



**FIRST-YEAR OF BACHELOR OF SCIENCE  
CHEMISTRY (MAJOR AND MINOR)  
REVISED SYLLABUS ACCORDING TO CBCS  
NEP2020**

**COURSE TITLE: PHYSICAL, INORGANIC & ORGANIC CHEMISTRY-IV  
SEMESTER-II  
W.E.F. 2023-2024**

**RECOMMENDED BY THE BOARD OF STUDIES IN CHEMISTRY  
AND  
APPROVED BY THE ACADEMIC COUNCIL**

Devrukh Shikshan Prasarak Mandal's  
Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce, and  
Vid. Dadasaheb Pitre Science College (Autonomous), Devrukh.  
Tal. Sangameshwar, Dist. Ratnagiri-415804, Maharashtra,  
India

Academic Council Item No: 03 dated 08 July 2023

Name of the Implementing Institute	:	Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce, and Vid. Dadasaheb Pitre Science College (Autonomous), Devrukh. Tal. Sangameshwar, Dist. Ratnagiri-415804,
Name of the Parent University	:	University of Mumbai
Name of the Programme	:	Bachelor of Science
Name of the Department	:	Chemistry
Name of the Class	:	First Year
Semester	:	Second
No. of Credits	:	02
Title of the Course	:	Physical, Inorganic & Organic Chemistry-IV
Course Code	:	S105CHT
Name of the Vertical in adherence to NEP 2020	:	Major and Minor
Eligibility for Admission	:	Any 12 <sup>th</sup> Science Pass learner seeking Admission to Degree Programme in adherence to Rules and Regulations of the University of Mumbai and Government of Maharashtra
Passing Marks	:	40%
Mode of Assessment	:	Formative and Summative
Level	:	UG
Pattern of Marks Distribution for SEE and CIA	:	60:40
Status	:	NEP-CBCS
To be implemented from Academic Year	:	2023-2024
Ordinances /Regulations (if any)		

## Syllabus for First Year of Bachelor of Science in Chemistry

(With effect from the academic year 2023-2024)

**SEMESTER-II**

**Paper No.– 2**

**Course Title: Physical, Inorganic & Organic Chemistry-IV**

**No. of Credits - 02**

**Type of Vertical: Major and Minor**

**COURSE CODE: S105CHT**

### Learning Outcomes Based on BLOOM's Taxonomy:

After completing the course, the learner will be able to...		
Course Learning Outcome No.	Blooms Taxonomy	Course Learning Outcome
CLO-01	Understand	explain types of chemical bond, postulates of VSEPR theory and describe concept of aromaticity and various electrophilic substitution reactions.
CLO-02	Apply	solve numericals based on Henderson equation and buffer capacity and draw conformation analysis of cyclohexane in Chair, Boat and Twist boat forms.
CLO-03	Analyse	distinguish between Strong, moderate and weak electrolytes.

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**No. of Credits - 02**

**Type of Vertical: Major and Minor**

**COURSE CODE: S105CHT**

<b>COURSE CONTENT</b>			
<b>Module No.</b>	<b>Content</b>	<b>Credits</b>	<b>No. of Hours</b>
1	<p><b>Unit I</b></p> <p><b>1.1 Ionic Equilibria:</b></p> <p>Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water, ionization of weak acids and bases, pH scale, common ion effect, dissociation constants of mono-, di- and triprotic acid (exact treatment for monoprotic acid) Buffers: Introduction, types of buffers, derivation of Henderson equation for acidic and basic buffers, buffer action, buffer capacity (Numericals expected)</p> <p><b>1.2 Molecular Spectroscopy:</b></p> <p>Electromagnetic radiation, electromagnetic spectrum, Planck's equation, interaction of electromagnetic radiation with matter: Absorption, emission, scattering, fluorescence, electronic, vibrational and rotational transitions, Beer-Lambert's law (Numericals expected)</p> <p><b>1.3 Solid State Chemistry:</b></p> <p>Types of solids, crystal lattice, lattice points, unit cell, space lattice and lattice plane, laws of crystallography: Law of constancy of interfacial angle, law of symmetry and law of rational indices (Numericals expected)</p>	02	10
2	<p><b>Unit-II</b></p> <p><b>2.1: Chemical Bond and Reactivity:</b></p> <p>Types of chemical bond, comparison between ionic and covalent bonds, polarizability (Fajan's Rule), shapes of molecules, Lewis dot structure, Sidgwick Powell Theory, basic VSEPR theory for AB<sub>n</sub> type molecules with and without lone pair of electrons, isoelectronic principles, applications and limitations of VSEPR theory.</p>		10

