



**Swami Ramanand Teerth Marathwada  
University, Nanded**



**SYLLABUS**

**B. Sc. First Year (Chemistry)**

**Semester-I & II**

**C B C S**

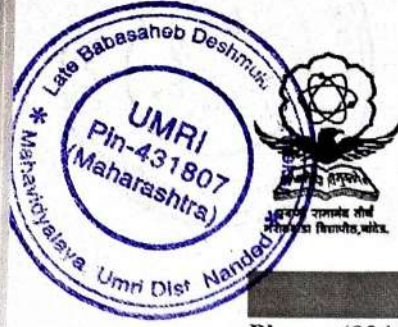
**In force from June - 2019**

*Yatish*

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*Principal*

Late Babasaheb Deshmukh  
Gorthekar Arts, Commerce  
& Science Mahavidyalaya,  
Umri, Dist. Nanded. [M.S.]



॥ सा विद्या या विमुक्तये ॥

## स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

"ज्ञानतीर्थ" परिसर, विष्णुपुरी, नांदेड - ४३१६०६ (महाराष्ट्र)

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED**

"Dnyanteerth", Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)

Established on 17th September 1994 - Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade



### ACADEMIC (1-BOARD OF STUDIES) SECTION

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संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरवरील प्रथम वर्षाचे CBCS Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०१९-२० पासून लागू करण्याबाबत.

### परिपत्रक

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक ०८ जून २०१९ रोजी संपन्न झालेल्या ४४व्या मा. विद्या परिषद बैठकीतील ऐनवेळचा विषय क्र.११/४४-२०१९ च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरवरील प्रथम वर्षाचे खालील विषयांचे C.B.C.S. (Choice Based Credit System) Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०१९-२० पासून लागू करण्यात येत आहेत.

- |  |                                       |
|--|---------------------------------------|
| 1. Agricultural Microbiology                           | 18. Dyes and Drugs                    |
| 2. Agrochemicals & Fertilizers                         | 19. Electronics                       |
| 3. Analytical Chemistry                                | 20. Environmental Science             |
| 4. B.C.A.  | 21. Fishery Science                   |
| 5. B. Voc. (Food Processing, Preservation and Storage) | 22. Food Science                      |
| 6. B. Voc. (Web Printing Technology)                   | 23. Geology                           |
| 7. Biochemistry  | 24. Horticulture                      |
| 8. Bioinformatics                                      | 25. Industrial Chemistry              |
| 9. Biophysics  | 26. Information Technology (Optional) |
| 10. Biotechnology (Vocational)                         | 27. Mathematics                       |
| 11. Biotechnology                                      | 28. Microbiology                      |
| 12. Botany   | 29. Network Technology                |
| 13. Chemistry  | 30. Physics                           |
| 14. Computer Application (Optional)                    | 31. Software Engineering              |
| 15. Computer Science (Optional)                        | 32. Statistics                        |
| 16. Computer Science                                   | 33. Zoology                           |
| 17. Dairy Science                                      |                                       |

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या [www.srtmun.ac.in](http://www.srtmun.ac.in) या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी.

'ज्ञानतीर्थ' परिसर,

विष्णुपुरी, नांदेड - ४३१ ६०६.

जा.क्र.: शैक्षणिक-०१/परिपत्रक/पदवी-सीबीसीएस अभ्यासक्रम/  
२०१९-२०/२९२

दिनांक : ०३.०७.२०१९.

प्रत माहिती व पुढील कार्यवाहीस्तव :

- १) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- २) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- ३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
- ४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
- ५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
- ६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

स्वाक्षरित/-

उपकुलसचिव

शैक्षणिक (१-अभ्यासमंडळ) विभाग

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## Aims and Objectives.



