

# Swami Ramanand Teerth Marathwada University, Nanded



**B. O. S. In Chemistry**  
**B. Sc. First Year (Chemistry)**

**Semester-I & II**

**C B C S**

**In force from June - 2016**

Distribution of credits for B.Sc. Chemistry (optional)  
Under Faculty of Science  
**B. Sc. Syllabus structure**  
Semester Pattern (CBCS) effective from June, 2016  
**Subject: Chemistry**

**Total credits semester I and II:  
12**

**Note:**

Semester	Paper No.	Name of the Course	Instructi on Hrs/ week	Total period	Internal Evaluatio n	Marks of Semest er	Total Marks	Credits
I	CCC I (Section A)	Organic + Inorganic Chemistry, <b>P-I</b>	02+01=03	30+15=45	10	40	50	2
	CCC I (Section B)	Physical + Inorganic Chemistry, <b>P-II</b>	02+01=03	30+15=45	10	40	50	2
II	CCC II (Section A)	Organic + Inorganic Chemistry, <b>P-III</b>	02+01=03	30+15=45	10	40	50	2
	CCC II (Section B)	Physical + Inorganic Chemistry, <b>P-IV</b>	02+01=03	30+15=45	10	40	50	2
	CCC P-I ( CCC- I & II), (section A&B)	Practical's based on Section A & Section B of CCC- I & CCCC- II ( <b>P-V</b> )	04	20 Practicals	20	80	100	4

- The syllabus is based on six (3\*2) theory periods and four practical periods per batch per week. Candidates should require passing separately in theory and practical examinations.
- Theory examination 40 marks (30+10 mcq for each paper).
- Internal evaluation 10 marks (test for assignment and attendance).
- At least twenty practicals should be taken: **6** practicals from Inorganic Chemistry, **8** from Organic and **6** from Physical Chemistry.

Semester	Paper No.	Name of the Course	Instructi on Hrs/ week	Total period	Internal Evaluatio n	Marks of Semeste r	Total Mark s	Credits
III	CCC III (Section A)	Organic + Inorganic Chemistry, <b>P-VI</b>	02+01=03	30+15=45	10	40	50	2
	CCC III (Section B)	Physical + Inorganic Chemistry, <b>P-VII</b>	02+01=03	30+15=45	10	40	50	2
	CCCP II (CCC III &IV) ( Section-A)	Practical based on P-VI &P VIII ( <b>P-X</b> )	04	20 practical	10	40	50	2
	CCCP II (CCC III &IV) ( Section-A)	SEC-I( 1 Skill/ optional)			15*3=45			(02)*
IV	CCC IV (Section A)	Organic + Inorganic Chemistry, <b>P-VIII</b>	02+01=03	30+15=45	10	40	50	2
	CCC IV (Section B)	Physical + Inorganic Chemistry, <b>P-IX</b>	02+01=03	30+15=45	10	40	50	2
	CCCP III (CCC III & IV) ( Section-B)	Practical based on P-VII & P-IX ( <b>P-XI</b> )	04	20 practical	10	40	50	2
	CCCP III (CCC III &IV) ( Section-B)	SEC-II( 1 Skill/ optional)			15*3=45			(02)*

**Total credits semester III and IV: 12 (04)\***

Semester	Course No.	Name of the Course	Instruction Hrs/ week	Total period	Internal Evaluation	Marks of Semester	Total Marks	Credits
V	DECC I (Section A)	Organic + Inorganic Chemistry (P-XII)	03	45	10	40	50	2
	DECC I [(Section B) Elective]	Physical + Inorganic Chemistry(P-XIII) OR Applications of Computers in Chemistry OR Green Chemistry OR Inorganic Materials of Industrial Importance, etc.	03	45	10	40	50	2
	DECCP I [DECC I & II (Section A)]	Practical's based on P- XII & PXIV(P-XVI)	04	20 Practicals	10	40	50	2
	DECCP II [DECC I& II (Section A)]	SEC III (1 Skill/ optional) Basic Analytical Chemistry OR Chemical Technology and Society OR Business Skills for Chemists OR Analytical Clinical Biochemistry, etc			15×3 = 45	-	-	(02)*
VI	DECC II (Section A)	Organic + Inorganic Chemistry (P-XIV)	03	45	10	40	50	2
	DECC II [(Section B) Elective]	Physical + Inorganic Chemistry (P-XV) OR Instrumental Methods of Analysis OR Organometalics, Bioinorg - anic Chemistry, Poly - nuclear hydrocarbons and UV, IR, Spectroscopy OR Molecules of Life, etc.	03	45	10	40	50	2
	DECCP III) [DECC I & II (Section B)]	Practical's based on P- XIII & P-XV (P-XVII)	04	20 Practicals	10	40	50	2
	DECCP-IV DCCI and II (Section B)	<b>SEC IV Project-work.</b>			50	-	50	(2)*
<b>Total credits semester V and VI</b>								<b>12(04)*</b>

