Ltd.: New Delhi (2009).
- Mahan,B.H.*UniversityChemistry*,3rdEd.Narosa(1998).
- Petrucci,R.H.*GeneralChemistry*,5thEd.,MacmillanPublishingCo.:NewYork (1985).
- Morrison,R.T.&Boyd,R.N.*OrganicChemistry*,DorlingKindersley(India)Pvt. Ltd. (Pearson Education).
- Finar,I.L.*OrganicChemistry*(*Volume1*),DorlingKindersley(India)Pvt.Ltd.(Pearson Education).
- Finar,I.L.*OrganicChemistry*(*Volume2)*,DorlingKindersley(India)Pvt.Ltd.(Pearson Education).
- Nelson,D.L.&Cox,M.M.*Lehninger'sPrinciplesofBioch*emistry*7th Ed.*,W.H. Freeman.
- Berg,J.M.,Tymoczko,J.L.&Stryer,L.*Biochemistry*,W.H.Freeman,2002.

Course Outcomes

B.Sc.IIIemester

DSC-1Lab.Course(CONDUCTANCE, ELECTRO CHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY-II)

CO 1.Able to explain the systematic identfic of organic compound.

CO2. To describe different type of litration based on condnctance and potentiometry.

CO 3. To analyseredox potential of ions.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1					
PO-2					
PO-3					
PO-4					
PO-5					
PO-6					
PO-7					
PO-8					
PO-9					
PO-10					
PO-11					

CONDUCTANCE,ELECTROCHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY-III

CREDIT: **THEORY- 01**	**HOURS:** **PRACTICAL:30**
MARKS: **PRACTICAL:50**	

A. Identification of an organic compound through the functional group analysis, determination of melting point and preparation of derivatives, (Aliphatic and aromatic).

(i) To determine strength of given acid conductometrically using standard alkali solution.

(ii) To determine solubility and solubility product of a sparingly soluble electrolyte conductometrically.

(iii) To study saponification of ethyl acetate conductometrically.

(iv) To determine the ionization constant of a weak acid conductometrically.

(v) To titrate potentiometrically the given ferrous ammonium sulphate using $KMnO_4$/ $K_2Cr_2O_7$ as titrant and calculate the redox potential of Fe2+/ Fe3+ system on the hydrogen scale.

Conductance

I. Determinationofcellconstant

II. Determinationofequivalentconductance,degreeofdissociationanddissociationconstant of a weak acid.

III. Performthefollowingconductometrictitrations:

i. Strongacidvs.strongbase

ii. Weakacidvs.strongbase

Potentiometry

Performthefollowingpotentiometrictitrations:

i. Strongacidvs.strongbase

ii. Weakacidvs.strongbase

iii. Potassiumdichromatevs.Mohr'ssalt

ReferenceBooks:

- A.I.Vogel:QualitativeInorganicAnalysis,PrenticeHall,7thEdn.
- A.I.Vogel:QuantitativeChemicalAnalysis,PrenticeHall,6thEdnKhosla
- B.D.Garg.V.C.&Gulati, A. Senior practical chemistry ;R.Chand& Co; New Delhi (2011)

Course Outcomes

B.Sc.IIISemester

DSE- 1**s, p, d, AND f BLOCK ELEMENTS**

Aftercompletionofcoursethestudentswillableto:-

CO1. To Understand the electronic elements configuration of s,p,d,& f block elements.

CO2.To explain the general concepts on group relation and periodic properties of s,p,d, and block elements .

CO3. Differentiate the similarities and dissimilarities of lanthanides and actinides.

CO4.Analyse magnetic and spectral properties of transition metal complexes.

CO5. Inculcate consequences of lanthanide and actinide contraction.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓
PO-3				✓	
PO-4	✓	✓			
PO-5		✓			
PO-6					✓
PO-7	✓	✓	✓	✓	✓
PO-8	✓	✓		✓	
PO-9					
PO-10					
PO-11					

B. Sc. – III SEMESTER

DSECHE :s,p,d and f block ELEMENTS

COURSE CODE : UD2 **PAPER CODE: DSECHE01**

CREDIT: **PRACTICAL:03**	**HOURS:** **THEORY:45** **PRACTICAL:00**
MARKS:80 **THEORY:**	

S block elements:

General concepts on group relationships and periodic properties. Comparative study. Salient features of hydrides. Solvation and complexationtendencies including their function in biosystems. Introduction to alkyl and aryl derivatives of alkali and alkaline earth metals.

