

**Kavayitri Bahinabai Chaudhari**  
**North Maharashtra University**

'A' Grade NAAC Re-Accredited (3<sup>rd</sup> Cycle)

Jalgaon-425001, Maharashtra, (India)



**B.O.S. in Chemistry**  
**B.Sc. First Year (Chemistry)**  
**Semester I & II**

**C B C S**

With effect from **June-2018**

## **FOREWORD**

As per the directive from the North Maharashtra University, Jalgaon the chemistry syllabus for F.Y.B.Sc. (CBCS) had to be prepared. Guidelines for this were provided by the university.

Teachers of the affiliated colleges and university department were participated in workshop keeping in view of the aims of the UGC model curriculum in developing chemistry skill in students linking theory and practical courses and allowing both vertical and horizontal mobility and also catering to local needs the syllabus was prepared.

Teachers of different branches of chemistry namely Physical, Inorganic, Analytical and Organic had separate and joint brainstorming session and arrived at a draft of syllabus in chemistry for I & II semester of F.Y.B.Sc..

The final draft incorporating the suggestion was placed before the Board of Studies in Chemistry on 23-06-2018.for approval.

**Chairman**

**Board of Studies in Chemistry**

**North Maharashtra University, Jalgaon**

# **North Maharashtra University, Jalgaon**

## **B.O.S. in Chemistry**

### **Skeleton of Choice Based Credit System**

**w.e.f. 2018-19**

<b>For Theory</b>	<b>1 Credit</b>	<b>1 Hour</b>
	<b>1 Credit</b>	<b>15 Hours/Semester</b>
	<b>2 Credits</b>	<b>30 Hours/Semester</b>
	<b>2 Credits</b>	<b>45 Lectures of 40 Minutes/Semester</b>
<b>For Practical</b>	<b>1 Credit</b>	<b>2 Hours</b>
	<b>2 Credits</b>	<b>60 Hours/Semester</b>
	<b>2 Credits</b>	<b>90 Lectures of 40 Minutes/Semester</b>



## F.Y.B.Sc. Chemistry C.B.C.S. Pattern

Semester	Core Course	Paper No.	Name of Course	No. of Credits	No. of Hours per week	No. of Lectures per week	Int. Exam. Marks	Ext. Exam. Marks	Total Marks
I	CC-A-1	Paper I (Section A) CH-101	Physical & Inorganic Chemistry-I	2	2	3	40	60	100
		Paper II (Section B) CH-102	Organic & Inorganic Chemistry-I	2	2	3	40	60	100
		Paper III (Section A & B) CH-103	Chemistry Practical-I (Based on Section A & B)	2	4	6	40	60	100
II	CC-A-II	Paper I (Section A) CH-201	Physical & Inorganic Chemistry-II	2	2	3	40	60	100
		Paper II (Section B) CH-202	Organic & Inorganic Chemistry-II	2	2	3	40	60	100
		Paper III (Section A & B) CH-203	Chemistry Practical-II (Based on Section A& B)	2	4	6	40	60	100
			<b>Total Credits</b>	<b>12</b>					

**CC- Core Course**

## S.Y.B.Sc. Chemistry C.B.C.S. Pattern

Semester	Core Course	Paper No.	Name of Course	No. of Credits	No. of Hours in per week	No. of Lectures per week	Int. Exam. Marks	Ext. Exam Marks	Total Marks
III	CC-A-III	Paper I (Section A) CH-301	Physical & Inorganic Chemistry	2	2	3	40	60	100
		Paper II (Section B) CH-302	Organic & Inorganic Chemistry	2	2	3	40	60	100
		Paper III (Section A & B) CH-303	Chemistry Practical (Based on Section A & B)	2	4	6	40	60	100
	SEC-1	CH-304	Basic Analytical Chemistry	2	2	3	40	60	100
IV	CC-A-IV	Paper I (Section A) CH-401	Physical & Inorganic Chemistry	2	2	3	40	60	100
		Paper II (Section B) CH-402	Organic & Inorganic Chemistry	2	2	3	40	60	100
		Paper III (Section A & B) CH-403	Chemistry Practical (Based on Section A & B)	2	4	6	40	60	100
	SCE-2	CH-404	Analytical Methods in Chemistry	2	2	3	40	60	100
			<b>Total Credits</b>	<b>16</b>					

