M.Sc. Pg maybe

JECRC UNIVERSITY™

BUILD YOUR WORLD

Department of Chemistry

Course Structure and Syllabi

B.Sc. Pass Course

Session 2021-22

JECRC UNIVERSITY
FACULTY OF SCIENCE
SESSION 2021-2022

Details of Scheme for B Sc. (Passcourse.) with various Courses and their credits with contact hours are given below:

Semester I

S.No.	Subject	Lecture (Hr.)	Tutorials (Hr.)	Practical (Hr.)	Credits			Total Credits	Paper Category
					L	T	P		
1.	Core 1: Periodicity, Mechanism of organic reactions and states of matter	4	-	2	4		1	5	Core
2.	Subject B (Course 1)	4	-	2	4		1	5	Core
3.	Subject C (Course 1)	4	-	2	4		1	5	Core
4.	Fundamental of Computers	2	-		2			2	Fundamenta
5.	Fundamental of Computers lab			2			1	1	Fundamenta
6.	Environment Studies	3		2*	3		1	4	Fundamenta
7.	Communication Skills	2	0	0	2	0	0	2	Foundation
8.	Communication Skills Lab	0	0	2	0	0	1	1	Foundation
9.	Culture Education I	2	-		2			2	Foundation
		21		12	21		6	27	

*Field/ Project Work and Report

Semester II

Subject Code	Subject	Lecture (Hr.)	Tutorials (Hr.)	Practical (Hr.)	Credits			Total Credits	Paper Category
					L	T	P		
1.	Core 2: Chemical bonding and hydrocarbons	4	-	2	4		1	5	Core
2.	Subject B (Course 2)	4	-	2	4		1	5	Core
3.	Subject C (Course 2)	4	-	2	4		1	5	Core

4.	Computer Application-II (Advanced MS-Excel)		-	2			1	1	Fundamental
5.	Professional Skills	2	0	0	2	0	0	2	Foundation
6.	Professional Skills Lab	0	0	2	0	0	1	1	Foundation
7.	Culture Education-2	2	0	0	2	0	0	2	Foundation
		16		10	16		5	21	

Semester III

S.No	Subject	Lecture (Hr.)	Tutorials (Hr.)	Practical (Hr.)		Credits		Total Credits	Paper Category
					L	T	P		
1.	Core 3: Stereochemistry and solutions	4	-	2	4		1	5	Core
2.	Subject B (Course3)	4	-	2	4		1	5	Core
3.	Subject C (Course3)	4	-	2	4		1	5	Core
4.	Computer Application -III (MS- Projects)		-	2			1	1	Fundamental
5.	Life Skills1(Aptitude)	1	0	2	1	0	1	2	Foundation
6.	Value Education-1	1	0	0	1	0	0	1	Foundation
7.	Open Elective I	3		0	3		0	3	Interdisciplinary
		17		10	17		5	22	

Semester IV

S.No	Subject	Lecture (Hr.)	Tutorials (Hr.)	Practical (Hr.)		Credits		Total Credits	Paper Category
					L	T	P		
1.	Core 4: Transition & inner transition metals, aromaticity and	4	-	2	4		1	5	Core

	thermodynamics								
2.	Subject B (Course4)	4	-	2	4		1	5	Core
3.	Subject C (Course 4)	4	-	2	4		1	5	Core
4.	Computer Application -IV (Web Designing)	2	-		2			2	Fundamenta
5.	Computer Application -IV (Web Designing) Lab			2			1	1	Fundamenta
6.	Life Skills-2 (Personality Development)	1	0-	2	1	0	1	2	Foundation
7.	Value Education-2	1	0	0	1	0	0	1	Foundation
		16		10	16		5	21	

Semester V

S.No	Subject	Lecture (Hr.)	Tutorials (Hr.)	Practical (Hr.)		Credits		Total Credits	Paper Categor
					L	T	P		
1.	Core 5: Coordination compounds, alkyl & aryl halides and chemical kinetics	4	-	2	4		1	5	Core
2.	Subject B(Course5	4	-	2	4		1	5	Core
3.	Subject C(Course5)	4	-	2	4		1	5	Core
4.	Project			12			6	6	Discipline Specific
		12		18	12		9	21	

Semester VI

S.No	Subject	Lecture (Hr.)	Tutorials (Hr.)	Practical (Hr.)		Credits		Total Credits	Paper Categor
					L	T	P		
	Core 6: Alcohols,	4	-	2	4		1	5	Core

	phenols and organometallic chemistry								
	Subject B(Course 6	4		2	4		1	5	Core
	Subject C (Course 6	4		2	4		1	5	Core
	Open Elective- II	3			3			3	Interdisciplinar
	Open Elective –III	3			3			3	Interdisciplinar
	Total Credits	18		6	18		3	21	

Credits	I Sem	II Sem	III Sem	IV Sem	V Sem	VI Sem	Total
	27	21	22	21	21	21	133

PROGRAMME OUTCOMES

PO1Core competency: The chemistry graduates are expected to know the fundamental concepts of chemistry and applied chemistry. These fundamental concepts would reflect the latest understanding of the subject and in allied subject areas. Students will learn to investigate, experiment, relate information and draw logical conclusions based on scientific reasoning.