(10Hours)

P block Elements:

General concepts on group relationships and periodic properties. Halides, hydrides, oxides and oxy acids of Boron, Aluminium, Nitrogen, phosphorous and Sulphur. Boranes, Borazene, Fullerine, Graphene and Silicates. Interhalogen compounds.

Chemical properties of Nobel gases. Chemistry of Xenon : Structure and bonding in fluorides and oxides of Xenon.

(15Hours)

d Block Elements:

Transition elements : position in periodic table, Electronic configuration. General characterstics viz. atomic and ionic radii, variable oxidation states, ability to form complexes, formation of coloured ions, magnetic moment and catalytic behavior. General comparative treatment of 4d and 5d elements with their 3d analogues with respect to ionic radii, oxidation states and magnetic properties.

(10Hours)

f Block Elements

Lanthanides: Electronic structure, Oxidation states and ionic radii. Lanthanide contraction and it's consequences. Complex formation. Occurance and isolation of Lanthanides.

Actinides : Electronic structure, Oxidation states and ionic radii. Similarities between latter actinides with lanthanides. Separation of Np, Pu and Am from Uranium.**(10Hours)**

ReferenceBooks:

- Lee,J.D.*ConciseInorganicChemistry*ELBS,1991.
- Cotton,F.A.,Wilkinson,G.&Gaus,P.L.*BasicInorganicChemistry*,3rd ed.,Wiley.
- Douglas, B.E., McDaniel, D.H. & Alexander, J.J. *Conceptsand Models in InorganicChemistry*, John Wiley & Sons.
- Huheey,J.E.,Keiter,E.A.,Keiter,R.L.&Medhi,O.K.*InorganicChemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.

B. Sc. – III SEMESTERLAB.	
PAPER CODE : DSE : s,p,d and f block	
CREDIT: **PRACTICAL:01**	**HOURS:** **PRACTICAL:30**
MARKS: **PRACTICAL:50**	

(A) Iodo/Iodimetric titrations

(i) Estimation of Cu(II) and $K_2Cr_2O_7$ using sodium thiosulphate solution (Iodometrically)

(ii) Estimation of iodine content in iodised salt.

(B) Complexometric titrations using disodium salt of EDTA

(i) Estimation of Mg^{2+} and Zn^{2+}

(ii) Estimation of Ca^{2+} by substitution method

(iii) Estimation of calcium content in milk.

(C) Paper chromatographic separation of

(i) Ni(II) and Co(II)

(ii) Cu (II) and Cd(II)

(D) Inorganic preparations

(i) Cuprous Chloride, Cu_2Cl_2

(ii) Potash alum

ReferenceBooks:

- A.I.Vogel:QualitativeInorganicAnalysis,PrenticeHall,7thEdn.
- A.I.Vogel:QuantitativeChemicalAnalysis,PrenticeHall,6thEdn

Course Outcomes

B.Sc.IVSemester

DSC-4 CHEMICAL KINETICS,SURFACE CHEMISTRY AND THERMODYNAMICS

Aftercompletionofcoursethestudentswillableto:-

CO1.RecalldifferentconceptsofAcids&BaseslikeArrhenius,BronstedLawry,Luxflood,Lewisacidbaseconcept.

CO2. Comparethepropertiesoflanthanidesandactinides.

CO3.Compareandcontrastbetweenionicequilibriumandphaseequilibrium.

CO4.Elucidatethestructureofbenzenediazoniumchloride.

CO5.Explainstructuralfeaturesaffectingbasicityofamines.

CO6.ApplytheconceptoffluorescencePhosphorescenceandchemiluminescenefordescribingmaterials.

CO7.Analysethecharacteristicsofelectromagneticradiation andlawsofphotochemistry.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7
PO- 1	✓	✓	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓	✓	✓
PO-3				✓			
PO-4	✓					✓	
PO-5				✓			
PO-6					✓		
PO-7	✓	✓	✓	✓	✓	✓	✓
PO-8							✓
PO-9							
PO-10							
PO-11	✓				✓		

B. Sc. – IV SEMESTER	
DSC IV:CHEMICAL KINETICS,SURFACE CHEMISTRY AND THERMODYNAMICS	
COURSE CODE : UD2	**PAPER CODE : DSCCHE 04**
CREDIT: **Theory :03**	**HOURS** **THEORY:45**
MARKS **THEOTY:80**	

ChemicalKinetics

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reactionrates.Orderandmolecularityofareaction.Derivationofintegratedrateequations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).**(15Hours**)

Colloidal state and surface chemistry

Classification. Optical, Kinetic and electrical properties of colloids. Coagulation, Hardy Schulze law, Flocculation value. Protective colloids. Gold number. Emulsion. Micelles and its types. Applications of colloids.Adsorption: Physical and chemical adsorption. Adsorption isotherms (Langmuir and Freundlich) Qualitative discussion of BET adsorption isotherm.