**CC- Core Course, SEC-Skill Enhancement Course**

## T.Y.B.Sc. Chemistry, C.B.C.S. Pattern

Semester	Discipline Sub. Elective Paper	Paper No.	Name of Course	No. of Credits	No. of Hours in terms of Credit per week	No. of Lectures per week	Int. Exam. Marks	Ext. Exam. Marks	Total Marks
<b>V</b>	DSE-A-1	Paper I (Section A) CH-501	Fundamental Physical Chemistry	2	2	3	40	60	100
		Paper II (Section B) CH-502	Fundamental Inorganic Chemistry	2	2	3	40	60	100
		Paper VIII (Section A & B) CH-508	Chemistry Practical (Based on Section A & B)	2	4	6	40	60	100
	DSE-A-2	Paper III (Section A) CH-503	Organic Reaction Mechanism	2	2	3	40	60	100
		Paper IV (Section B) CH-504	Fundamental Analytical Chemistry	2	2	3	40	60	100
		Paper IX (Section A & B) CH-509	Chemistry Practical (Based on Section A & B)	2	4	6	40	60	100
	DSE-B-1	Paper V (Section A) CH-505	Theory Course	2	2	3	40	60	100
		Paper VI (Section B) CH-506	Theory Course	2	2	3	40	60	100
		Paper X (Section A & B)	Chemistry Practical (Based on Section A & B)	2	4	6	40	60	100

		B) CH-510							
	SEC-3	Paper VII CH-507	Molecules of life / Industrial Chemicals and Environment	2	2	3	40	60	100
VI	DSE-A-4	Paper I (Section A) CH-601	Advanced Physical Chemistry	2	2	3	40	60	100
		Paper II (Section B) CH-602	Advanced Inorganic Chemistry	2	2	3	40	60	100
		Paper VIII (Section A & B) CH-608	Chemistry Practical (Based on Section A & B)	2	4	6	40	60	100
	DSE-A-5	Paper III (Section A) CH-603	Spectroscopic Methods of Structure Determination	2	2	3	40	60	100
		Paper IV (Section B) CH-604	Instrumental Methods of Analysis	2	2	3	40	60	100
		Paper IX (Section A & B) CH-609	Chemistry Practical (Based on Section A & B)	2	4	6	40	60	100
	DSE-B-2	Paper V (Section A) CH-605	Theory Course	2	2	3	40	60	100
		Paper VI (Section B) CH-606	Theory Course	2	2	3	40	60	100
		Paper X (Section A & B) CH-610	Chemistry Practical ( Based on Section A & B)	2	4	6	40	60	100
	SEC-4	Paper VII CH-607	Polymer Chemistry / Green Chemistry	2	2	3	40	60	100
			<b>Total Credits</b>	<b>58</b>					



**DSE- Discipline Specific Elective, SEC-Skill Enhancement Course**

## **Salient features**

- ❖ Cover an important theoretical and practical topic of physical, inorganic, analytical and organic chemistry.
- ❖ The course is self-contained and broadly covers the fundamental concept in chemistry.
- ❖ The syllabus provides logical sequencing of the “units” of the subject matter with proper placement of concepts with their linkage for better understanding.
- ❖ Promote understanding of basic principles in chemistry while retaining the excitement in chemistry.
- ❖ Develop an interest in student to study the chemistry as discipline.
- ❖ Emphasis has been promoting processes skills, problem solving abilities and applications of concept of chemistry for making learning of chemistry more relevant meaningful and interesting.
- ❖ Develop positive scientific attitude and appreciate contribution of chemistry towards the improvement of quality of human life.

## **Utility**

- ❖ Describe and explain processes phenomenon in chemistry
- ❖ An ability to communicate chemical understanding
- ❖ Recall and interpret concept, theories and principles in chemistry
- ❖ Determine analyses and evaluate the interpretation ships involve in chemistry.
- ❖ Develop thirst of chemical knowledge, become flexible and persistence learners and appreciate the need for lifelong learning.
- ❖ Operate chemical equipment and technology safely.
- ❖ Make use of chemical data, concept, principles and terminology in communicating chemical information.
- ❖ Understand basic chemical concept in sufficient depth to provide an adequate foundation for specialization.

## **Learning objective**

- ❖ To expose & develop interest in the field of chemistry
- ❖ To develop ability & to acquire the knowledge of terms, facts concept processes techniques & principles of subject
- ❖ To develop problem solving skills in students
- ❖ To develop proper aptitude towards the subject.
- ❖ To develop ability to apply the knowledge of contents of principles of chemistry
- ❖ To develop skills required in chemistry such as the proper handling of apparatus & chemical analysis.
- ❖ To understand the fundamental principle and chemical analysis

## **Pre-requisites**

- ❖ To develop interest in learning chemistry.
- ❖ To develop practical skill in student.
- ❖ To develop scientific approach in student.
- ❖ To correlate theoretical concept of chemistry with practical approach.