PO2Disciplinary knowledge and skill: To learn and apply the knowledge of Chemistry in research and addressing practical problems and to apply various scientific methods to address different problems and critically analyze the data. The student will be inquisitive about processes and phenomena happening during experiments in laboratories and seeks answers through the research path.

PO3Skilled communicator: Communicate effectively on various scientific issues with the with society at large, They are expected to read and understand documents with in-depth analyses and logical arguments. Graduates are expected to be well-versed in speaking and communicating their idea.

PO4Critical thinker and problem solver: Critical thinking and analytical reasoning and the scientific knowledge will help to develop scientific temper of a Chemistry graduate that will be more beneficial for the society. The student will be able to draw logical conclusions based on a group of observations, facts and rules. Student will be able to solve the problems related with society like water sanitation, effective remediation, pollution, development of effective drugs and other necessary chemicals without side effects.

PO5Team player: The course curriculum has been designed to provide opportunity to act as team player by contributing in laboratory, field based work ,project and industry.

PO6Moral and ethical awareness: Graduates are expected to be responsible citizen of India and be aware of moral and ethical baseline of the country and the world.. Emphasis be given on academic and research ethics, including fair Benefit Sharing, Plagiarism, Scientific Misconduct and so on.

PO7Skilled project manager: Graduates are expected to be familiar with decision making process and basic managerial skills to become a better leader by acquiring knowledge about Chemistry project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.

PO8Digitally literate: The student will acquire knowledge in understanding and carrying out data analysis, use of library search tools, and use of chemical simulation software and related computational work. Students will acquire digital skills and integrate the fundamental concepts with modern tools.

PO9 Environment and sustainability Apply the knowledge of basic science, Chemistry and allied fields to protect environment and to prevent environmental degradation as science graduate, to stay firm on the value systems, of their culture, including their own for a healthy socio cultural environment.

PO10 Lifelong learner: Graduates will acquire the ability to engage in independent and self-learning as well as to successfully pursue their career objectives in advanced education and in professional courses, through the use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability.

Program Specific Outcome (PSO)

PSO1 The ability to demonstrate knowledge and understanding of essential facts, concepts, principles and theories relating to the subject areas identified.**(Learning skills)**

PSO2 The ability to recognize and analyze problems related to Chemistry and plan strategies for their solution.**(Problem solving skills)**

PSO3 Skills in the evaluation, interpretation and synthesis of chemical information and skills in the practical application of theory and skills in communicating scientific material and arguments **(Interpretation skills)**

Semester-I

BSC001A: Periodic Properties,Mechanism of Organic Reactions and States of Matter

Course Outcome *At the end of this course students will be able to:*

- *CO1: Evaluate the periodic properties like atomic and ionic radii, ionization energy, electron affinity and electronegativity and their applications.*
- *CO2: Understand the common themes running through ionic and metallic descriptions of chemical bonding*
- *CO-3: Analyze and formulate mechanisms of different organic reaction including addition, Substitution, elimination and rearrangement reactions.*
- *CO-4 Understand various types of State of matters, imperfections in crystals and crystal structures and various properties of liquid and gaseous state and their determinations*

Mapping of PO/CO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO-8	PO-9	PO-10	PSO-1	PSO-2	PSO-3
CO1	2	2	2	1	1	1			1	2	1	2	1
CO2	1	2	2	1	2	2	1			1	2	2	1
CO3	2	1	2		2	2		1		2	1	2	2
CO4	1	2	1	1	2	2				2	1	2	2

1 – LOW 2- MEDIUM 3-HIGH

Unit-I Periodic Properties : Atomic and ionic radii, ionization energy, electrode potential (use of redox potential-reaction feasibility), electron affinity and electronegativity – definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behavior, electronic configuration.

MIT : Principe of chemical science (fall 2008)

Unit-II Chemical Bonding- I

(i) **Ionic Bond** – Types of ionic solids, radius ratio effect and coordination number, limitations of radius ratio, lattice defects, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability, Fajan's rules.

(ii) **Metallic Bond :** Free electron, valence bond and band theories. Weak Interactions: Hydrogen Bond – experimental evidence, van der Waal's forces.

Unit III: Structure, Bonding & Mechanism of Organic Reactions

(i) Hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding. Types of organic reactions, Energy considerations.

(ii) Types, structure, relative stability, and reactivity of Carbocations, Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species. Methods of determination of reaction mechanism: product analysis, intermediates, isotope effects. Kinetic and stereochemical studies.