**B. Sc. Chemistry**  
**First Year (Semester-I) CBCS**  
**Paper-I Organic + Inorganic Chemistry (CCC-I, Section –A)**

Credits: 02

Periods: 45

**Part- I**  
**Organic Chemistry**

**Unit-I**

**1. Nomenclature of Organic Compounds : 06**

Functional groups and types of organic compounds, Basic rules of IUPAC nomenclature, Nomenclature of mono- and bi-functional compounds on the basis of priority order of the following classes of compounds: alkanes, alkenes, alkynes, haloalkanes, alcohols, ethers, aldehydes, ketones, carboxylic acids, carboxylic acid derivatives (acid halides, esters, anhydrides, amides), nitro compounds, nitriles and amines; Nomenclature of aromatic compounds: mono-, di-, and polysubstituted benzene (with not more than two functional groups), Monosubstituted fused polycyclic arenes – naphthalene, anthracene and phenanthrene. Nomenclature of bicyclic compounds.

**2. Basic Concepts In Organic Chemistry : 07**

Substrate and Reagents.

Types of reagents (Electrophilic and Nucleophilic).

Homolytic and heterolytic fission.

Electron mobility:

- a) Inductive effect (effect on acidic strength of the following acid: acetic acid, propanoic acid and  $\alpha$ -chloro acetic acid)
- b) Mesomerism (aniline, nitrobenzene)
- c) Hyperconjugation (toluene)
- d) Steric effect (mesitoic acid)

Formation and Study of reaction intermediates with stability order (Carbocations, Carbanions, Free radicals, Carbenes, Nitrenes, Arynes.)

Types of organic reaction: Substitution, Addition, Elimination, Rearrangement. (With one example)

**Unit-II**

**3. Alkanes and Cycloalkanes : 04**

**3.1 Alkanes**

Introduction, Preparation of alkane from a) Hydrolysis of Grignard reagent

b) Kolbe synthesis c) Corey House synthesis

**Chemical Reactions:**

a) Pyrolysis (mechanism) b) Aromatization

**3.2 Cycloalkanes** Introduction, Synthesis from a) Adipic Acid b) Aromatic hydrocarbon c) Dickman reaction. Baeyer-Strain Theory and Sachtel Mohr Theory. Ring opening reaction with  $H_2$  and HI

#### **4. Alkenes, Dienes and Alkynes :**

**08**

##### **4.1 Alkenes**

Introduction, Preparation methods:

a) But-1-ene from 1-butyne, b) But-2-ene from n-butyl alcohol and sec-butyl alcohol. Chemical Reactions: (with mechanism)

a) Electrophilic addition of  $Br_2$  to ethene

b) Free radical addition of HBr to propene. (Peroxide effect)

c) Reaction of propene with  $Cl_2/H_2O$  (Chlorohydrin formation)

d) Oxymercuration-Demercuration reaction

(Conversion of 3, 3-dimethyl-1-butene to 3, 3-dimethyl-2-butanol)

e) Cis-hydroxylation using alkaline  $KMnO_4$ .

##### **4.2 Dienes**

Introduction and classification

Resonance structure and molecular orbital picture of 1, 3-butadiene

Preparation methods of 1, 3-butadiene from-

a) 1, 4-dibromobutane

b) 1,4-butanediol.