- 1 B. Sc. First year, Chemistry syllabus has been framed as per UGC-CBCS pattern.
- 2 The students are expected to understand the fundamentals, principles, mathematical concepts and recent developments in the subject area.
- 3 To enable the students to understand basic concepts, nomenclature, functional groups, hydrocarbons, aromaticity, and fundamental term in organic chemistry.
- 4 The students are able to know the elements present in nature & its properties.
- 5 The practical course is in relevance to the theory courses to improve the understanding of concepts in chemistry.
- 6 It would help in development of practical skills of the students.
- 7 It is expected to inspire the students towards competitive exams in chemistry

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Distribution of credits for B.Sc. Chemistry (optional)

Under Faculty of Science & Technology

**B. Sc. Syllabus structure**

Semester Pattern (CBCS) effective from June, 2019

**Subject: Chemistry**

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

Semester	Paper No.	Name of the Course	Instruction Hrs/ week	Total period	Internal CA	ESE	Total Marks	Credits
I	CCC I (Section A)	Organic + Inorganic Chemistry, P-I	02+01=03	30+15=45	10	40	50	2
	CCC I (Section B)	Physical + Inorganic Chemistry, P-II	02+01=03	30+15=45	10	40	50	2
II	CCC II (Section A)	Organic + Inorganic Chemistry, P-III	02+01=03	30+15=45	10	40	50	2
	CCC II (Section B)	Physical + Inorganic Chemistry, P-IV	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 (P-V)	04	20 Practicals	20	80	100	4

**Note:**

- The syllabus is based on six theory periods and four practical periods per batch per week. Candidates should require passing separately in theory and practical examinations.
- End Semester Examination (ESE) 40 marks.
- Continuous Assessment (CA) 10 marks (Test of assignment and attendance).
- At least twenty practicals should be taken: 6 practicals from Inorganic Chemistry, 8 from Organic and 6 from Physical Chemistry.

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B.Sc. Chemistry First Year (Semester-I)  
Paper-I: Organic + Inorganic Chemistry, (CCC-I)  
Credits: 02

Periods: 45

Section-A (Organic Chemistry)

Unit-I

1. Nomenclature of Organic Compounds: 07

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 following classes of organic compounds: alkanes, alkenes, alkynes, alcohols, ethers, aldehydes, ketones, carboxylic acid, carboxylic acid derivatives (acid halides, esters, anhydrides, amides), amines; Nomenclature of aromatic compounds: Mono, di and polysubstituted benzene (with not more than two functional groups),

Unit-II

2. Basic Concepts in Organic Chemistry: 09

Basic terms: Substrate and Reagents, types of reagents (Electrophilic and Nucleophilic).

Notation of arrows: curved arrow, Half headed arrow, double headed arrow, straight arrow. Bond fission: Homolytic and heterolytic fission.

Reaction intermediates: Carbocation, Carbanion, Free radical, (Introduction, structure & Stability), carbene, nitrene & benzyne (only introduction).

Electron mobility: Inductive effect (effect on acidic strength of alpha substituted acetic acid and  $\alpha$ -chloroacetic acid), Mesomeric effect (Aniline and Nitrobenzene), Hyperconjugation (toluene).

Unit-III

3. Alkanes Alkenes and alkynes: 08

3.1 Alkanes: Introduction, Preparation of alkanes from a) Hydrolysis of Grignard reagent b) Kolbes synthesis. Chemical reaction: a) Pyrolysis (mechanism), b) aromatization.

3.2 Alkenes: Introduction, Preparation methods a) But-1-ene from but-1-yne b) But-2-ene from butan-2-ol.

Chemical reactions with mechanism: a) Electrophilic addition of  $\text{Br}_2$  to ethene b) Electrophilic addition of  $\text{HBr}$  to propene C) Free radical addition of  $\text{HBr}$  to propene (Peroxide effect).



3.3 Alkynes: Introduction, Preparation of ethyne from a) Iodoform, b) Hydrolysis of calcium carbide. Chemical reactions: Electrophilic addition of HBr and Br<sub>2</sub> to ethyne (with mechanism).

#### Unit-IV

#### 4. Cycloalkanes, Cycloalkenes and Dienes :

06

4.1 Cycloalkanes: Introduction, Preparation of cycloalkanes from a) Adipic acid  
b) Aromatic hydrocarbon.

Baeyer strain theory and Saches Mohr theory. Ring opening reaction with H<sub>2</sub> and HI.

4.2 Cycloalkenes: Introduction, preparation methods:

- a) Dehydration of cyclohexanol ,
- b) Dehydrohalogenation of halocyclohexane.

Chemical reactions: a) Epoxidation of cyclohexene, b) Allylic halogenations.

4.2 Dienes: Introduction, classification & Resonance structures.

Preparation methods of 1,3-butadiene from- a) 1,4-dibromobutane,  
b) 1,4-butanediol.

Chemical reactions: a) addition of Br<sub>2</sub> and HBr to 1,3-butadiene, b) addition of ethene to 1,3-butadiene (Diel's- Alder reaction).