Unit-IV Solid State: Types of crystals (molecular, covalent, metallic, ionic), Imperfections in crystals: point defect, Schottky defect, Frankel defect, metal excess defect (colour centre), line defect (dislocations), edge and screw dislocations, Crystal structure of NaCl, KCl, Graphite, and Diamond. Band theory of solids.

MIT- Band theory of solids

UNIT-V Liquid State: Surface tension of liquids, capillary action, surface tension and temperature, interfacial tension, surface active agents, Viscosity of liquids, experimental determination of viscosity coefficient, its variation with temperature, Intermolecular forces of liquids.

MIT- Band theory of solids, surface tension

Suggested Books

1.Concise Inorganic Chemistry by J.D.Lee
2.Inorganic Chemistry Principles of Structure and Reactivity-Huheey James,E.Keiter Ellen, A. Pearson,Edu.Delhi.
3.Stereochemistry of organic compounds-P.S.Kalsi,New age International
4.Organic chemistry Reaction and Reagents-O.P.Agarwal,KrishnaPrakashan Meerut
5.Advanced Organic Chemistry by Bahl & Bahl, S.Chand Publications.
6.Organic Chemistry by Morrison Boyd, Pearson Publications.
7.Advanced Organic Chemistry by Bahl & Bahl, S.Chand Publications.
8.Advanced Organic chemistry-Jagdamba singh and LDS Yadav
10.Advanced Physical chemistry –Gurdeep Raj,Goel Publication
11.Essentials of physical Chemistry-Puri, Sharma,Pathania

BSC002A :Acid –Base Titrations and Radical identification (Practicals)

INORGANIC CHEMISTRY

1. To analyse acidic radicals of concentrated H_2SO_4 group.
2. To analyse acidic radicals of concentrated H_2SO_4 group.
3. To analyse sulphate radical.
4. To analyse interfering radicals BO_3^{-3}, PO_4^{-3}, $C_2O_4^{-2}$, F^-

ORGANIC CHEMISTRY

1. To purify the impure sample of organic compounds by sublimation.
2. To separate the mixture (1 solid+1 liquid) by distillation.

3. To detect the elements (N and S) from the given organic compound.
4. To detect the element (halogen) from the given organic compound.
5. To purify the impure sample of organic compound by crystallization and decolourised the
6. compound by charcoal.

PHYSICAL CHEMISTRY

1. To prepare standard 0.1 N NaOH solution using 0.1 N oxalic acid as primary standard
2. solution.
3. To determine strength of unknown CH_3COOH using 0.1 N NaOH as intermediate
4. solution.
5. To determine the percentage composition of a given mixture (non interacting system) by viscosity method.
6. To determine the percentage composition of a given mixture (non interacting system) by
7. surface tension method
8. To determine the partition coefficient of Iodine between water and carbon tetrachloride (or chloroform, carbon disulphide etc) at room temperature.

Semester-II

BSC003A Chemical Bonding and Hydrocarbons

Course Outcome

At the end of this course students will be able to:

- *CO1: Analyze the structure and bonding in molecules / ions and predict the structure of molecules / ions via valence bond theory, valence shell electron pair repulsion and molecular orbital theory and its applications*
- *CO2: Understand the common themes running through ionic and metallic descriptions of chemical bonding.*
- *CO-3: understand physical properties and apply chemical properties of various hydrocarbons viz. alkanes, alkenes and cycloalkanes in different sectors.*
- *CO-4 Understand basic knowledge of various types properties of gaseous state and their determinations*

Mapping of PO/CO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO-8	PO-9	PO-10	PSO-1	PSO-2	PSO-3
CO1	2	3	2	3	2		1		2	3	2	2	1
CO2	1	2	1	2	2	1	1		1	1	2	1	2
CO3	2	2		1	2	1		2		2	2	2	1
CO4	2	3	1	2	2	1		1	2	2	2	1	2

1 – LOW 2- MEDIUM 3-HIGH

Unit – I Chemical Bonding II:

Shape of s,p,d orbitals and their characteristics,Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridizations and shapes of simple inorganic molecules and ions such as NH_3,H_3O^+, SF_4, ClF_3 $ICl_2^-$and H_2O by valence shell electron pair

repulsion (VSEPR) theory and Molecular Orbital Theory, bonding, nonbonding and antibonding molecular orbitals, linear combination of atomic orbitals(LCAO). Applications of MO theory.

Unit-II s-Block Elements :

Tendencies of alkali and alkaline-earth metals, hydration energies, solvation and complexation, Hydride (classification, general methods of preparation and salient features), principle of metallurgical extraction, Chemistry of Li and Be, their anomalous behaviour and diagonal relationships, alkyls and aryls and their role in biology.

Unit III: Alkanes & Cycloalkanes

Isomerism in alkanes, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction, and decarboxylation of carboxylic acids). Physical properties and chemical reaction of alkanes. Mechanism of free radical halogenations of alkanes, orientation, reactivity and selectivity.