**North Maharashtra University, Jalgaon**  
**Class- F. Y. B. Sc. Chemistry Syllabus (Semester Pattern)**  
**Choice Base Credit System (With effect from June 2018).**

The course structure and title of the courses for F. Y. B. Sc. (Chemistry) are as given below.

<b>Semester I</b>						
<b>Core Course CC-A-I</b>		<b>No of Credits</b>	<b>Hours/ Semester</b>	<b>Lectures/ Semester</b>	<b>Marks</b>	
<b>Code</b>	<b>Title</b>				<b>Ext.</b>	<b>Int.</b>
<b>CH-101</b>	Physical and Inorganic Chemistry-I (Section A)	2	30	45	60	40
<b>CH-102</b>	Organic and Inorganic Chemistry-I (Section B)	2	30	45	60	40
<b>CH-103</b>	Chemistry Practical-I (Based on Section A and B)	2	60	90	60	40
<b>Semester II</b>						
<b>Core Course CC-A-II</b>		<b>No of Credits</b>	<b>Hours/ Semester</b>	<b>Lectures/ Semester</b>	<b>Marks</b>	
<b>Code</b>	<b>Title</b>				<b>Ext.</b>	<b>Int.</b>
<b>CH-201</b>	Physical and Inorganic Chemistry-II (Section A)	2	30	45	60	40
<b>CH-202</b>	Organic and Inorganic Chemistry-II (Section B)	2	30	45	60	40
<b>CH-203</b>	Chemistry Practical-II (Based on Section A and B)	2	60	90	60	40

**Note**

1. Each theory course has weightage of 6 lectures per week. (Each Section is of 3 Lecture/ week)
2. Each practical course has weightage 6 lectures per week.
3. Each practical batch should consist of maximum 15 students.
4. Each Lecture is of 40 min duration.
5. Examination of practical course shall be held at the end of the each semester.
6. Calculation of credits and Hrs for theory and practical

<b>For Theory</b>	1 Credit	1 Hour
	1 Credit	15 Hours/ Semester
	2 Credits	30 Hours/ Semester
	2 Credits	45 Lectures of 40 Minutes/ Semester
<b>For Practical</b>	1 Credit	2 Hours
	2 Credits	60 Hours/ Semester
	2 Credits	90 Lectures of 40 Minutes/ Semester

**IMPORTANT NOTE**

\*In volumetric analysis, volume of pipette solution should be 10 ml instead of 25 ml. Similarly preparation of 100 ml solution by using 100 ml volumetric flask instead of

250 ml. (To avoid wastage of chemicals)

**External Examination Pattern**  
**Chemistry Practical Semester I/ II CH-103 /CH-203**

**Time: 3 Hrs.**

**Marks 60**

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**Instructions**

1. Duration of examination 3 hrs (Batch-I: 10.00 am to 1.00 pm. and Batch-II: 2 to 5 pm)

2. All the students in a batch should be divided in three equal groups.

**Note- Distribution of Experiments -  $\frac{1}{4}$  of the students in a batch will be given Physical chemistry experiment,  $\frac{1}{4}$  will be given an Analytical chemistry experiment and  $\frac{1}{2}$  will be given an Inorganic / Organic qualitative analysis.**

3. Students should bring complete certified journal at the time of practical examination.

Q. 1. Physical Chemistry / Analytical Chemistry experiment 40 Marks

OR

Inorganic/ Organic Qualitative analysis

Q. 2. Oral 10 Marks

Q. 3. Journal 10 Marks

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**Total: 60 Marks**

**Internal Examination Pattern**  
**Chemistry Practical Semester I/ II CH-103 / CH-203**

**Time: 3 Hrs.**

**Marks 40**

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Q. 1. Physical Chemistry/ Analytical Chemistry experiment 30 Marks

OR

Inorganic/ Organic Qualitative analysis

Q. 2. Oral 05 Marks

Q. 3. Attendance and Behavior 05 Marks

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**Total: 40 Marks**

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**

**Syllabus of F. Y. B. Sc. Chemistry**

**Choice Based Credit System, Semester System**

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**Core Course-A-1(Semester I)**

**CH: 101 Physical and Inorganic Chemistry -I (Section A)**

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**Chapter 1: Electrolytic conductance.**

**(L: 10, M: 13)**

Electrolytic conductance, Equivalent conductance, determination of conductance, variation of conductance with concentration, equivalent conductance at infinite dilution, Kohlrausch's law and its applications.