(12Hours)

Chemical Thermodynamics:

Intensive and extensive variables. State and path functions. Open Closed and Isolated systems. Zeroth law of thermodynamics. First law: concept of heat, work, internal energy. Statements of first law , enthalpy, relationship between Cp and Cv. Calculations of q, w, U and H for reversible irreversible and free expansion of gases under isothermal and adiabatic conditions. Joule Thompson expansion. Inversion temperature of gases.

Second law of thermodynamics : spontaneous process, second law, Carnot cycle and efficiency of heat engine. Carnot's theorem. Concept of entropy and entropy change in a reversible and irreversible process. Entropy change in isothermal reversible expansion of an ideal gas, entropy change in isothermal mixing of ideal gass. Physical significance of entropy.

Third law of thermodynamics. Calculation of absolute entropy of molecules.

(18Hours)

ReferenceBooks:

- Barrow,G.M.*PhysicalChemistry*TataMcGraw-Hill(2007).
- Castellan,G.W.*PhysicalChemistry*4thEd.Narosa(2004).
- Kotz,J.C.,Treichel,P.M.&Townsend,J.R.*GeneralChemistry*CengageLearning India Pvt. Ltd., New Delhi (2009).
- Mahan,B.H.*UniversityChemistry*3rdEd.Narosa(1998).
- Petrucci,R.H.*GeneralChemistry*5thEd.MacmillanPublishingCo.:NewYork(1985).

B. Sc. – IV SEMESTER LAB.	
CHEMICAL KINETICS,SURFACE CHEMISTRY AND THERMODYNAMICS	
CREDIT **Theory :01**	**HOURS** **PRACTICAL:30**
MARKS **PRACTICAL:50**	

A. Semi-micro quantitative analysis (using H_2S or other methods) of mixtures- not more than four ionic species (two cations and two anions excluding interfering insoluble salts) out of the following:
Cations : $NH4^+$, Pb^{2+} , Bi^{3+}, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Na^+, Ca^{2+}.
Anions : CO_3^{2-}, S^{2-}, $SO3^{2-}$, $S_2O_3^{2-}$, NO_2^-, CH_3COO^-, Cl^-, Br^-, I^-, SO_4^{2-},

B. (i) To determine the specific the specific rate of hydrolysis of methyl / ethyl acetate catalyzed by hydrogen ions at room temperature.
(ii) To study the effect of acid strength on the hydrolysis of water.
(iii) To compare the strengths of HCl and H_2SO_4 by studying the kinetics of hydrolysis of ethyl acetate.
(iv) To study kinetically the reaction between H_2O_2 and iodide.
(v) To prepare arsenioussulphide sol and compare the precipitating power of mono, di and trivalent anions.
(vi) To determine the % composition of a given mixture by viscocity method.
(vii) To determine the % composition of a given binary mixture by surface tension method.

(30 Hours)

ReferenceBooks:

- A.I.Vogel:QualitativeInorganicAnalysis,PrenticeHall,7thEdn.
- A.I.Vogel:QuantitativeChemicalAnalysis,PrenticeHall,6thEdn.
- Vogel,A.I.,Tatchell,A.R.,Furnis,B.S.,Hannaford,A.J.&Smith,P.W.G.,*Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
- Mann,F.G.&Saunders,B.C.*PracticalOrganicChemistry*Orient-Longman,1960.

Course Outcomes

B.Sc.IVSemester

DSE-2 MOLECULES OF LIFE

Aftercompletionofcoursethestudentswillableto:-

CO1. Learnanddemonstratehowthestructureofbiomoleculesdeterminestheirchemicalproperties,reactivityandbiologicaluses.

CO2. Gainaninsightintomechanism ofenzymeactionandinhibition.

CO3. Understandthebasicprinciplesofdrug-receptor interactionandSAR.

CO4. Understandbiologicalprocesseslikereplication,transcriptionandtranslation.