Chemical Reactions:

a) Addition of  $Br_2$  and HBr to 1,3-butadiene

b) Addition of ethene to 1,3-butadiene (Diels-Alder reaction)

##### **4.3 Alkynes**

Preparation of ethyne (Acetylene) from a)

Iodoform

b) Hydrolysis of calcium carbide  
Chemical Reactions (With Mechanism): Electrophilic addition of ethyne with HBr and  $Br_2$

#### **Unit-III**

#### **5. Alcohols and Epoxides**

**05**

##### **5.1 Alcohols**

Introduction and Classification.

##### **i) Dihydric alcohols: (Ethylene Glycol)**

Nomenclature,

Preparation methods:

a) Hydroxylation of alkene b)

1, 2-dihaloalkanes. Chemical

reactions:

Reaction with hydrogen chloride (HCl)

Oxidation with lead tetra acetate  $[\text{Pb}(\text{OCOCH}_3)_4]$

Dehydration of ethane-1, 2-diol using  $\text{P}_2\text{O}_5$  /  $\text{ZnCl}_2$

**ii) Trihydric alcohols : ( Glycerol)**

Nomenclature, Preparation methods from a) Fats and oils b) Propene

**Chemical reactions :**

a) Reaction with nitric acid b) Reaction with hydroiodic acid c) Reaction with acetyl chloride

**5.2 Epoxides**

Introduction and nomenclature

Preparation Methods :

a) Oxidation of ethene in the presence of silver catalyst b) Oxidation of ethene with peracetic acid

**Chemical reactions :**

Ring opening reaction of epoxides (propylene oxide): by acidic reagent and basic

Reagent. Reaction of epoxyethane with  $\text{CH}_3\text{-Mg-I}$  and  $\text{CH}_3\text{-Li}$ .

## Part –II

### Inorganic chemistry

#### Unit –IV

##### 1 Periodic Table and Periodic Properties:

10P

##### A] Periodic Table:

Modern periodic law, Long form of the periodic table, Sketch, Cause of periodicity, Division of elements in to s, p, d, and f blocks. General characteristics of s, p, d and f block elements.

##### B] Periodic properties:

*a) Atomic and Ionic size:* Definition and explanation of atomic radius, ionic radius, Covalent radius, Vander waals radius. Variation of atomic size along a period and in a group.

*b) Ionization Energy:* Definition and Explanation, Successive ionization energy, Factors affecting ionization energy. Variation of ionization energy along a period and in a group. Applications of ionization energy to chemical behavior of an element.

*c) Electron Affinity:* Definition and Explanation, Successive electron affinity, Factors affecting electron affinity. Variation of electron affinity along a period and in a group. Applications of electron affinity to chemical behavior of an element. Difference between ionization energy and electron affinity.

*d) Electronegativity:* Definition and Explanation, Factors affecting electronegativity. Variation of electronegativity along a period and in a group. Pauling's approach of electronegativity. Calculations of electronegativity by Pauling's method (Numerical), Mulliken's approach. Applications of electronegativity to bond properties such as percent ionic character, bond length, bond angle.

#### Unit- V

##### Noble Gas Chemistry:

05

a) Position in the Periodic table b)

Electronic configuration

c) Compounds of inert gases, under excited condition, through coordination, by physical trapping (Clathrates).

d) Fluorides of xenon :  $\text{XeF}_2$ ,  $\text{XeF}_4$  and  $\text{XeF}_6$  preparation, properties and structures.

##### Reference:

1. A New Pattern Text Book of Organic Chemistry for Competition: O.P.Tandon and A.K.Virmani (G.R.Bathla & Sons Publication) 2009 Edition
2. Chemistry for Degree Students: R.L.Madan (S.Chand Publication) 2010 Edition
3. A Textbook of Organic Chemistry: Arun Bahl and B.S. Bahl (S.Chand Publication) 2011



Revised Colour Edition.