#### (Section –B : Inorganic Chemistry )

#### Unit- V

#### 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.

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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- VI

#### 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: XeF<sub>2</sub>, XeF<sub>4</sub> and XeF<sub>6</sub> preparation, properties and structures.

#### Outcomes:

After completion of syllabus students will be able to understand following outcomes.

1. Student should learn basic concept of organic chemistry, Nomenclature.
2. Student get well acquainted with functional group in organic chemistry.
3. To understand the basic concepts and differences aliphatic hydrocarbons.
4. To know about term cycloalkane, cycloalkene and diene.
5. Learn and practice about organic compounds with their names.
6. Students learn some exceptional electronic configuration, trends and Periodicity in the following properties like atomic size, ionization energy, electron affinity & electronegativity.
7. To understand the inert gases forms compounds, different fluoride compounds of xenon.

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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
2. Chemistry for Degree Students: R.L.Madan (S.Chand Publication) 2010 Edition
3. A Textbook of Organic Chemistry: ArunBahl 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.
10. Advanced inorganic chemistry by Gurudeep Raj and ChatwalAnand.
11. Concise Inorganic Chemistry by J. D. Lee.
12. Basic Inorganic Chemistry by F. A. Cotton, G. Wilkinson and P. L. Gaus.
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)

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

Credits: 02

Periods: 45

Section A -(Physical Chemistry)

Unit-I: Mathematical concept and SI Units

07 P

(A) Mathematical concept:

- 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 OH.
- 1.3 Graphical representation: Rules for drawing graph, coordinates etc., Equation of straight lines, slope and intercept and Numerical Problems.
- 1.4 Derivative: Rules of differentiation, partial differentiation, Algebraic, logarithmic and exponential functions.
- 1.5 Integration: - Rules of integration, Algebraic and exponential functions.
- 1.6 Permutation, combinations and Probability, Numerical Problems.

(B) SI Units:

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

Unit -II: Surface Chemistry

07P

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

Unit-III :Gaseous State

09P

- 3.1 Kinetic molecular theory of gases -Postulates of kinetic molecular theory of gases. Derivation of kinetic gas equation. Ideal and non-ideal gases.
- 3.2 Deviation of gases from Ideal behavior and Compressibility factor (Z). Derivation of Van der waals equation, Units for Van der waals constants.



Critical phenomenon-The P-V isotherms of Carbon dioxide, application of Vander Waals' equation to the isotherms of Carbon dioxide, relation between critical constants and Van der Waals constants..

- 3.4 Liquefaction of gases, Linde's method, Claude's method.
- 3.5 Molecular velocities-Root mean square, average and most probable velocities, Relation between molecular velocities, qualitative discussion of the Maxwell's distribution of molecular velocities.
- 3.6 Numerical on Vander Waals constants and Critical constants, Root mean square velocities.

#### Unit-IV : Solid state

07P

- 4.1 Introduction, Characteristics of solids, space lattice and Unit Cell.
- 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.
- 4.3 Weiss indices and Miller indices, Determination of Miller indices. Numerical on Miller indices
- 4.4 Cubic Unit cells and types of cubic unit cells, spacing of lattice planes.
- 4.5 X-rays crystallography, Derivation of Bragg's equation. Experimental methods- The Rotating Crystal method and The Powder method.
- 4.6 Determination of crystal structure of NaCl and KCl on the basis of Bragg's equation.

#### (Section -B : 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 , acetylaceton. 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.

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**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

**Outcomes:** After completion of syllabus students will be able to understand following outcomes.

1. Learning and understanding rules of logarithm, Rules of drawing graph, Derivatives, Integration, different mathematical concept and SI units, and their use in solving numerical.
2. Learning surface phenomena at heterogeneous surfaces.
3. Student will learn the basic knowledge of gas phase, Kinetic molecular theory, critical phenomenon, liquefaction and molecular velocities.
4. To impart knowledge about solid phase, crystallography and some crystal structure.
5. General characteristics of s-block elements, oxides, hydroxide, carbonate & its complexes
6. Study the oxidation and reduction by different methods.