Introduction and nomenclature of cycloalkanes, Baeyer's strain theory and its limitations, Ring strains in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring; banana bonds.

Unit IV: Alkenes

Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halide, regioselectivity in alcohol dehydration The Saytzeff rule, Hofmann's elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanisms involved in hydrogenation, electrophilic and free radical additions, Markovnikov's rule, hydroboration- oxidation, oxymercutation -reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$. Polymerization of alkenes. Substitution at the allylic and vinylic-positions of alkenes. Industrial applications of ethylene and propene.

Unit V: Gaseous State: Kinetic theory of gases, transport coefficients. Collision in a gas- mean free path, collision diameter and its dynamics, collision number and effusion. Behaviour of real gases -Van der Waal's equation, Critical phenomena - critical constants of a gas and their determination, continuity of state, critical state, Principle of corresponding states, liquefaction of gases.

MIT- Kinetic theory of gases, transport coefficients, collision diameter and its dynamics, collision number and effusion.

Suggested Books

1.Concise Inorganic Chemistry by J.D.Lee

2.Inorganic Chemistry Principles of Structure and Reactivity-Huheey James,E.Keiter Ellen, A. Pearson,Edu.Delhi.
3.Stereochemistry of organic compounds-P.S.Kalsi,New age International
4.Organic chemistry Reaction and Reagents-O.P.Agarwal,KrishnaPrakashan Meerut
5.Advanced Organic Chemistry by Bahl & Bahl, S.Chand Publications.
6.Organic Chemistry by Morrison Boyd, Pearson Publications.
7.Advanced Organic Chemistry by Bahl & Bahl, S.Chand Publications.
8.Advanced Organic chemistry-Jagdamba singh and LDS Yadav
10.Advanced Physical chemistry –Gurdeep Raj,Goel Publication
11.Essentials of physical Chemistry-Puri, Sharma,Pathania

BSC004A: Mixture Analysis and Functional Group identification (Practicals)

INORGANIC CHEMISTRY

1. To analyse mixture containing three acidic and three basic radicals (Group I ,II andVII).
2. To analyse mixture containing three acidic and three basic radicals(Group II,III and VII).
3. To analyse mixture containing three acidic and three basic radicals(GroupIV,VI and VII).
4. To analyse mixture containing three acidic and three basic radicals(Group I ,II and V).
5. To analyse mixture containing three acidic and three basic radicals including BO_3^{-3}as the interfering radical.
6. To analyse mixture containing three acidic and three basic radicals including PO_4^{-3}as the interfering radical.
7. To analyse mixture containing three acidic and three basic radicals including $C_2O_4^{-2}$ or F^- the interfering radical.
8. To analyse mixture containing three acidic and three basic radicals. Mixture contains combination of acidic radicals. (Chloride in presence of Bromide or Iodide).
9. To analyse mixture containing three acidic and three basic radicals. Mixture contains combination of acidic radicals.(Oxalate in presence of Carbonate)

ORGANIC CHEMISTRY

1. To detect the functional group (alcoholic and phenolic) from the given organic compound.
2. To detect the functional group (Carboxylic and ester) from the given organic compound.
3. To detect the functional group (Carbonyl and Amide) from the given organic compound.
4. To detect the functional group (Amine and Aniline) from the given organic compound.
5. To detect the functional group (Carbohydrate And Nitro) from the given organic compound.

PHYSICAL CHEMISTRY

1. To determine the specific reaction rate of the hydrolysis of methyl or ethyl acetate catalysed by HCl at room temperature.
2. To determine the specific reaction rate of the hydrolysis of methyl or ethyl acetate catalysed by H_2SO_4 at room temperature and compare the relative strength of acids.
3. To determine the specific reaction rate of the hydrolysis of methyl or ethyl acetate catalysed by HCl at higher temperature (40°C) and also determine energy of activation for the reaction.
4. To study the effect of acid strength on the hydrolysis of ester.
5. To prepare colloidal solution of arsenius sulphide.

Semester-III

BSC005A: Stereochemistry and solutions

Course Outcome

At the end of this course students will be able to:

- *CO1: Understand the salient features of p-block Elements (Group 13 and 14) and their different compounds having the industrial and biological applications.*
- *CO-2: understand physical properties and apply chemical properties of various hydrocarbons viz. alkynes and dienes in different sectors.*
- *CO-3: develop a sound understanding of the fundamental concepts of stereochemistry.*
- *CO-4 Understand basic knowledge of ideal and non ideal solutions and their properties and different types of colligative properties of dilute solution.*

Mapping of PO/CO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO-8	PO-9	PO-10	PSO-1	PSO-2	PSO-3
CO1	1	3	2	3	2	1		2	2	2	2	3	1
CO2	2	2	2	1	2	2	1	1	2		2	2	1
CO3	3	2	2	1	3	1		1		2	2	2	2
CO4	2	2	2	2	1	1	1	2	2	1	2	2	2