4. Organic chemistry: S M Mukherji and S P Singh, (New Age International Publication) vol.I, Second edition, 2010.
5. Principles of Organic Chemistry by R.O.C. Norman and J.M. Coxon.
6. Organic Chemistry by Robert Thornton Morrison and Robert Neilson Boyd
7. A Guide book to mechanism on Organic Chemistry: Peter Sykes.
8. Text Book of organic Chemistry: P. L. Soni.
9. Principles of Inorganic chemistry by Puri, Sharma and Kalia.
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13. Inorganic Chemistry by A. G. Sharp.
14. Inorganic Chemistry by G. L. Miessler and D. A. Tarr.
15. Chemistry for degree students by Dr. R.L. Madan, (S. Chand)

**B. Sc. First Year (Semester-I)  
Paper-II: (CCC-I, Section-B)  
Physical + Inorganic Chemistry**

**Credits:02**

**Periods: 45**

**Unit-I**

**Part - I  
(Physical Chemistry)**

**A) Mathematical concept and SI Units:**

**07P**

**Mathematical concepts**

- 1.1 Logarithm: - Rules of logarithm, Characteristic and mantissa, Change of sign and base, Numerical problems.
- 1.2 Definition of pH and pOH, Relation between pH and POH, Numerical Problems based on pH and pOH.
- 1.3 Graphical representation of equations: - Rules for drawing graph, coordinates etc., Equation of straight lines, slope and intercept, plotting the graph from the data of chemical properties and Numerical Problems.
- 1.4 Derivative: - Rules of differentiation, partial differentiation, Algebraic, logarithmic and exponential functions. Numerical Problems.
- 1.5 Integration: - Rules of integration, Algebraic and exponential functions. Numerical Problems.
- 1.6 Permutation and combinations, Probability, Numerical Problems.

**B) Physical quantities and their dimensions**

- 1.7 International systems of units, derived units, subsidiary units, prefixes used in SI units, internal conversions of these units.

**Unit-II**

**Surface Chemistry**

**06P**

- 2.1 Introduction, Adsorption, mechanism of adsorption, factors affecting adsorption, difference between adsorption and absorption.
- 2.2 Types of adsorption: Physical adsorption and chemical adsorption.
- 2.3 Adsorption of gaseous by solids.
- 2.4 Types of adsorption isotherm: i) Freundlich adsorption isotherm ii) Langmuir adsorption isotherm (Derivation).

### **Unit-III**

#### **Gaseous State:**

**10P**

- 3.1 Introduction to Postulates of kinetic theory of gases, Ideal and non-ideal gases, Deviation of gases from Ideal behavior and Compressibility factor (Z).
- 3.2 Derivation of kinetic gas equation, Van der Waals' equation of state, Units for Van der Waals' constants, Interpretation of deviations from Van der Waals' equation.
- 3.3 Critical phenomenon-The P-V isotherms of Carbon dioxide, application of Van der Waals' equation to the isotherms of Carbon dioxide, relation between critical constants and Van der Waals' constants. Liquifaction of gases, Claude's method.
- 3.4 Molecular velocities-Root mean square, average and most probable velocities, qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter.
- 3.5 Numericals on Van der Waals' constants and Critical constants, Root mean velocities.

### **Unit-IV**

#### **Solid state:**

**07P**

- 4.1 Introduction to space lattice, Unit Cell, Characteristics of solids
- 4.2 Laws of crystallography: (i) Law of constancy of interfacial angles, (ii) Law of symmetry, Symmetry elements in crystals and (iii) Law of rational indices, Weiss indices and Miller indices, Determination of Miller indices.
- 4.3 Cubic lattice and types of cubic lattice, planes or faces of a simple cubic system, spacing of lattice planes.
- 4.4 Diffraction of X-rays: Derivation of Bragg's equation. Experimental methods, rotating crystal and powder method.
- 4.5 Determination of crystal structure of NaCl and KCl on the basis of Bragg's equation.
- 4.6 Numericals on Miller indices and Bragg's equation.

## Part II Inorganic Chemistry

### UNIT - V

#### A)

#### S-Block elements

10

General characteristics of S-block elements

Variation in properties of S-block elements, atomic radii, ionization potential, colour of flame, reducing property and metallic property, diagonal relationship between Li and Mg, Points of difference between Li and other alkali metals. General study of hydrides of IA and IIA group. General studies of Oxides IA and IIA group, Basic strength of hydroxides of alkali and alkaline earth metals, Carbonates and bicarbonates of alkali and alkaline earth metals.

Complexes of alkali metals with salicylaldehyde, acetylacetonate. wrap around complexes with polydentate ligand such as crown ether and cryptate. Complexes of alkaline earth metals such as beryllium oxalate ion, chlorophyll and complex of calcium with EDTA.