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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.
2. Principles of Physical Chemistry. By Maron and Pruton 4th Ed. Oxford and IBH publication.
4. Physical Chemistry. By G.M. Barrow. th
5. Essentials of Physical Chemistry .By B. S. Bahl, G. D. Tuli, ArunBahl ( S. Chand and Co Ltd. ) ( 25 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.
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B.Sc. Chemistry First Year (Semester-II)  
Paper-III: Organic + Inorganic Chemistry, (CCC-II)

Credits: 02

Periods: 45

Section-A (Organic Chemistry)

Unit-I : Aromatic Hydrocarbons and Aromaticity

09

Introduction, Nomenclature, Kekule and resonance structure of benzene, stability, Orbital picture of benzene. Aromaticity and antiaromaticity by Huckel's Rule (Benzene, Naphthalene, Anthracene, Pyrrole, Furan, Thiophene, Pyridine, Cyclopentadienyl cation and anion, Cyclopropenyl cation). Electrophilic Substitution reaction of benzene (with mechanism): Nitration, Halogenation, Friedel Craft alkylation and acylation. **Orientation effect:** Effect of activating and deactivating groups (-OH, NO<sub>2</sub>, CH<sub>3</sub>, Cl) on aromatic electrophilic (Nitration) substitution reaction (with mechanism)

Unit-II: 1. Phenols

05

Introduction, classification and acidic character of phenol (compare with ethanol). Chemical reactions with mechanism: Reimer-Tiemann reaction, Acetylation, Fries rearrangement, Kolbe's carboxylation reaction.

2: Haloalkenes and Haloarenes

06

2.1 Haloalkenes:

- a) Vinyl Chloride: synthesis of vinyl chloride from 1) 1, 2-dichloroethane 2) ethene  
Chemical reactions: Addition reaction with HBr, polymerization reaction.
- b) Allyl Iodide: synthesis of allyl iodide from 1) allyl chloride 2) glycerol and HI.  
Chemical reactions: reaction with NaOH, KCN, & Br<sub>2</sub>.

2.2 Haloarenes:

Introduction, Synthesis of halobenzene from 1) Hunsdiecker reaction 2) Gattermann reaction. Chemical reactions (with mechanism): Ullmann biaryl synthesis. Resonance & Relative reactivity of alkyl halides v/s vinyl and aryl halides towards nucleophilic substitution reactions.

Unit-III : Carboxylic acid derivatives:

05

- A) Acid Chlorides: Introduction, preparation methods: 1) From acetic acid and thionyl chloride, 2) From acetic acid and phosphorous pentachloride. Chemical reactions: (Hydrolysis, Action with alcohol, Action with amines).



- B) **Acid anhydrides:** Introduction, preparation methods: 1) From acetyl chloride and carboxylic acid, 2) From acetyl chloride and sodium acetate. Chemical reactions: (Hydrolysis, Action with alcohol, Action with amines).
- C) **Esters:** Introduction, preparation methods: 1) From ethyl alcohol and acetic acid, 2) From ethyl alcohol and acetyl chloride. Chemical reactions: (Hydrolysis, Action of amines, Reduction).
- D) **Amides:** Introduction, preparation methods: 1) From ammonia and acetyl chloride 2) From ammonia and acetic anhydride. Chemical reaction: (Hydrolysis, Action of nitrous acid).

**Unit- IV: Alcohols and epoxides**

05

- A) **Alcohols:** Introduction and Classification.
- a) **Dihydric alcohol (ethylene glycol):** Preparation methods: (Hydroxylation of alkene and From 1,2-dihaloalkane). Chemical reactions: [Reaction of ethylene glycol with, 1)  $Pb(OAc)_4$ , 2)  $P_2O_5/ZnCl_2$ ].
- b) **Trihydric alcohol (Glycerol):** Preparation methods from: 1) Oils and fats 2) Propene. Chemical reactions: [Reactions of glycerol with, 1) Nitric acid, 2) Acetyl chloride].
- B) **Epoxides :** Introduction and nomenclature. Preparation methods:
- a) Oxidation of ethene in presence of Ag catalyst, b) Oxidation of ethene with per acetic acid. Chemical reactions: (Ring opening reactions of propylene oxide in acidic
- b) and basic medium/reagent,

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Section -B : 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.:

10

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.