CO5.Demonstrateanunderstandingofmetabolicpathways,theirinter-relationship,regulation andenergyproductionfrom.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓
PO-3				✓	
PO-4	✓	✓	✓	✓	✓
PO-5		✓			
PO-6					✓
PO-7	✓	✓	✓	✓	✓
PO-8	✓	✓	✓	✓	✓
PO-9					
PO-10					
PO-11					

B. Sc. – IV SEMESTER		
DSE-2 MOLECULES OF LIFE		
PAPER CODE :UD2	**COURSE CODE : DSECHE 02**	
CREDIT: **Theory :03**	**HOURS** **THEORY :45**	
MARKS **THEORY: 80**		

Carbohydrates

Classification of carbohydrates, reducing and non-reducing sugars, General Properties of Glucose and Fructose, their open chainstructure. Epimers, mutarotation and anomers. Determination ofconfiguration of Glucose (Fischer proof).
Cyclicstructureofglucose.Haworthprojections.Cyclicstructureoffructose.
Linkage between monosachharides, structure of disacharrides (sucrose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation. **(15Hours)**

AminoAcids,PeptidesandProteins

Classification*ofAminoAcids,*ZwitterionstructureandIsoelectricpoint.
OverviewofPrimary,Secondary,TertiaryandQuaternarystructureofproteins.
Determination of primary structure of peptides, determination of N-terminal amino acid (by DNFBandEdman method) and C–terminal amino acid (by thiohydantoin and with carboxypeptidase enzyme). Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C-activating groups and Merrifield solid phase synthesis**. (15Hours)**

Nucleic Acids and Lipids
ComponentsofNucleicacids:Adenine,guanine,thymineandCytosine(Structureonly), othercomponentsofnucleicacids,Nucleosidesandnucleotides**(nomenclature**),Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA(**typesofRNA**),
GeneticCode,BiologicalrolesofDNAandRNA:Replication,Transcriptionand Translation.
(15Hours)
Introductiontolipids,classification.
Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number.
Biologicalimportanceoftriglycerides,phospholipids,glycolipids,andsteroids(cholesterol).

ReferenceBooks:

- GrahamSolomon,T.W.,Fryhle,C.B.&Dnyder,S.A.OrganicChemistry,JohnWiley&Sons(2014).
- McMurry,J.E.FundamentalsofOrganicChemistry,7thEd.CengageLearningIndiaEdition,2013.
- Sykes,P.AGuidebooktoMechanisminOrganicChemistry,OrientLongman,NewDelhi(1988).
- Finar,I.L.OrganicChemistry(Vol.I&II),E.L.B.S.
- Morrison,R.T.&Boyd,R.N.OrganicChemistry,Pearson,2010.
- Bahl,A.&Bahl,B.S.AdvancedOrganicChemistry,S.Chand,2010.

B. Sc. – IV SEMESTERLAB.

DSE IV LAB (MOLECULES OF LIFE)

CREDIT
PRACTICAL:01

HOURS
PRACTICAL: 30

MARKS
PRACTICAL: 50

30Hours

1. Separationofaminoacidsbypaperchromatography
2. Todeterminetheconcentrationofglycinesolutionbyformylationmethod.
3. Studyoftitrationcurveofglycine
4. Actionofsalivaryamylaseonstarch
5. Effectoftemperatureontheactionofsalivaryamylaseonstarch.
6. Todeterminethesaponificationvalueofanoil/fat.
7. Todeterminetheiodinevalueofanoil/fat
8. Differentiatebetweenareducing/nonreducingsugar.
9. ExtractionofDNAfromonion/cauliflower
10. Tosynthesiseaspirinbyacetylationofsalicylicacidandcompareitwiththe ingredient of an aspirin tablet by TLC.

RecommendedTexts:

- 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.*ComprehensivePracticalOrganicChemistry,*

UniversitiesPress

Course Outcomes

B.Sc.VSemester

DSC-5 COORDINATION CHEMISTRY FUNCTIONAL GROUP ORGANIC CHEMISTRY IV

Aftercompletionofcourse the students will able to:-

CO1.Recallvalencebondtheoryandcrystalfieldtheory.

CO2.Explainconceptofcolorandchemicalconstitutionandar omaticityin5&6memberedheterocyclicchemistry.

CO3.Explainthebasicsofquantummechanicsviavariouseffects,operationsand Equations.

CO4. Compareandcontrastbetweenmolecularorbitalandvalencebondmodel s.

CO5.AnalyseCharacteristicsofelectromagneticradiationregionsintensityandrep resentationofspectra.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓
PO-3		✓	✓		✓
PO-4					
PO-5					✓
PO-6					✓
PO-7	✓	✓	✓	✓	✓
PO-8		✓	✓	✓	✓
PO-9					
PO-10					
PO-11					

B.Sc.VSemester

DSC-V COORDINATION CHEMISTRY FUNCTIONAL GROUP ORGANIC CHEMISTRY IV

COURSE CODE: UD2 **PAPER CODE : DSCCHE :05**

CREDITI THEORY :3 **CREDITI HOURS : 45**

MARKS HOURS: 80

CoordinationChemistry

Classification of Ligands.IUPACsystemofnomenclature Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Structural and stereoisomerism in complexes withcoordination numbers 4 and 6. DrawbacksofVBT.

Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystalfieldeffectsforweakandstrongfields.Tetrahedralsymmetry.Factorsaffectingthe magnitude of D. Spectrochemical series.Comparison of CFSE for $O_h$and $T_d$complexes, Tetragonal distortion of octahedral geometry.Jahn-Tellerdistortion.

Magnetic properties: Spin only magnetic moment. Orbital contribution to the magnetic moment. Spin crossover and high spin low spin equilibrium. L-S coupling.Microstates.Term symbol.

Colour and electronic spectra : Laporte and spin selection rule. d-d transition. Charge transfer.Orgel diagram for octahedral and tetrahedral complexes.

(20 Hours)

Carboxylicacidsandtheirderivatives

Carboxylicacids(aliphaticandaromatic) *Preparation:* Acidic and Alkaline hydrolysis of esters. *Reactions:* Hell

Vohlard - Zelinsky Reaction.

Carboxylicacidderivatives(aliphatic):(Upto5carbons)

Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion.
Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation.

AminesandDiazoniumSalts

Amines(AliphaticandAromatic):(Upto5carbons)
Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, HofmannBromamidereaction.
Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, reaction with HNO_2, Schotten–BaumannReaction.Electrophilicsubstitution(caseaniline):nitration, bromination, sulphonation.

Diazoniumsalts:*Preparation:*fromaromaticamines.**(25 Hours)**

ReferenceBooks:

- Barrow,G.M.*PhysicalChemistry*TataMcGraw-Hill(2007).
- Castellan,G.W.*PhysicalChemistry*4thEd.Narosa(2004).
- Kotz,J.C.,Treichel,P.M.&Townsend,J.R.*GeneralChemistry*CengageLearning India Pvt. Ltd., New Delhi (2009).
- Mahan,B.H.*UniversityChemistry*3rdEd.Narosa(1998).
- Petrucci,R.H.*GeneralChemistry*5thEd.MacmillanPublishingCo.:NewYork(1985).
- Cotton,F.A.&Wilkinson,G.*BasicInorganicChemistry*,Wiley.
- Shriver,D.F.&Atkins,P.W.*InorganicChemistry*,OxfordUniversityPress.
- Wulfsberg,G.*InorganicChemistry*,VivaBooksPvt.Ltd.
- Rodgers,G.E.*Inorganic&SolidStateChemistry*,CengageLearningIndiaLtd.,2008.

B. Sc. – IV SEMESTER LAB.	
DSC-V COORDINATION CHEMISTRY FUNCTIONAL GROUP ORGANIC CHEMIS	
CREDIT : THEORY:01 HOURS PRACTICAL:30	
MARKS: PRACTICAL:50	

(i)Preparation of sodiumtrioxalatoferrate (III)
(ii) Preparation of Ni-DMG complex.
(iii) Preparation of copper tetra amine complex
(iv) Gravimetric analysis of Cu as CuSCN, Ni as $Ni(DMG)_2$, Ba as $BaSO_4$ and Fe as Fe_2O_3

(v) DeterminethecompositionoftheFe^{3+}-salicylicacidcomplex solutionbyJob's method.
(vi) Estimationof(i)Mg^{2+}or(ii)Zn^{2+}bycomplexometrictitrationsusing EDTA.
(vii) Estimationoftotalhardnessofagivensampleofwaterbycomplexometrictitration.
(viii) DeterminationofconcentrationofNa^{+}andK^{+}usingFlame Photometry.

(i)Acetylation of salicylic acid, aniline, and hydroquinone.
(ii) Preparation of iodoform from ethanol and acetone.
(iii) preparation of m – dinitrobenzene and p- nitroacetanilide.
(iv) Preparation of p- bromoacetanilide.
(v) preparation of benzoic acid from toluene.
(vi) preparation of aniline from nitrobenzene. (**30 Hours)**

RecommendedTexts:

- 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.*ComprehensivePracticalOrganicChemistry*, UniversitiesPress

ReferenceBooks:

- A.I.Vogel:QualitativeInorganicAnalysis,PrenticeHall,7thEdn.
- A.I.Vogel:QuantitativeChemicalAnalysis,PrenticeHall,6thEdn.
- Vogel,A.I.,Tatchell,A.R.,Furnis,B.S.,Hannaford,A.J.&Smith,P.W.G.,*Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
- Mann,F.G.&Saunders,B.C.*PracticalOrganicChemistry*Orient-Longman,1960.