#### B)

#### Oxidation and reduction:

05

Definition of oxidation, Reduction, Oxidizing agent and reducing agents according to classical concept, electronic concept, oxidation number concept. Rules for assigning oxidation number, Balancing of redox reaction by

- 1) Ion-electron method and
- 2) Oxidation number method

#### Reference Books:-

1. Mathematical preparation for physical Chemistry .By F. Daniel, Mc. Graw Hill publication.
2. University General Chemistry. By C.N. R. Rao Mc. Millan Publication.
3. Principles of Physical Chemistry. By Maron and Pruton 4th Ed. Oxford and IBH publication.
4. Physical Chemistry. By G.M. Barrow.
5. Essentials of Physical Chemistry .By B. S. Bahl, G. D. Tuli, ArunBahl ( S. Chand and Co Ltd. ) ( 25<sup>th</sup> edition)
6. Elements of Physical Chemistry. By S. Glasstone and D. Lewis (The Macmillan Press Ltd. )
7. Physical Chemistry. By Robert A. Alberty( John Willey and Sons )
8. Principles of Physical Chemistry. By Puri– Sharma.
9. The Elements of Physical Chemistry .By P. W. Atkins
10. Advanced Physical Chemistry. By Harish Gurudeep.
11. Principles of Inorganic chemistry by Puri, Sharma and Kalia.
12. Advanced inorganic chemistry by Gurudeep Raj and ChatwalAnand.
13. Concise Inorganic Chemistry by J. D. Lee.
14. Basic Inorganic Chemistry by F. A. Cotton, G. Wilkinson and P. L. Gaus.
15. Inorganic Chemistry by A. G. Sharp.
16. Inorganic Chemistry by G. L. Miessler and D. A. Tarr.
17. Chemistry for Degree Students ,B.Sc F.Y by Dr. R.L. Madan(S. Chand)

**B. Sc. First Year (Semester-II)**  
**Paper-III [CCC-II, Section-A]**  
**Organic + Inorganic Chemistry**

**Credits: 02**

**Part –A**  
**Organic Chemistry**

**Periods: 45**

**Unit-I**

**1. Aromatic Hydrocarbons and Aromaticity** **10**

Source, Nomenclature, isomerism of aromatic compounds. Structure of benzene, stability, orbital picture of benzene. Aromaticity and anti-aromaticity by Huckel's Rule (Benzene, Naphthalene, Anthracene, Pyrrole, Furan, Thiophene, Pyridine, Cyclobutadiene, Cyclopentadienyl cation and anion).

Mechanism of electrophilic aromatic substitution of benzene: Nitration, halogenation, Birch reduction, Friedel Craft alkylation and acylation.

**Orientation :** Effect of Activating and Deactivating Groups ( -OH, -NO<sub>2</sub>, -CH<sub>3</sub>, Cl groups) On Aromatic Electrophilic (Nitration) substitution reaction (with mechanism)

**Unit -II**

**2. Phenols** **06**

Introduction, Classification,

Acidic character (Comparison of acidity : phenol and ethanol) Chemical Reactions :

Reimer-Tiemann reaction (Mechanism), Acetylation (mechanism), Fries rearrangement (Mechanism), Lederer-Manasse reaction, Kolbe's Carboxylation reaction (Mechanism), Hauben-Hoesch reaction.

**3. Haloalkene and Haloarene** **08**

**Haloalkene**

**A] Vinyl Chloride:**

Synthesis of vinyl chloride from 1) 1, 2-Dichloroethane 2) Ethene 3) Ethyne

**Chemical Reactions :**

Resonance structure of vinyl chloride

Addition reaction with Br<sub>2</sub> and HBr, polymerization reaction.

**B] Allyl Iodide:**

Synthesis of allyl iodide from (a) allyl chloride (Finkelstein reaction) (b) glycerol and HI.

**Chemical Reactions :**

Reaction with NaOH, KCN, NH<sub>3</sub>, AgNO<sub>2</sub> and Br<sub>2</sub>.

**Haloarene**

Nomenclature, Synthesis of halobenzene from 1) Hunsdiecker reaction 2) Gatterman reaction 3) Balz-Schiemann reaction.

**Chemical Reactions: (with mechanism)**

Ullmann biaryl synthesis, Dows process (Reaction with NaOH)

Relative reactivity of alkyl halide v/s vinyl and aryl halide towards nucleophilic substitution.