**Outcomes:** After completion of syllabus students will be able to understand following outcomes.

1. Student should learn the concept of aromatic hydrocarbons, Aromaticity and antiaromaticity.
2. Student should understand the phenols and synthesis of phenols
3. Student knows about the haloalkene and haloarenes compounds.
4. To know the concepts of carboxylic acids and their derivatives.
5. To know about the types of alcohols and reaction of epoxide.
6. To study the different properties of P- block elements.
7. To know the acids & Bases by different concepts.

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Gorthekar Arts, Commerce  
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**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: ArunBahl 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.
10. Advanced inorganic chemistry by Gurudeep Raj and ChatwalAnand.
11. Concise Inorganic Chemistry by J. D. Lee.
12. Basic Inorganic Chemistry by F. A. Cotton, G. Wilkinson and P. L. Gaus.
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)

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B. Sc. First Year ( Semester-II )  
Paper-IV (CCC-II)  
Physical + Inorganic Chemistry

Credits:02

Periods: 45

Section A ( Physical Chemistry)

Unit-I : Atomic structure:

08P

- 1.1 Introduction, Rutherford's alpha particle scattering experiment, Rutherford's atomic model and its drawbacks.
- 1.2 Bohr's theory of hydrogen atom: Bohr's atomic model- Postulates, Merits and demerits. Derivation for radius of an orbit, velocity of an electron and energy of an electron. Energy difference in terms of wave number and Rydberg constant. Bohr's explanation of hydrogen spectrum. The Sommerfeld extension of the Bohr theory.
- 1.3 Electronic configuration of elements: Aufbau principle, Pauli's Exclusion principle, Hund's rule of maximum multiplicity and  $(n + l)$  rule.
- 1.5 Quantum numbers.
- 1.4 Numerical problems on radius and energy.

Unit- II: Liquid state :

07P

- 2.1 Introduction, Various intermolecular forces in liquids dipole-dipole attraction, London forces, Hydrogen bonding.
- 2.2 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 based on method.
- 2.3 Viscosity of liquid, units of viscosity, effect of temperature on viscosity, measurement of viscosity by Ostwald's method, numerical Problems based on method.
- 2.4 Parachor and chemical constitution: Relation between parachor and surface tension, application of parachors in deciding structures.

Unit- III: Colloidal state

07P

- 3.1 Introduction , classification of colloidal systems.
- 3.2 Sols (Solids in liquids):-Types of sols, Preparation of sols, Dispersion and aggregation methods. Properties of sols- Colour, Optical (Tyndall effect), Kinetic ( Brownian movement) and electrical properties ( electrophoresis and electro osmosis). Coagulation of colloidal solution -Hardy Schulze rule. Protective action of sol and Gold Number.

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- 3.3 Emulsions (Liquids in liquids):- Types of emulsions, preparation of emulsion, Emulsifier, Role of emulsifier.
- 3.4 Gels (Liquids in solids):- Classification gels, preparation of gel and properties gel – Hydration, Swelling, Syneresis and Thixotropy.
- 3.5 Applications of colloids ( Food, Medicine, smoke precipitation, sewage precipitation and in purification of water.)

#### Unit- IV: Catalysis

08P

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

#### Section –B : Inorganic Chemistry.

#### Unit- V: Chemical Bonding-I

10

- 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.

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- 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.

**Unit-VI : Chemical Bonding –II**

05

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  $CO$ .

**Outcomes:** After completion of syllabus students will be able to understand following outcomes.

1. To impart knowledge of atomic structure, different theories of atomic structure, rules of electronic configuration and quantum numbers.
2. Learning of properties of liquid phase as surface tension, Viscosity and parachor.
3. Student will learn the basic knowledge of colloidal state, types, preparation, properties and applications of colloidal state.
4. Learning and understanding of catalysis, types of catalysis and characteristics of catalyzed reactions.
5. To understanding the chemical bond and its different types of bonds.
6. Learning the Concept of hybridization and study of VSEPR & Molecular Orbital theory.

*Ganesh*

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**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. th
5. Essentials of Physical Chemistry .By B. S. Bahl, G. D. Tuli, ArunBahl ( S. Chand and Co Ltd. ) ( 25 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.
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B.Sc. First Year  
Paper-V [CCCP-I]  
credits: 04 Periods : 120

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.

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- To study Kinetics of hydrolysis of ester in presence of mineral acid like HCl.  
Preparation of  $As_2S_3$  solution from  $As_2O_3$  and compare the precipitation power of NaCl and  $MgCl_2$ .
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  $KNO_3/NH_4Cl$ .
  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

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