Course Outcomes

B.Sc.VSemester

DSE-3 ORGANOMETALLIC CHEMISTRY

Aftercompletionofcoursethestudentswillableto:-

CO1. Have a good overview of the fundamental principles of organotransition –metal chemistry and know how chemical properties are affected by metals and ligands.

CO2. Be able to the use knowledge about structure and bonding issues to understand the stability and reactivity of simple organometallic complex.

CO3. Have insight into the use of modern method to characterize sandwich compounds.

CO4. Understand fundamental reaction types and mechanisms and how to combine there to understand efficient catalytic proceses.

CO5. Know important application of organometallic homogenous. Catalysis in the production of large –scale (bulk) and smaller – scale (fine chemicals)production.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓
PO-3				✓	
PO-4		✓			
PO-5		✓			
PO-6					✓
PO-7	✓	✓	✓	✓	✓
PO-8	✓	✓			✓
P0-9					✓
P0-10					
P0-11					

B. Sc. – V SEMESTER		
DSE-3 ORGANOMETALLIC CHEMISTRY		
PAPER CODE: DSECHE03 **COURSE CODE:DSECHE03**		
CREDIT: **Theory :03**	**HOURS:** **PRACTICAL:45**	
MARKS: **PRACTICAL:80**		

Introduction .

Classification of organometallic compound. Ligands in organometallic chemistry. Heptacity of ligands . Electron counting and EAN rule. Classification of metal carbonyl clusters. Calculation of metal- metal bonds in cluster. Classification of high nucleated carbonyl clusters . Carbenes and carbynes. **(10 Hours)**

Metal Carbonyls:

Preparation ,Bonding in metal carbonyls. Important reaction of metal carbonyls.Vibrational (IR) and NMR study of Metal carbonyls. Effect of other ligands in spectroscopic data.

(10 Hours)

Reactions in Organometallic Chemistry Oxidative Addition (Concerted, SN2 and Radical Mechanism), Reductive Elimination. Migratory Insertion .Beta Hydride elimination. Ligand substitution. **(10 Hours)**

Sandwich Compound:

Metallocenes, Metal Arene complexes. Preparation and reactions of ferrocene. Swarts reagent, tabbe reagent.**(5 Hours)**

Catalysis by Organometallic Compound:

Homogeneous and Hetrogeneous catalysis .TOM andTOF. Wilkinson catalysist. Hydroformylation. Wacker process

Organopalladiumcataliyzed cross coupling reaction: sonogashira coupling. Stille coupling, Keck coupling, Suzuki coupling negishi coupling **(10 Hours)**

ReferenceBooks:

1.K.F.purcell and J.C. Kotz. Inorganic Chemistry. WB saunders co. USA(1977)

2. M.C. Day and J.Selbin, Theoretical Inorganic chemistry, Van Nostrand Co. New York (1974).

3. J.E. Huheey, Inorganic Chemistry, harper Collins NYIV Edition (1993)

B. Sc. – V SEMESTER LAB.		
DSE V (ORGANOMETALLIC CHEMISTRY)		
CREDIT: **Theory :01**	**HOURS:** **PRACTICAL:30**	
MARKS: **PRACTICAL:50**		

(i) Semi-micro quantitative analysis (using H_2S or other methods) of mixtures- not more than six ionic species (3 cations and 3 anions excluding interfering insoluble salts) out of the following:

Cations : $NH4^+$, Pb^{2+} , Bi^{3+}, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Na^+, Ca^{2+}.

Anions : CO_3^{2-}, S^{2-}, $SO3^{2-}$, $S_2O_3^{2-}$, NO_2^-, CH_3COO^-, Cl^-, Br^-, I^-, SO_4^{2-},

(II) Mixtures should contain one interfering anion, or insoluble component ($BaSO_4$, $SrSO_4$, $PbSO_4$, CaF_2 or Al_2O_3) or combination of anions e.g. CO_3^{2-} and SO_3^{2-}, NO_2^- and NO_3^-, Cl^- and Br^-, Cl^- and I^-, Br^- and I. Spot tests should be done whenever possible. (30 Hours)

ReferenceBooks:

- A.I.Vogel:QualitativeInorganicAnalysis,PrenticeHall,7thEdn.
- A.I.Vogel:QuantitativeChemicalAnalysis,PrenticeHall,6thEdn.
- Svehla, G. (1996), QualitativeInorganicAnalysis,

Course Outcomes

B.Sc.VISemester

DSC-6 QUANTUM CHEMISTRY & PHOTOCHEMISTRY

Aftercompletionofcoursethestudentswillableto:-

CO1.

Understandbondingandpreparationofmetalcarbonylandinorganic polymers.