## Unit -III

### 3. Carboxylic Acid Derivatives

06

#### A] Acid chlorides:(Acetyl chloride)

Introduction

Preparation Methods:

- By the action of thionyl chloride on acetic acid.
- By the action of phosphorus pentachloride on acetic acid.

Chemical Reactions:

- Hydrolysis
- Action with alcohol
- Action with amines
- Action with sodium acetate.

#### B] Acid anhydride : (acetic anhydride)

Introduction

Preparation Methods:

- From acid halide and carboxylic acid..
- From sodium acetate and acetyl chloride.

**Chemical Reactions:**

- Hydrolysis
- Action with alcohol
- Action with amines
- Action with benzene

#### C] Esters:(Ethyl acetate)

Preparation Methods:

- From ethyl alcohol and acetic acid
- From ethyl alcohol and acetyl chloride.

**Chemical Reactions:**

- Alkaline hydrolysis.
- Action of amines
- Reduction.

#### D] Amides: (Acetamide)

Preparation Methods:

- By the action of ammonia on acid chloride.
- By the action of ammonia on acetic anhydride.

Chemical Reactions:

- Hydrolysis
- Action of nitrous acid
- Reduction
- Action of  $\text{Br}_2$  and  $\text{NaOH}$ .

## Part -II

### Inorganic chemistry

#### Unit IV

#### Study of P-block elements

05

Variation in properties : atomic radius, ionization energy, electron affinity, electronegativity , metallic character , melting and boiling point , oxidizing and reducing properties , Variation in acidic and basic character of hydroxides of P-block elements , diagonal relationship between B and Si .

#### Unit-V

#### Acids and Bases.

10P

Introduction, Arrhenius concept, Bronsted-Lowry concept, Lewis acids and bases concept  
Discuss briefly with suitable example.

Solvent system concept, Cady-Elsey concept, Lux-Flood concept and Usanovich concept for acids and bases.

Definition of Hard, Soft and borderline acids and bases with various example. Pearson's principle (SHAB Principle), theories of hardness and softness such as Electronic theory, pi-bonding theory and Pitzer's theory.

Application of SHAB Principle such as relative stability of compound, feasibility of chemical reaction.

Limitation of SHAB concept.

#### Reference:

1. A New Pattern Text Book of Organic Chemistry for Competition: O.P.Tandon and A.K.Virman (G.R.Bathla& Sons Publication) 2009 Edition
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**B. Sc. First Year (Semester-II)  
Paper-IV; (CCC-II, Section B)  
Physical + Inorganic Chemistry**

**Credits : 02**

**Periods:45**

**Part -I  
Physical Chemistry**

**Unit-I**

**10 P**

**Atomic structure:**

- 1.1 Introduction to Dalton's atomic theory, Rutherford's atomic model.
- 1.2 The nature of electro-magnetic radiations
- 1.3 Black body radiation, Planck's radiation law-Quantisation of energy Bohr's model of hydrogen atom: Postulates, derivation for i) radius of an orbit ii) velocity of an electron,iii) energy of an electron and iv) energy difference of an electron in terms of wave number, Rydeberg's constant. Merits and demerits of Bohr's theory, origin of spectral series-Hydrogen spectrum.  
Sommerfeld's extension of Bohr's theory and its limitations.  
Arrangements of electrons in Orbits-Bohr-Bury Scheme.  
Quantum numbers.
- 1.5 Electronic configuration of elements: Aufbau principle, Pauli's Exclusion principle, Hund's rule of maximum multiplicity and screening rule.
- 1.6
- 1.7 Numerical problems.
- 1.8

**Unit-II**

**Liquid State: -**

**06 P**

- 2.1 Introduction-Variou intermolecular forces in liquids.  
Surface tension of liquid, units of surface tension, effect of temperature on surface tension, determination of surface tension of liquids by stalagmometer method, numerical Problems.
- 2.2 Viscosity of liquid, units of viscosity, effect of temperature on viscosity, measurement of viscosity by Ostwald's method, numerical Problems.
- 2.3 Parachor and chemical constitution: Relation between parachor and surface tension, application of parachors in deciding structures.
- 2.4 Numerical Problems.