Applications of conductance measurements.

- a) Solubility of sparingly soluble salts\
- b) Determination of degree of ionization.
- c) Determination of Ionic product of water
- d) Conductometric titration, Acid-Base Titrations,

Numerical problems relevant to the topic are expected.

**Ref. 1, 2 (Relevant pages)**

**Chapter 2: Surface Chemistry .**

**(L: 06, M: 08)**

Introduction, Adsorption, Mechanism of adsorption, Factors affecting adsorption of gases by solids, Difference between adsorption and absorption, Types of adsorption: Physical and Chemical adsorption, Adsorption of gases by solid, Types of adsorption isotherms: 1. Freundlich Adsorption Isotherm, 2. Langmuir Adsorption Isotherm (Derivation).

Ref. 3, 4 (Relevant pages)

**Chapter 3: Mathematical Preparation in Chemistry**

**(L: 14, M: 19)**

**Logarithm:** Rules of Logarithm (without proof), Characteristic and Mantissa of Logarithm, Negative Logarithm, numerical based on applications of Logarithm in calculating pH with change of base of logarithm, antilogarithm.

**Graphical representation of equations:** Rules for drawing graph co-ordinates etc., Equation of straight line, slope and intercept, plotting the graph from the data of chemical properties and problems.

**Derivative:** Rules of differentiation (without proof), Algebraic, Logarithmic and exponential functions and numerical.

**Integration:** rules of integration (without proof), Integration with limit, Algebraic, Logarithmic and exponential functions and numerical. Numerical related to Chemistry.

**Ref.5 (Relevant pages)**

**Chapter 4: Periodic properties**

**(L: 08, M: 10)**

**a) Atomic and ionic size**

Definition and explanation of atomic radius, ionic radius, covalent radius and Van der Waal radius. Variation of atomic size along a period and a group.

### **b) Ionisation energy**

Definition and explanation, factors affecting ionisation energy. Variation of ionisation energy along a period and a group. Applications of I. E. to chemical behavior of an element.

### **c) Electron affinity**

Definition and explanation, factors affecting electron affinity. Variation of electron affinity along a period and a group. Applications electron affinity to chemical behavior of an element. Difference between I.E. and E.A.

### **d) Electronegativity**

Definition and explanation, factors affecting electronegativity. Variation of electronegativity along a period and a group. Pauling's electronegativity scale, Mullikan's approach of electro negativity, electro negativity and percent ionic character.

**Ref.6, 7 (Relevant pages)**

### **Chapter 5: S block element**

**(L: 07, M: 10)**

Electronic configuration, variation in properties of S block elements: atomic radii, ionization energy, colour of flame, reducing property, metallic property. Complexes of alkali metals with salicylaldehyde, acetyl acetone, wrap around complexes with polydentate ligands such as crown ether and cryptate. Complexes of alkali metals such as beryllium oxalate ion, chlorophyll, complexes of Ca and Mg with EDTA.

**Ref. 6, 7 (Relevant pages)**

### **Reference Books**

- [1] Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli, Arun Bahl ( S. Chand and Co Ltd.) (25<sup>th</sup> edition).
- [2] Elements of Physical Chemistry, S. Glasstone and D. Lewis (The Macmillan Press Ltd. (2nd edition).
- [3] Principles of Physical Chemistry, S. H. Maron and C. F. Prutton (4<sup>th</sup> edition).
- [4] Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, M.S. Pathaniya
- [5] Mathematical Preparation for Physical Chemistry, Farrington Daniels, Mc Graw- Hill Publication.
- [6] Advanced inorganic chemistry volume 1 – Satyaprakash Tuli, Basu, Madan(S Chand publications)
- [7] Concise inorganic chemistry – J D Lee (5<sup>th</sup> edition)

## Core Course-A-1(Semester I)

### CH: 102 Organic and Inorganic Chemistry-I (Section B)

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#### Chapter 1: Introduction to Organic Chemistry

(L: 08, M: 10)

Introduction, general properties of organic compounds, applications of organic compounds in everyday life.