CO2.Explaintheroleofmetalinbiologicalsystem.

CO3.DescribethebasicprinciplesandapplicationofIR,U.V.andNMR spectroscopy.

CO4.Evaluatevibrational,Raman,ElectronicSpectroscopictechniquesand therefundamentalconceptionalprinciples

CO5.Applyelectro chemical,GalvanicandConcentrationcellindeterminingvalencyofions ,solubilityandactivitycofficient.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓
PO-3				✓	✓
PO-4	✓	✓	✓	✓	✓
PO-5					
PO-6		✓			
PO-7	✓	✓	✓	✓	✓
PO-8	✓			✓	✓
PO-9					
PO-10					
PO-11					

B. Sc. – VI SEMESTER		
DSE VI QUANTUM CHEMISTRY & PHOTOCHEMISTRY		
COURSE CODE :UD2 PAPER CODE :DSCCHE -06		
CREDIT: **Theory :03**	**HOURS:** **PRACTICAL:45**	
MARKS: **THEORY:80**		

Quantum Mechanics I:

Black body radiation. Plank's radiation law. Photoelectric effect. Compton effect. Operator : Hamiltonian Operator, Angular momentum operator, Laplacian Operator. Postulates of quantum mechanics. Eigen values, Eigen function. Schrodinger time independent wave equation. Physical significance of Applications of Schrodinger wave equation to particle in one dimensional box. Hydrogen atom (separation into three equations) . radial and angular wave functions

16Hours)

Quantum Mechanics II:

Quantum mechanical approach of molecular orbital theory. Basic idea of forming M.O. and A.O., LCAO approximation. Formation of H2+ ion. Calculation of energy levels from wave functions. Bonding and antibonding wave functions. Concept of …… orbitals and their characterstics. Hybrid orbitals – sp, sp2 and sp3. Calculation of coefficients of atomic orbitals used in these hybrid orbitals.

Introduction of valence bond model of H2, Comparision of M.O. and V.B. models. Huckel theory. Application of Huckel theory to ethane, propene etc.

(16Hours)

Photochemistry

Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws, of photochemistry, quantum yield, actinometry,examples of law and high quantum yields, jablonski diagram depicting various process accurring in the excited state , Description of fluorescence ,phosphorescence, non radiative processes (internal conversion, intersystem crossing)photosensitised reactions, quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence.

(13Hours)

ReferenceBooks:

- Banwell,C.N.&McCash,E.M.*FundamentalsofMolecularSpectroscopy*4thEd . Tata McGraw-Hill: New Delhi (2006).
- Chandra,A.K.*IntroductoryQuantumChemistry*TataMcGraw-Hill(2001).

B. Sc. – VI SEMESTER	
LABORATORY COURSE (QUANTUM CHEMISTRY & PHOTOCHEMISTRY)	
CREDIT: **Theory :1**	**HOURS:** **PRACTICAL:30**
MARKS: **PRACTICAL:50**	

e spectroscopy

- Verify Lambert-Beer's law and determine the concentration of $CuSO_4$/$KMnO_4$/$K_2Cr_2O_7$

in a solution of unknown concentration

- Determine the concentrations of $KMnO_4$ and $K_2Cr_2O_7$ in a mixture.
- Study the kinetics of iodination of propanone in acidic medium.
- Determine the amount of iron present in a sample using 1,10-phenathroline.
- Determine the dissociation constant of an indicator (phenolphthalein).
- Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium

hydroxide.

- Study of pH-dependence of the UV-Vis spectrum (200-500 nm) of potassium dichromate.
- Spectral characteristics study (UV) of given compounds (acetone, acelaldehyde, acetic

acid, etc.) in water.

- Absorption spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M H_2SO_4) and determine λ_{max} values.

Note: **Experiments may be added/deleted subject to availability of time and facilities**

ReferenceBooks:

- A.I. Vogel: Qualitative Inorganic Analysis, Prentice Hall,7thEdn.
- A.I. Vogel: Qualitative Chemical Analysis, Prentice Hall, 6th Edn.
- Vogel A.I. Tatchell, A.R.Furnis,B.S. Hannaford ,A.J. & Smith,P,W.G.,TTextbook of practical Organic chemistry, prentice-Hall, 5th edition 1996
- Mann.F.G.& Saunders , B.C.practical organic chemistry Orient- Longum 1960.

Course Outcomes

B.Sc.VISemester

DSE-4- SOLID STATE AND MOLECULAR SPECTROSCOPY

Aftercompletionofcoursethestudentswillableto:-

CO1. Understand the form of solid , crystal system idenfication lattice plane.