**Unit-III**

**Colloidal State:**

**07 P**

- 3.1 Definition, Classification of colloidal systems.
- 3.2 Solids in liquids (Sols):-
  - 3.2.1 Preparation of sols: Dispersion and Aggregation methods.
  - 3.2.2 Properties of sols :Colour, optical, kinetic and electrical properties.



- 3.2.3 Stability of sols, protective action, Hardy-Schulze law, gold number.
- 3.3 Liquids in liquids (Emulsions):- Types of emulsions, preparation, Emulsifier.
- 3.4 Liquids in solids (Gels):- Classification, preparation and properties, Inhibition.
- 3.5 Applications of colloids.

#### Unit-IV

##### Catalysis:

07 P

- 4.1 Introduction to Catalyst and Catalysis.  
Type of catalyst, positive and negative catalyst with examples.
- 4.2 Catalysis:-Type of catalysis, homogenous and heterogeneous catalysis with examples.
- 4.3 Autocatalysis- explanation with examples.
- 4.4 Characteristics of catalytic reactions.
- 4.5 Promoters: - Definition, example, explanation of promotion action.
- 4.6 Catalytic poisoning: - Definition, example, explanation of catalytic poisoning.
- 4.7 Acid – Base catalysis, General Acid-Base catalysis.
- 4.8 Enzyme catalysis, examples, mechanism of enzyme catalysis, characteristics of enzyme catalysis.
- 4.9 Applications of catalysis in industries.

#### Unit-V

##### Part –II Inorganic Chemistry

##### A) Chemical Bonding-I

10P

- 1.1 Definition, Cause for chemical bonding, Types of chemical bonding.
- 1.2 **Ionic Bonding**: Definition and explanation, Factors affecting the formation of ionic bond, Energy changes in the formation of ionic bond, Lattice energy and Born-Haber cycle. Polarizing power and polarisability and Fajan's rule.
- 1.3 **Covalent bonding** : Definition and explanation, Sigma and pi-bond, Valence bond theory of covalent bonding and its limitations, Percentage ionic character in covalent bond from dipole moment and electronegativity difference (Numericals).
- 1.4 **Metallic bonding**: Definition and explanation, Free electron theory of metallic bonding, Effects of metallic bonding on metallic properties.
- 1.5 **Vander Waal's bonding**: Definition and explanation, Types of Vander Waal's forces responsible for Vander waals bonding.
  
- 1.6 **Hydrogen bonding**: Definition and explanation, Types of hydrogen bonding and consequences of hydrogen bonding. Unique properties of water based on hydrogen bonding.  
Importance of hydrogen bonding in sustaining life.

## B) Chemical bonding-II

05P

2.1 **Concept of hybridization:** Definition and explanation of  $dsp^2$  hybridization by taking example of  $[Ni(CN)_4]^{2-}$ ,  $sp^3d$  hybridization by taking example  $PCl_5$ ,  $sp^3d^2$  hybridization by taking example  $SF_6$ .  $sp^3d^3$  hybridization by taking example  $IF_7$ .

2.2 **VSEPR Theory:** Postulates and explanation, Applications in explaining geometry and bond angle in molecules such as  $CH_4$ ,  $NH_3$ , and  $H_2O$ . Limitations of VSEPR theory.

2.3 **Molecular Orbital Theory:** Basic principle of MOT, LCAO, Bonding and anti-bonding molecular orbital, Energy level diagram for molecular orbital. Rules for adding electrons in MO's, Bond order, Molecular orbital diagram of homo nuclear diatomic molecules such as  $H_2$ ,  $N_2$ ,  $O_2$ , and  $Ne_2$  And CO.