Benzene and its stability, Huckel's rule of aromaticity, nomenclature of derivatives of benzene (mono and disubstituted benzene only)

Structural effects: Inductive effect, resonance, hyper conjugation, steric effect, electromeric effect

Fission of covalent bond: homolytic and heterolytic fission, types of reagents: electrophiles and nucleophiles, types of organic reactions: addition, elimination, substitution and rearrangement reactions.

Ref. 1,2,3,4 (relevant pages)

#### Chapter 2: Hydrocarbons

(L: 08, M: 10)

**Alkanes:** Introduction, nomenclature (common and IUPAC system)

Preparation of alkanes: by Wurtz reaction, by hydrogenation of alkenes. Reactions of alkanes: halogenation, combustion.

**Alkenes:** Introduction, nomenclature (common and IUPAC system)

Preparation of alkenes: by dehydration of alcohols, dehydrohalogenation of alkyl halides, Reactions of alkenes: Addition of halogen, hydrogen halide and hydration.

**Alkynes:** Introduction, nomenclature (common and IUPAC system)

Preparation of alkynes: by Double Dehydrohalogenation of vicinal and geminal dihalides, by alkylation of acetylene.

Reactions: Addition of halogens, hydrogen halides, hydration.

Ref. 1,2,3,4 (relevant pages)

#### Chapter 3: Haloalkanes and haloarenes

(L: 06, M: 10)

**Haloalkanes:** Introduction, classification, nomenclature (common and IUPAC system)

Monohalogen derivatives: Classification, methods of preparation- from alcohols (using HX,  $PX_3$ ,  $PX_5$ ,  $SOCl_2$ ). Reactions - with aqueous alkali, sodium alkoxide, alc.KCN, silver salt of acid, alc.ammonia, NaSH/ KSH, dehydrohalogenation, formation of Grignard's reagent. Dihalogen derivatives: preparation of vicinal and geminal dihalides, reactions: hydrolysis with aq. NaOH.

**Haloarenes:** Introduction, nomenclature, reactions of haloarenes: nucleophilic substitution reactions with  $NaNH_2$ /  $KNH_2$ , NaOH,  $NH_3$ , CuCN, Ullman reaction.

Ref. 1,2,3,4 (relevant pages)

#### Chapter 4: Alcohols, phenols and ethers

(L: 08, M: 10)

**Alcohols:** Introduction, classification, nomenclature (common and IUPAC system), methods of preparation: from Grignard's reagent (using aldehydes and Ketones), by reduction of aldehydes and ketones. Physical properties of alcohols. Reactions of alcohols: reaction with active metals, dehydration, oxidation.

**Phenols:** Introduction, nomenclature, acidity of phenols, Preparation of phenol from benzene sulphonic acid, benzene diazonium chloride, Reactions of phenols: ester formation (acylation), formation of aryl ethers.

**Ethers** - Introduction, classification, nomenclature (common and IUPAC system), methods of preparation: by Williamson's synthesis, by dehydration of alcohols, from diazomethane. Reactions of ethers: reaction with hot and cold HI, hydrolysis with dil.  $\text{H}_2\text{SO}_4$ .

**Ref. 1,2,3,4 (relevant pages)**

## **Chapter 5: Ionic equilibria**

**(L: 06, M: 08)**

Strong and weak acids and bases, degree of dissociation, dissociation constants of acids and bases,  $\text{P}^{\text{H}}$  and  $\text{P}^{\text{OH}}$ , ionic product of water, numericals.

Buffer solutions: Definition, types, Henderson equation, buffer action, buffer capacity, numericals, applications of buffer solutions.

**Ref.5, 6, 7 (relevant pages)**

## **Chapter 6: VSEPR theory and shapes of covalent molecules**

**(L: 09, M: 12)**

Sidgwick – Powell theory, VSEPR theory: assumptions, need of the theory, effect of lone pairs and electronegativity.

Applications of VSEPR theory to explain a) Geometry of molecules containing bond pair of electrons:  $\text{BeF}_2$ ,  $\text{BF}_3$ ,  $\text{CH}_4$ ,  $\text{PF}_5$ ,  $\text{SF}_6$ ,  $\text{IF}_7$  b) Geometry of molecules containing lone pairs as well as bond pair of electrons:  $\text{SnCl}_2$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{SF}_4$ ,  $\text{ClF}_3$ ,  $\text{XeF}_2$ ,  $\text{XeF}_4$ ,  $\text{IF}_5$ .

Limitations of VSEPR theory.