CO2. Explain Law of rational indices, structure of different crystals, and defects of crystals.

CO3. Describe the basic principles of NMR, electronic spectroscopy, Electron spin Resonance Spectroscopy

CO4. Evaluate vibrational Raman, Electron Spectroscopy techniques and their application.

CO5.Apply,rotational vibrational, Electronic and NMR Spectroscopy on structure determination of compounds.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓	✓	✓	✓	✓
PO-2	✓	✓	✓	✓	✓
PO-3					✓
PO-4	\	✓	✓	✓	✓
PO-5					
PO-6		✓			
PO-7	✓	✓	✓	✓	✓
PO-8	✓			✓	✓
P0-9					
P0-10					
P0-11					

B. Sc. – VI SEMESTER	
DSE-VI- SOLID STATE AND MOLECULAR SPECTROSCOPY	
COURSE CODE:DSECHE04 **PAPER CODE** **DSECHE04**	
CREDIT: **Theory :03**	**HOURS:** **PRACTICAL:45**
MARKS: **PRACTICAL:80**	

Solids: Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacialangles, Law of rational indices. Miller indices. X–Ray diffraction by crystals, Bragg's law. StructuresofNaCl,KClandCsCl(qualitativetreatmentonly).Defectsincrystals.Glasses and liquid crystals.

(12Hours)

MolecularSpectroscopy: Interaction of electromagnetic radiation with molecules and various types of spectra; Born-Oppenheimer approximation.

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules,modesofvibration,conceptofgroupfrequencies.Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches. **(12Hours)**

Ramanspectroscopy: QualitativetreatmentofRotationalRamaneffect;Effectofnuclear spin,VibrationalRamanspectra,Stokesandanti-Stokeslines;theirintensitydifference,rule of mutual exclusion.**(11Hours)**

Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and predissociation, calculation of electronic transitions of polyenes using free electron model. **(12Hours**

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra, different scales, spin-spin coupling and high resolution spectra, interpretation of PMR spectra of organic molecules.
ElectronSpinResonance(ESR)spectroscopy: principle, selection rule.hyperfinesplitting.Super hyperfine splitting. Zero field splitting and Kremer degeneracy. ESRof simple radicals.

(33Hours)

ReferenceBooks: Chandra,A.K.*IntroductoryQuantumChemistry*TataMcGraw-Hill(2001).

- House,J.E.*FundamentalsofQuantumChemistry*2nd Ed.Elsevier:USA(2004).
- Lowe,J.P.&Peterson,K.*QuantumChemistry*,AcademicPress(2005).
- Kakkar, R. *Atomic & Molecular Spectroscopy*: *Concepts & Applications*, CambridgeUniversity Press (2015).

B. Sc. – VI SEMESTER lAB	
(SOLID STATE AND MOLECULAR SPECTROSCOPY)	
CREDIT: **Theory :01**	**HOURS:** **PRACTICAL:30**
MARKS: **PRACTICAL:50**	

(30Hours)

I. Studythe200-500nmabsorbancespectraofKMnO$_4$andK$_2$Cr$_2$O$_7$(in0.1MH$_2$SO$_4$) and determine the λ_{max} values.

II. StudythepH-dependenceoftheUV-Visspectrum(200-500nm)ofK$_2$Cr$_2$O$_7$

III. Verify Lambert-Beer's law and determine the concentrationof CuSO$_4$/KMnO$_4$/K$_2$Cr$_2$O$_7$ in a solution of unknown concentration

IV. DeterminetheconcentrationsofKMnO$_4$andK$_2$Cr$_2$O$_7$inamixture.

V. Studythekineticsofiodinationofpropanoneinacidicmedium.

VI. Determinetheamountofironpresentinasampleusing1,10-phenathroline.

VII. Determinethedissociationconstantofanindicator(phenolphthalein).

VIII. Studythekineticsofinteractionofcrystalviolet/phenolphthaleinwithsodium hydroxide.

IX. Analysethegivenvibration-rotationspectrumofHCl(g)

ReferenceBooks

- Mendham,J.*Vogel'sQuantitativeChemicalAnalysis*,Pearson,2009.
- Khosla, B. D.; Garg, V. C. &Gulati, A.,*Senior Practical Physical Chemistry,* R.Chand & Co.: New Delhi (2011).
- Garland,C.W.;Nibler,J.W.&Shoemaker,D.P.*ExperimentsinPhysical Chemistry 8th Ed.;* McGraw-Hill: New York (2003).
- Halpern, A. M. &McBane, G. C. *Experimental Physical Chemistry 3rd Ed.;* W.H.Freeman & Co.: New York (2003).