### Reference Books:-

1. Mathematical preparation for physical Chemistry .By F. Daniel, Mc. Graw Hill publication.
2. University General Chemistry. By C.N. R. Rao Mc. Millan Publication.
3. Principles of Physical Chemistry. By Maron and Pruton 4th Ed. Oxford and IBH publication.
4. Physical Chemistry. By G.M. Barrow.
5. Essentials of Physical Chemistry .By B. S. Bahl, G. D. Tuli, ArunBahl ( S. Chand and Co Ltd. ) ( 25<sup>th</sup> edition)
6. Elements of Physical Chemistry. By S. Glasstone and D. Lewis (The Macmillan Press Ltd. )
7. Physical Chemistry. By Robert A. Alberty( John Willey and Sons )
8. Principles of Physical Chemistry. By Puri– Sharma.
9. The Elements of Physical Chemistry .By P. W. Atkins
10. Advanced Physical Chemistry. By Harish Gurudeep.
11. Principles of Inorganic chemistry by Puri, Sharma and Kalia.
12. Advanced inorganic chemistry by Gurudeep Raj and ChatwalAnand.
13. Concise Inorganic Chemistry by J. D. Lee.
14. Basic Inorganic Chemistry by F. A. Cotton, G. Wilkinson and P. L. Gaus.
15. Inorganic Chemistry by A. G. Sharp.
16. Inorganic Chemistry by G. L. Miessler and D. A. Tarr.
17. Chemistry for Degree Students ,B.Sc F.Y by Dr. R.L. Madan(S. Chand)

**Note : At least Sixteen experiments should be taken.**

**A) Inorganic Chemistry**

Identification of Two acidic and Two basic radicals by Semi-micro qualitative analysis technique.(Including interfering radicals). (**Any Six**)

- 1) At least eight mixtures of salt must be practiced.
- 2) Spot- tests (of each radical) are compulsory.

**B) Organic Chemistry**

I) Preparations (**Any Four**) :

- a) Phthalimide from phthalic anhydride and urea.
- b) Acetanilide from aniline.
- c) Iodoform from acetone.

d) Phenyl – azo –  $\beta$  – naphthol from aniline. e) m-Dinitrobenzene from nitrobenzene.

f) Phthalic anhydride from phthalic acid.

(Recrystallization and Melting point of product is compulsory )

II) Determination of Physical constant of Organic liquids (**Any four**)

Aniline, Ethanol, Toluene, Benzene, ortho and meta toluidines, Chlorobenzene and Nitrobenzene.

III) Demonstration on purification by -

- a) Recrystallisation of Phthalic acid/Benzoic acid from hot water. b) Distillation of Ethyl alcohol.
- c) Sublimation of Naphthalene.

**C) Physical Chemistry (Any Six)**

1. Determination of the Viscosity of liquid by Ostwald's viscometer.
2. Determination of the Viscosity of two pure liquids A & B. Hence find the composition of the mixture of two liquids. (Density data of liquids, viscosity of water to be given).  
[Any two liquids from : Acetone, Carbon tetrachloride, Chloroform, Ethyl alcohol, Benzyl alcohol, Ethylene glycol and n-propyl alcohol].
3. To determine the surface tension of a given liquid by stalagmometer method.

4. Determine the equivalent weight of magnesium by hydrogen displacement method using Eudiometer.
5. To study Kinetics of hydrolysis of ester in presence of mineral acid like HCl.
6. Preparation of  $\text{As}_2\text{S}_3$  solution from  $\text{As}_2\text{O}_3$  and compare the precipitation power of NaCl and  $\text{MgCl}_2$ .
7. To study distribution of benzoic acid between benzene and water.
8. To study critical solution temperature (CST) of phenol water system.
9. Determination of Heat of solution of  $\text{KNO}_3/\text{NH}_4\text{Cl}$ .
10. Determination of Heat of reaction of displacement of copper by zinc.
11. To study kinetics of cooling of hot water.

**Reference Books :**

1. Advanced practical Inorganic chemistry by Gurudeep Raj.
2. Experiments in Inorganic chemistry by Gurtu and Kapoor.
3. Practical Organic chemistry by A.I. Vogel.
4. Experiments in General chemistry by C.N.R. Rao and Agrawal East West Press.
5. Experiments in Physical chemistry by R.C. Das and Behere, Tata McGraw Hill.
6. Experimental Physical chemistry by F. Daniel and others (International Student Edition).
7. Systematic Experimental Physical chemistry by S.W. Rajbhoj and Dr. T.K. Chondhekar, Anjali Publication, Aurangabad.
8. Advanced practical physical chemistry by J.B. Jadhav (Goel Publishing house, Meerut).
9. Experiments in Chemistry by D.V. Jahagirdar.
10. A Textbook of quantitative Inorganic analysis by A.I. Vogel.