**Ref.5, 7, 8 (relevant pages)**

## **Reference Books**

- [1] Organic Chemistry - Francis A Carey (3<sup>rd</sup> Edition)
- [2] Organic Chemistry - Morrison and Boyd (6<sup>th</sup> Edition)
- [3] Organic Chemistry - Stanley H pine (5<sup>th</sup> Edition)
- [4] A Text Book of Organic Chemistry Arun Bahl and B S Bahl, S Chand publication.
- [5] Advanced Inorganic Chemistry, Volume 1 – Satyaprakash Tuli, Basu, Madan (S Chand publications)
- [6] Analytical Chemistry – G D Christian (6<sup>th</sup> Edition)
- [7] Principles of Inorganic Chemistry – Puri, Sharma, Kalia
- [8] Concise Inorganic Chemistry – J D Lee (5<sup>th</sup> Edition)



**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**F. Y. B. Sc. Semester I**  
**CH-103 Chemistry Practicals –I (Based on Section A and B)**

**A) Physical Chemistry Experiments (Any three)**

1. Calibration of volumetric apparatus Pipette / Volumetric flask.
2. To investigate the adsorption of oxalic acid from aqueous solution by activated charcoal and examine the validity of Freundlich and Langmuir's adsorption isotherms.
3. To standardize commercial sample of HCl using Borax and to write material safety data of the chemicals involved.
4. To determine the equivalent weight of Mg metal by Eudiometer method.
5. Determination of dissociation constant of weak monobasic acid ( $\text{CH}_3\text{COOH}$ ) by conductance measurement.
6. Determination of the solubility of sparingly soluble salt by conductometry.

**B) Analytical Chemistry Experiments (Any three)**

[Instruction- Prepare solutions using 100 ml volumetric flask]

1. Preparation of std. 0.1N oxalic acid solution and standardization of KOH solution.
2. Preparation of std. 0.1N  $\text{K}_2\text{Cr}_2\text{O}_7$  solution and standardization of ferrous ammonium sulphate solution.
3. Preparation of std. 0.1N NaCl solution and standardization of  $\text{AgNO}_3$  solution.
4. Determination of loss per gram and percentage purity of Zinc Carbonate gravimetrically.
5. Determination of loss per gram and percent purity of mixture of  $\text{NaHCO}_3$  and  $\text{Na}_2\text{CO}_3$ .

**C) Inorganic Qualitative Analysis (Any Four compounds)**

Analysis of inorganic compound containing one cation and anion

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**

**Syllabus of F. Y. B. Sc. Chemistry**

**Choice Based Credit System, Semester System**

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**Core Course-A-II (Semester II)**

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**CH: 201 Physical and Inorganic Chemistry-II (Section A)**

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**Chapter 1: The Gaseous State**

**(L: 14, M: 19)**

The kinetic theory of ideal gases. Assumptions of kinetic theory of gases. Kinetic gas equation and its Significance (Derivation not expected), Deductions of Avogadro's principle, Graham's law, kinetic energy of translation. Deviation of real gases from ideal behavior. Reasons for deviation, compressibility factor, Van der Waal's equation, its applications. Andrew's isotherms of CO<sub>2</sub>, relation between critical constants and Van der Waal's constants, liquification of Gases, Joule Thomson effect, related numericals

**Ref. 1, 2 (Relevant pages)**

**Chapter 2: Liquid State**

**(L: 06, M: 08)**

Introduction, Surface tension of liquid, units of surface tension, factors affecting surface tension, determination of surface tension of liquids by single capillary method and stalagnometer method. Viscosity of liquid, units of viscosity, measurement of viscosity of liquid by Ostwald's method, related numerical.

**Ref. 2, 3 (Relevant pages)**

**Chapter 3: Second Law of Thermodynamics**

**(L: 10, M: 13)**

Introduction, Limitations of first law of thermodynamics, spontaneous and non spontaneous process with examples, Statements of second law of thermodynamics, entropy, entropy changes in isolated systems, entropy changes for systems only, entropy of mixing of gases, entropy changes in ideal gases and physical transformation, Numerical.

**Ref.1 (Relevant pages)**

**Chapter 4: Metals and metallurgy**

**(L: 07, M: 10)**

Occurrence of metals, various steps involved in metallurgical processes, concentration of ore, calcinations, roasting, reduction to free metals, electrometallurgy, hydrometallurgy, refining of metals.

