



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

**COURSE TITLE: PHYSICAL, INORGANIC & ORGANIC CHEMISTRY-III  
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-III
Course Code	:	S104CHT
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.– 1**

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

**No. of Credits - 02**

**Type of Vertical: Major and Minor**

**COURSE CODE: S104CHT**

### 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	illustrate role of papers impregnated with Reagents in qualitative analysis and explain Arrhenius, Lowry-Bronsted and Lewis concepts of acid- base.
CLO-02	Apply	solve numerical based on Boyle's temperature and Joule Thomson effect.
CLO-03	Analyse	differentiate between Ideal gases and Real gases, Markownikoff and Anti-Markownikoff addition as well as syn and anti-hydroxylation.

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(With effect from the academic year 2023-2024)

**SEMESTER-II**

**Paper No.– 1**

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

**No. of Credits - 02**

**Type of Vertical: Major and Minor**

**COURSE CODE: S104CHT**

COURSE CONTENT			
Module No.	Content	Credits	No. of Hours
1	<p><b>Unit-I</b></p> <p><b>1.1 Gaseous State:</b></p> <ul style="list-style-type: none"> <li>• Ideal gas laws, kinetic theory of gases, Maxwell-Boltzmann's distribution of velocities (qualitative discussion)</li> <li>• Ideal gases, real gases, compressibility factor, Boyle's temperature (Numericals expected)</li> <li>• Deviation from ideal gas laws, reasons for deviation from ideal gas laws, Van der Waals equation of state</li> <li>• Joule-Thomson effect: qualitative discussion and experimentation. (Numericals expected)</li> </ul> <p><b>1.2 Chemical Equilibria and Thermodynamic Parameters:</b></p> <ul style="list-style-type: none"> <li>• Reversible and irreversible reactions, law of mass action, dynamic equilibria, equilibrium constant, (<math>K_c</math> and <math>K_p</math>), relationship between <math>K_c</math> and <math>K_p</math></li> <li>• Le Chatelier's principle, factors affecting chemical equilibrium (Numericals expected)</li> <li>• Statement of second law of thermodynamics, concepts of entropy and free energy, spontaneity and physical significance of free energy</li> <li>• Thermodynamic derivation of equilibrium constant (Numericals expected)</li> </ul>	02	10
2	<p><b>Unit II</b></p> <p><b>2.1 Concept of Qualitative Analysis:</b></p> <ul style="list-style-type: none"> <li>• Testing of Gaseous Evolutes, Role of Papers impregnated with Reagents in qualitative analysis (with reference to papers impregnated with, potassium dichromate, dimethylglyoxime and oxine reagents).</li> </ul>		10

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	<ul style="list-style-type: none"> <li>• Precipitation equilibria, effect of common ions, uncommon ions, oxidation states, buffer action, complexing agents on precipitation of ionic compounds. (Balanced chemical equations and numerical problems expected.)</li> </ul> <p><b>2.2 Acid Base Theories:</b></p> <ul style="list-style-type: none"> <li>• Arrhenius, Lowry- Bronsted, Lewis, Solvent – Solute concept of acids and bases, Hard and Soft acids and bases.</li> <li>• Applications of HSAB</li> <li>• Applications of acid base chemistry in:             <ol style="list-style-type: none"> <li>i) Understanding organic reactions like Friedel Craft's (acylation/alkylation) reaction</li> <li>ii) Volumetric analysis with special reference to calculation of titration curve involving strong acid and strong base.</li> </ol> </li> </ul>		
3	<p><b>Unit III</b></p> <p><b>Chemistry of Aliphatic Hydrocarbons</b></p> <p><b>3.1 Carbon-Carbon sigma bonds containing molecules:</b></p> <p>Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.</p> <p><b>3.2 Carbon-Carbon pi bonds containing molecules:</b></p> <p>Formation of alkenes and alkynes by elimination reactions: Mechanism of, E2, reactions. Saytzev and Hofmann eliminations. Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/Anti Markownikoff addition), hydroboration- oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). Peroxide effect with respect to free radical mechanism, 1, 2-and 1, 4- addition reactions in conjugated dienes and, Diels-Alder reaction; Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration reactions of carbonyl compounds, Alkylation of terminal alkynes.</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.