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3	<p><b>2.2 Air, Water and Soil chemistry:</b></p> <p>Structure and composition of atmosphere; photochemical reactions in atmosphere; smog: classical smog and photochemical smog, aerosols: PM 10, PM 2.5; chemistry of acid rain, case studies; ozone chemistry and ozone layer depletion, role of CFCs in ozone depletion. Physicochemical properties of water; alkalinity and acidity of water, hardness of water, solubility of gases in water, metal complex formation and chelation; heavy metals in water. Soil composition; relation between organic carbon and organic matter, inorganic and organic components in soil; soil humus; cation exchange reactions in soil; NPK in soil.</p> <p><b>Unit III</b></p> <p><b>3.1 Stereochemistry-II: Cycloalkanes &amp; Conformational Analysis:</b></p> <p>Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy.</p> <p><b>3.2 Aromatic Hydrocarbons:</b></p> <p>Aromaticity: Huckel's rule anti-aromaticity, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel Crafts alkylation/acylation with their mechanism. Hammond's postulate, Directing effects of the groups.</p>		10
	<b>Total</b>	<b>02</b>	<b>30</b>

## Access to the Course

The course is available for all the students admitted for Bachelor of Science.

## Methods of Assessment

The assessment pattern would be 60:40, 60% for Semester End Examination (SEE) and 40% for Continuous Internal Assessment (CIA). The structure of the SEE and CIA would be as recommended by the Board of Studies and approved by the Board of Examination and the Academic Council of the college.

## References:

### Unit I:

1. Atkins P.W. and Paula J.de, Atkin's Physical Chemistry, 10th Ed., Oxford University Press (2014).
2. Ball D.W., Physical Chemistry, Thomson Press, India (2007).
3. Castellan G.W., Physical Chemistry, 4th Ed., Narosa (2004).
4. Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
5. Engel T. and Reid P., Physical Chemistry, 3rd Ed., Pearson (2013).
6. Peter A. and Paula J. de., Physical Chemistry, 10th Ed., Oxford University Press (2014).
7. McQuarrie D.A. and Simon J.D., Molecular Thermodynamics, Viva Books Pvt. Ltd., NewDelhi (2004).
8. Levine I.N., Physical Chemistry, 6th Ed., Tata Mc Graw Hill (2010).
9. Metz C.R., 2000 Solved Problems in Chemistry, Schaum Series (2006).
10. Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
11. Banwell C.N., Fundamentals of Molecular Spectroscopy, 4th Ed., Tata McGraw Hill(1994).
12. K.L. Kapoor, A Textbook of Physical Chemistry, Macmillan (2000).
13. A. Bhal, B.S. Bahl, G.D.Tuli- Essential of physical Chemistry

### Unit II:

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford,1970
3. Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.
4. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962.
5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.
6. Textbook of Inorganic Chemistry- O.P.Tandon, GRS.

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**Unit III:**

1. Morrison, R. T. and Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt Ltd. (Pearson Education).2012
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
4. Eliel, E. L. and Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994.
5. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.
6. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
7. Paula Y Bruice, Organic Chemistry, pearson education, Asia.
8. Graham Solomon, Fryhle, Snyder, Organic Chemistry, wiley publication.
9. Bahl and Bahl, advanced organic chemistry by S. Chand publication.
10. Guidebook to the mechanism in organic chemistry by P. Sykes.