**Ref.4, 5 (Relevant pages)**

## Chapter 5: P block elements

(L: 08, M: 10)

Electronic configurations of P block elements. Variation in properties: atomic radius, ionisation energy, electron affinity, electro negativity, metallic character, oxidation state, reactivity. Acidic and basic character of hydroxides of P block elements. Bonding and shapes of following molecules:  $\text{Al}_2\text{Br}_6$ , diamond and graphite,  $\text{P}_4$ ,  $\text{S}_8$ ,  $\text{ClF}_3$ .

**Ref.6, 7 (Relevant pages)**

### Reference Books

- [1] Principles of Physical Chemistry, S. H. Maron and C. F. Prutton (4th edition).
- [2] Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli, Arun Bahl ( S. Chand and Co Ltd. ) (25th edition).
- [3] Elements of Physical Chemistry, S. Glasstone and D. Lewis (The Macmillan Press Ltd. (2nd edition).
- [4] Principles of Inorganic Chemistry – Puri, Sharma, Kalia
- [5] Theoretical Principles of Inorganic Chemistry – G S Manku
- [6] Advanced Inorganic Chemistry, Volume 1 – Satyaprakash Tuli, Basu, Madan (S Chand Publications)
- [7] Concise Inorganic Chemistry – J D Lee (5th edn)

## Core Course-A-II (Semester II)

### CH: 202 Organic and Inorganic Chemistry-II (Section –B)

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#### Chapter 1: Aldehydes and ketones

(L: 12, M: 15)

Introduction, structure of carbonyl group, nomenclature of aldehydes and ketones (common and IUPAC system)

**Aliphatic Aldehydes:** Preparation of aliphatic aldehydes- by reduction of acid chlorides, from Grignard' reagent and HCN, from terminal geminal dihalides and from calcium salt of acids.

**Aliphatic Ketones:** Preparation from Grignard's reagent and R-CN, from nonterminal geminal dihalides, from calcium salt of acids.

**Reactions of aliphatic aldehydes & Ketones:** Reducing properties of aldehydes: reaction with Tollen's reagent and Fehling's solution, Clemmenson reduction, Wolff Kishner reduction, Aldol condensation, crossed Aldol, Cannizzaro reaction, crossed Cannizzaro reaction, addition of HCN, NaHSO<sub>3</sub>, addition of derivatives of ammonia (hydroxyl amine, phenyl hydrazine, 2,4 DNP, semicarbazide).

**Aromatic aldehydes and ketones:** Preparation of benzaldehyde by Gatterman Kotch reaction, by oxidation of toluene. Reactions of benzaldehyde: addition of HCN, addition of Grignard's reagent, benzoin condensation.

Preparation of acetophenone: by oxidation of ethyl benzene, by F C acylation. Reactions of acetophenone: addition of HCN, addition of Grignard's reagent, oxime formation.

**Ref. 1,2,3,4 (relevant pages)**

#### Chapter 2: Carboxylic acids and their derivatives

(L: 10, M: 13)

**Carboxylic acids:** Introduction, nomenclature (common and IUPAC system), preparation of carboxylic acids: by carbonation of Grignard's reagent, and by hydrolysis of nitriles. Physical properties of acids, acidity of carboxylic acids. Reactions of carboxylic acids: formation of salt (with NaOH, KOH, Na<sub>2</sub>CO<sub>3</sub>, NaHCO<sub>3</sub>, NH<sub>4</sub>OH and active metals), Hell- Volhard- Zelinsky reaction, formation of acid anhydrides.

**Aromatic carboxylic acids:** Preparation of benzoic acid: by hydrolysis of phenyl cyanide and by carbonation of Grignard's reagent. Reactions of benzoic acid: formation of salt, benzoyl chloride, benzamide and reduction to benzyl alcohol.

**Esters:** Preparation of esters- from alcohol & acid, alcohols & acid chloride, alkaline and acidic hydrolysis of esters.

**Acid chlorides:** preparation of acid chlorides from carboxylic acids by using PCl<sub>3</sub>, PCl<sub>5</sub>, SOCl<sub>2</sub>. Reactions of acid chlorides with benzene and with sodium salt of acids.

**Amides** – Preparation of amides from acid and ammonia and from acid chloride and ammonia. Reactions of amides – hydrolysis and Hofmann rearrangement.

**Ref. 1, 2, 3, 4 (relevant pages)**

#### Chapter 3: Amines

(L: 08, M: 12)

**Aliphatic amines:** Introduction, classification, nomenclature (common and IUPAC system), preparation of amines: by reduction of nitro alkanes, nitriles and oximes, by alkylation of primary and secondary amines, by reduction of isocyanides. Basicity of amines, reactions: action of nitrous acid, acylation, carbyl amine test, Hinsberg's test.