1 – LOW 2- MEDIUM 3-HIGH

Unit-I p-Block Elements :

Comparative study (group-wise) of group 13 & 14 elements with respect to periodic properties. Compounds such as hydrides, halides, oxides and oxyacids; diagonal relationship; preparation, properties, bonding and structure of diborane, borazine and alkali metal borohydrides. Preparation, properties and technical applications of carbides and fluorocarbons. Silicones and structural principles of Silicates , Borazines, Phosphonitrichaides

Unit II: Alkynes and Dienes

Nomenclature, structure and bonding in alkynes. Methods of preparation. Chemical reactions of alkynes, acidity of alkynes. Mechanisms of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reduction, oxidation and polymerization.

Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions-1,2- and 1,4-additions, Diels-alder reaction

Unit III: Stereochemistry

Concept of isomerism, types of isomerism. Optical isomerism: elements of symmetry, molecular chirality enantiomers. stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers. meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration: sequence rules, D & L and R & S systems of nomenclature. Determination of configuration of geometrical isomers, E & Z systems of nomenclature, geometric isomerism in oximes and alicyclic compounds.

Unit IV: Solutions: Liquid-liquid - ideal solutions, Raoult's law. Ideally dilute solutions, Henry's law. Non- ideal solutions. Vapour pressure - composition and vapour pressure- temperature curves; Azeotropes-HCl-H_2O, ethanol-water systems and fractional distillation. Partially miscible liquids-phenol-water, trimethylamine-water, nicotine-water systems. Effect of impurity on consulate temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

Unit V: Dilute solutions:

Colligative properties. relative lowering of vapour pressure, its relation to molecular weight of non-volatile solute. Elevation of boiling point and depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods of determination. Osmosis, osmotic pressure, experimental determination. Abnormal Colligative properties- Van't Hoff factor.

MIT- Osmosis,osmotic pressure, Abnormal Colligative properties- Van't Hoff factor.

Suggested Books

1.Concise Inorganic Chemistry by J.D.Lee
2.Inorganic Chemistry Principles of Structure and Reactivity-Huheey James,E.Keiter Ellen, A. Pearson,Edu.Delhi.
3.Stereochemistry of organic compounds-P.S.Kalsi,New age International
4.Organic chemistry Reaction and Reagents-O.P.Agarwal,KrishnaPrakashan Meerut
5.Advanced Organic Chemistry by Bahl & Bahl, S.Chand Publications.
6.Organic Chemistry by Morrison Boyd, Pearson Publications.
7.Advanced Organic Chemistry by Bahl & Bahl, S.Chand Publications.

8.Advanced Organic chemistry-Jagdamba singh and LDS Yadav
10.Advanced Physical chemistry –Gurdeep Raj,Goel Publication
11.Essentials of physical Chemistry-Puri, Sharma,Pathania

BSC006A Chromatographic Analysis and Calibrations (Practicals)

INORGANIC CHEMISTRY

1. To calibrate fractional weights, pipettes and burettes.
2. To prepare standard solution and dilution -0.1 M to .001M solution.
3. To estimate hardness of water by EDTA.
4. To measure dissolved oxygen in water.
5. To measure Total Solid in sewage.
6. To measure chloride in water.

ORGANIC CHEMISTRY

Thin Layer Chromatography

1. To separate the mixture of Methyl Orange and Methylene Blue by using cyclohexane and
2. ethyl acetate(8.5:1.5) as solvent system.
3. Preparation and separation of 2,4-dinitro Phenylhydrazone of acetone , 2-butanone, hexane-2-one and hexane-3-one using toluene and petroleum ether(40:60).
4. Paper Chromatography
5. To separate the mixture of phenylalanine and glycine.Alanine and aspartic acid.Leucine and glutamic acd.Spray reagent –Ninhydrin.
6. To separate the mixture of D,L-alanine,glycine and L-leucine using n-butanol : acetic acid :water (4:1:5).Spray reagent- Ninhydrin.
7. To separate monosaccharides –a mixture of D –galactose and D-fructose using n-butanol : acetone: water (4:1:5). Spray reagent –aniline hydrogen phthalate.

PHYSICAL CHEMISTRY

1. To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
2. To determine the water equivalent of the thermos flask or calorimeter.
3. To determine the enthalpy of neutralization or heat of neutralization for a strong acid and
4. strong base.
5. To determine heat of neutralization of a weak acid say acetic acid and hence calculate its
6. heat of ionization or enthalpy of ionization.
7. To determine heat of neutralization of a weak base say NH_4OH and hence calculate its
8. heat of ionization or enthalpy of ionization.

Semester-IV

BSC007A: Transition & inner transition metals, aromaticity and thermodynamics

Course Outcome

At the end of this course students will be able to:

- *CO-1: Understand the vast world of transition and inner transition elements with their basket of unique properties*
- *CO-2 understand the carbohydrates, their occurrence, structure, configuration, properties and also get the knowledge of the role of these bio-molecules in biological system and day to day life.*
- *CO-3: interpret the concept of aromaticity, properties and the chemical reactions of aromatic compounds.*
- *CO-4 Understand basic knowledge of various process of thermodynamics and their properties*

Mapping of PO/CO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO-8	PO-9	PO-10	PSO-1	PSO-2	PSO-3
CO1	2	3	2	3	2	2	2	2	2	2	3	2	2
CO2	3	2	2	2	3	2	1	2	3	1	2	3	1
CO3	2	2	1	1	3	1	1	1	1		1	2	2
CO4	2	3	2	2	1	2		1	2	1	2	1	1

1 – LOW 2- MEDIUM 3-HIGH

Unit-I Transition Metals:

Characteristic properties of 3d elements – ionic radii, oxidation states, complexation tendency, magnetic behaviour and electronic spectral properties. Spectrophotometric estimation of metal ions.

Unit-II Lanthanides & Actinides:

Comparative study of lanthanide elements with respect to electronic configuration, atomic and ionic radii, oxidation state and complex formation. Lanthanide contraction. Occurrence and principles of separation of lanthanides. Actinides: electronic configuration, atomic and ionic radii, oxidation state, Magnetic and spectral properties

Unit III: Carbohydrates

Classification and nomenclature of monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into

mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D (+) glucose.

Unit IV: Arenes & Aromaticity

Nomenclature of benzene derivatives. The aryl group, aromatic nucleus and side chain structure of benzene, molecular formula and Kekule structure, stability.
Huckle's rule, aromatic ions, Aromatic electrophilic substitution-general pattern of the mechanism, role of σ and π complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction, energy profile diagrams. Activating & deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction

Unit-V Thermodynamics-I:

Introduction of different terms and processes in thermodynamics : Systems (isolated, closed, open) and surroundings, macroscopic properties (extensive and intensive), kinds of processes, work, heat and First Law of thermodynamics, state and state functions (exact and inexact differential), path dependence of work and heat. Enthalpy, heat changes at constant volume and constant pressure, heat capacities (Cv , Cp) and relation between them for ideal gases.

MIT- First Law of thermodynamics, work and heat. Enthalpy,

Suggested Books

1. Concise Inorganic Chemistry 5 ed- J. D. Lee
2. Advanced Inorganic chemistry-S. K Agarwal, Keemtilal
3.. Organic Chemistry by Morrison& Boyd
3. Advanced Organic chemistry-Jagdamba singh and LDS Yadav
4. Reaction mechanism in Organic chemistry –S M Mukherji and S P Singh, Macmillan
5. Chemical thermodynamics-R. P. Rastogi and R.R Mishra
6. Advanced Physical chemistry –Gurdeep Raj, Goel Publication
7. Chemical thermodynamics-R. C. Srivastava, S. K. Sahaand Abhay K. Jain

BSC008A:Volumetric Analysis, Identification of Organic Compounds and Conductometric Analysis (Practicals)

INORGANIC CHEMISTRY

Volumetric Analysis

1. To determine alkali content in anta acid tablet using HCl.
2. To estimate copper using thiosulphate.
3. To determine acetic acid in commercial vinegar using NaOH solution.

Synthesis

4. To prepare Tetraammine copper (II) sulphate.
5. To prepare Ni-DMG complex.

ORGANIC CHEMISTRY

1. To indentify an organic compound (1) through the functional group analysis, determine its M.P and prepare its suitable derivative.
2. To identify an organic compound (2) through the functional group analysis,determine its M.P and prepare its suitable derivative.
3. To identify an organic compound (3) through the functional group analysis,determine its M.P and prepare its suitable derivative.
4. To identify an organic compound (4) through the functional group analysis,determine its M.P and prepare its suitable derivative.
5. To identify an organic compound (5) through the functional group analysis,determine its M.P and prepare its suitable derivative.

PHYSICAL CHEMISTRY

1. To determine the strength of given acid pH metrically.For this you are provided with standard NaOH solution.
2. To draw the solubility curve of phenol –water system and to determine critical solution temperature of the system and the composition of phenol-water system at C.S.T.
3. To determine the C.S.T of phenol-water system in presence of 1% NaCl solution and 1% succinic acid solution.
4. To determine the dissociation constant of a weak acid conductometrically and verify Ostwalds dilution law.
5. To determine the transition temperature of the given substance by thermometric method ($MnCl_2.4H_2O$)

Semester-V

BSC009A: Coordination compounds, alkyl & aryl halides and chemical kinetics

Course Outcome

At the end of this course students will be able to:

- *CO-1: Identify common organic ligands used to construct coordination complexes, their interaction with transition metals and shapes of molecules on the basis of VBT and CFT.*
- *CO-2: evaluate the structure and classes of alkyl halides, physical properties, and preparation of halo compounds, substitution, elimination, reduction reactions and their uses in everyday life w.r.t. environment concern.*
- *CO-3: evaluate the structure and classes of aryl halides, physical properties, and preparation of halo compounds, substitution, elimination, reduction reactions and their uses in everyday life w.r.t. environment concern*
- *CO-4 Understand basic knowledge of different types of kinetics reactions and collision theory, transition state theory.*

Mapping of PO/CO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO-8	PO-9	PO-10	PSO-1	PSO-2	PSO-3
CO1	2	2	3	2	2	3	2	3	2	2	2	3	2
CO2	1	3	2	3	2	1	2	2		2	2	1	2
CO3	3	3	2	2	1	1		2	2	1		2	2

CO4	2	2	1	2	2	1	1		1		2		1

Unit-I Coordination Compounds :

Werner's theory, nomenclature, chelates, stereo-chemistry of coordination numbers 4, 5 and 6. Various types of isomerism in coordination complexes. Important applications of coordination compounds. Theories of metal-ligand bonding in transition metal complexes- Sidgwick effective atomic number concept, valence bond theory of coordination compounds.

MIT : Principle of chemical science (fall 2014)

Unit-II Metal-Ligand bonding :

Limitations of valence bond theory; Crystal-field theory and crystal-field splitting in octahedral and tetrahedral complexes; factors affecting the crystal-field parameters.

MIT : Principe of chemical science (fall 2014)

Unit III: Alkyl Halides

Nomenclature of alkyl halides, methods of preparation, chemical reactions. Mechanism of nucleophilic substitution reactions of alky halides, SN^2 and SN^1 reactions with energy profile diagrams. Polyhalogen compounds, chloroform, carbon tetrachloride.

Unit IV Aryl Halides

Methods of formation of aryl halides, nuclear and side chain reactions. The addition, elimination and the elimination-addition mechanism of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl,allyl,vinyl and aryl halides. Synthesis and use of D.D.T. and B.H.C.

UNIT-V Chemical Kinetics-I:

Introduction, order and molecularity of a chemical reactions, integrated rate equations for zeroth, first, second and third order reactions, effect of temperature on reaction rates (Arrhenius equation),collision theory and transition state theory (derivation thermodynamically), deviations from collision theory.

Suggested Books

1. Selected topics in inorganic chemistry –Malik tuli, Madan.
2. Kinetics and Mechanism of Chemical Transformation-J. Rajaram and J. C. Kuriacose
3. Advanced Physical Chemistry –Gurdeep Raj,Goel Publication
4. Organic Chemistry Reaction and Reagents-O.P.Agarwal,Krishna Prakashan Meerut
5. Chemical Kinetics-Laidler

MIT- collision theory and transition state theory (derivation thermodynamically), deviations from collision theory.

BSC010A: Inorganic Preparations, Organic Mixture Separation and Adsorption Isotherms (Practicals)

INORGANIC CHEMISTRY

1. To prepare cis-potassium-dioxalatodiaquachromate (III).
2. To prepare trans-potassium-dioxalatodiaquachromate (III).
3. To prepare sodium trioxalatoferrate (III).
4. To estimate Ni as Ni-DMG in given solution.
5. To estimate Cu as CuSCN in given solution.

ORGANIC CHEMISTRY

1. To separate and identify the organic mixture containing two solid components using water and prepare their suitable derivatives.
2. To separate and identify the organic mixture containing two solid components using NaOH and prepare their suitable derivatives.
3. To separate and identify the organic mixture containing two solid components using NaOH and prepare their suitable derivatives.
4. To separate and identify the organic mixture containing two solid components using $NaHCO_3$ and prepare their suitable derivatives.
5. To separate and identify the organic mixture containing two solid components using $NaHCO_3$ and prepare their suitable derivatives

PHYSICAL CHEMISTRY

1. To determine the strength of the given acid (HCl) conductometrically using standard alkali solution.
2. To determine the strength of the given acid (CH_3COOH) conductometrically using standard alkali solution.
3. To determine the solubility and solubility product of a sparingly soluble salt conductometrically.
4. To draw spectral absorption curve for given substance ($K_2Cr_2O_7$ or $KMnO_4$) using spectrophotometer and determine the wavelength for maximum absorption for each of them. Also verify the Lambert Beer's Law and determine the concentration of unknown solution .
5. To investigate the adsorption of oxalic acid from aqueous solution by activated charcoal and examine validity of Freundlich and Langmuir adsorption isotherm.