**Aromatic amines**

Preparation of aniline: from chlorobenzene and from nitrobenzene. Basicity of aromatic amines. Reactions: benzylation, N- alkylation. Preparation of benzene diazonium chloride, reactions of benzene diazonium chloride: formation of iodobenzene, Sandmeyer reaction, azo coupling reaction: formation of methyl orange.

**Ref. 1, 2, 3, 4 (relevant pages)**

#### **Chapter 4: Volumetric analysis**

**(L: 09, M: 12)**

Molecular weight, formula weight, equivalent weight, calculation of equivalent weight of acids, bases, oxidizing and reducing agents, units of concentration – molarity, normality, formality, molality and parts per million (ppm), numerical, standard solution, primary and secondary standards, titrant, analyte, millimoles and milliequivalents, equivalence point, end point.

Measurement of volume, effect of temperature on volume, apparatus for precise measurement of volume : pipette, burette, volumetric flask, calibration of pipette, burette and volumetric flask.

**Ref. 5, 6 (relevant pages)**

#### **Chapter 5: Chemical bonding and structure**

**(L: 06, M: 08)**

Attainment of stable configuration, types of bonds: a) ionic bond- NaCl and CaCl<sub>2</sub> b) Covalent bond (Lewis concept) H<sub>2</sub>, Cl<sub>2</sub>, HF, O<sub>2</sub> and N<sub>2</sub> c) Coordinate bond- NH<sub>4</sub><sup>+</sup> and H<sub>3</sub>N: BF<sub>3</sub> d) metallic bond- free electron theory, limitations of Lewis concept. Theories of

bonding: valence bond theory, Heitler- London theory and Pauling- Slater theory.

Types of overlap: s-s, s-p and p-p overlap with examples like H<sub>2</sub>, Cl<sub>2</sub>, HF, O<sub>2</sub>, N<sub>2</sub>

Limitations of valence bond theory.

**Ref. 7, 8, 9 (relevant pages)**

#### **Reference Books**

1. Organic Chemistry - Francis A Carey (3<sup>rd</sup> Edition)
2. Organic Chemistry - Morrison and Boyd (6<sup>th</sup> Edition)
3. Organic Chemistry - Stanley H pine (5<sup>th</sup> Edition)
4. A Text Book of Organic Chemistry- Arun Bahl and B S Bahl, S Chand publication.
5. Analytical Chemistry – G D Christian (6th edn)
6. Vogel's Textbook of Quantitative Chemical Analysis
7. Advanced Inorganic Chemistry, Volume 1 – Satyaprakash Tuli, Basu, Madan( S Chand publications)
8. Principles of Inorganic Chemistry – Puri, Sharma, Kalia
9. Concise Inorganic Chemistry – J D Lee (5th edn)

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**

**F. Y. B. Sc. Semester II**

**CH-203 Chemistry Practicals-II (Based on Section A and B)**

**A) Physical Chemistry Experiments (Any three)**

1. Determination of surface tension by drop number method of given liquid by using stalagmometer.
2. To compare the cleaning power of different samples of soap and detergent by surface tension measurement.
3. Determination of heat of solution of  $\text{KNO}_3$  /  $\text{NH}_4\text{Cl}$  by water equivalent method.
4. Determination of relative viscosity of liquid A and B by viscometer.
5. Determination of percentage composition (v/v) of given mixture of ethyl alcohol and water by viscometer.
6. Determination of normality and strength of acid ( $\text{HCl}$  /  $\text{CH}_3\text{COOH}$ ) conductometrically

**B) Analytical Chemistry Experiments (Any three)**

1. Preparation of std. 0.05 N potassium hydrogen phthalate solution and standardization of  $\text{NaOH}$  solution
2. Preparation of std. 0.1N  $\text{ZnSO}_4$  solution and standardization of EDTA solution.
3. Preparation of 0.1 N  $\text{K}_2\text{Cr}_2\text{O}_7$  solution and standardization of  $\text{Na}_2\text{S}_2\text{O}_3$  solution.
4. Estimation of aniline / phenol.
5. Determination of number of molecules of water of crystallization in sample of crystalline barium chloride / magnesium sulphate.

**C) Organic Qualitative Analysis (Any Four compounds)**

1. Type determination
  2. Preliminary tests
  3. Physical constant
  4. Functional group tests
- (Structural formula not expected)