Semester-VI

BSC011A: Alcohols, phenols and organometallic chemistry

Course Outcome

At the end of this course students will be able to:

- *CO-1 understand the synthesis and reactions of alcohols and phenols, their synthetic and industrial applications, their use as solvent and important synthetic reagents.*
- *CO-2* knowledge about the interactions of electromagnetic radiation and matter, Principles and applications of Atomic Spectroscopy, AAS, FES, ICPES.
- *CO-3 Understand basic knowledge of laws of photochemical equivalence, quantum yield and various process transitions.*

- *CO-4: Understand the classification, properties and applications of organometallic compounds.*

Mapping of PO/CO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO-8	PO-9	PO-10	PSO-1	PSO-2	PSO-3
CO1	3	2	2	2	2	3	2	3	2	2	1	2	2
CO2	2	2	2	3	2	2	1	2			2	1	2
CO3	3	3	2	3	3	1	2	1	2	1	1		2
CO4	2	2	1	2	2	1	1	1	1	2	2	2	2

Unit I: Alcohols

Classification and nomenclature. Monohydric alcohols - Nomenclature, Method of formation by Reduction of aldehydes, Ketones, Carboxylic acids and esters, Hydrogen bonding. Acidic nature. Reactions of alcohols.

Dihydric Alcohols - Nomenclature, methods of formation, Chemical reaction of vicinal glycols, Oxidative-Cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement. Trihydric Alcohols - Nomenclature and methods of formation, chemical reactions of glycerol.

Unit II: Phenols

Nomenclature, Structure and bonding. Preparation of Phenols, Physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, Resonance stabilization of phenoxide ion. Reactions of phenols: electrophilic aromatic substitution, acylation and carboxylation. Mechanism of fries rearrangement, Claisen rearrangement, Gatter-man synthesis. Hauben- Hoesch reaction, Lederer-manasse reaction and Reimer-Tiemann Reaction.

Unit-III Atomic Spectroscopy

Elecromagnetic radiations, concept of electromagnetic spectrum. Introduction of Absorption and Emission spectroscopy. Principle of Flame Emission Spectroscopy (FES) and Atomic absorption Spectroscopy (AAS), comparison, instrumentation and applications, Burners (Total consumption burner and Premix burners), Inductively coupled plasma Emission Spectroscopy (ICPES).

Unit IV- Photochemistry

Law of photochemical equivalence, quantum efficiency, reasons for low and high quantum efficiency. Jablosnski diagram depicting various processes occurring in the exited sate, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized Reactions.

MIT- Phase rule, phase diagrams of one component systems (water and sulfur), condensed phase rule,

Unit-V Organometallic Chemistry :

Definition, nomenclature and classification of organometallic compounds.Preparation, properties, bonding and applications of alkyl and aryls of Li, Al, Hg, Sn, Ti. A brief account of metal-ethylenic complexes and homogeneous hydrogenation.Metal carbonyls : 7h EAN rule, classification of metal carbonyls, structures and shapes of metal carbonyls of V, Cr, Mn, Fe, Co and Ni.

Suggested Books

1. Concise Inorganic Chemistry 5 ed- J. D. Lee
2. Inorganic Chemistry by Cotton-Willikinson
3. Organic Chemistry-R. T. Morrison and R. N. Boyd, Prentice Hall
4. Advanced Organic Chemistry-Jagdamba singh and LDS Yadav
5. Advanced Physical Chemistry –Gurdeep Raj,Goel Publication
6. Essentials of Physical Chemistry-Puri, Sharma, Pathania
7. A Text book of Electro- Chemistry-Glasstone
8. Spectroscopy of Organic Compounds by P.S. Kalsi, New Age International Publications.

BSC012A: Inorganic and Organic Preparations and Optical Analysis (Practicals)

INORGANIC CHEMISTRY

1. To synthesize Hexaammine nickel (II)chloride.
2. To synthesize prussian blue.
3. To measure fluoride in the given sample by SPANDS method.
4. To separate and estimate Mg(II) and Zn(II).
5. To separate and estimate Cu(II) and Ni(II).

ORGANIC CHEMISTRY

1. To prepare acetanilide from aniline (Acetylation).
2. To prepare phenylbenzoate from phenol (Benzoylation).
3. To prepare Iodoform from ethanol and acetone. (Aliphatic Electrophilic Substitution).
4. To prepare m-dinitro benzene from nitro benzene .
5. To prepare p-nitro acetanilide from acetanilide.
6. To prepare Benzoic acid from toluene.

PHYSICAL CHEMISTRY

1. To determine the specific rotation of a given optically active compound.
2. To determine the equivalent conductance of a strong electrolyte KCl or NaCl at several concentrations and verify the applicability of Debye Huckel Onsager equation.
3. To determine the equivalent conductance of a strong electrolyte HCl at several concentrations and verify the applicability of Debye Huckel Onsager equation.
4. To study saponification of ethyl acetate conductometrically.
5. To determine the freezing point depression constant of camphor using naphthalene as solute and hence determine the molecular weight of acetanilide by