THIRD-YEAR OF BACHELOR OF SCIENCE CHEMISTRY (MAJOR) REVISED SYLLABUS ACCORDING TO CBCS NEP2020

COURSE TITLE: **CHEMISTRY-II**

SEMESTER-VI

W.E.F. 2025-2026

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: 02/2025

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	:	Third Year
Semester	:	Sixth
No. of Credits	:	02
Title of the Course	:	Chemistry-II
Course Code	:	S311CHT
Name of the Vertical in adherence to NEP 2020	:	Major
Eligibility for Admission	:	Any student admitted to Third Year of B.Sc. 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	:	5.5
Pattern of Marks Distribution for SEE and CIA	:	40:60%
Status	:	NEP-CBCS
To be implemented from Academic Year	:	2025-2026
Ordinances /Regulations (if any)		

Syllabus for Third Year of Bachelor of Science in Chemistry

(With effect from the academic year 2025-2026)

SEMESTER-VI **Paper No.– II**

Course Title: Chemistry-II **No. of Credits - 02**

Type of Vertical: Major **COURSE CODE: S311CHT**

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	Remember	describe properties of coordination compounds, general steps of metallurgy, biological importance of metal ions
CLO-02	Understand	explain the concept of distortion from octahedral geometry, catalysis, characteristics of group 18
CLO-03	Apply	differentiate between crystal field theory & molecular orbital theory; construct ligand group orbitals and molecular orbitals
CLO-04	Analyse	calculate crystal field stabilization energy for metal ions

Syllabus for Third Year of Bachelor of Science in Chemistry

(With effect from the academic year 2025-2026)

SEMESTER-VI **Paper No.– II**

Course Title: Chemistry-II **No. of Credits - 02**

Type of Vertical: Major **COURSE CODE: S311CHT**

COURSE CONTENT			
Module No.	**Content**	**Credits**	**No. of Hours**
1	**1.1 Coordination Chemistry (8L)** 1.1.1 Crystal Field Theory and effect of crystal field on central metal valence orbitals in various geometries from linear to Octahedral (from coordination number 2 to coordination number 6) 1.1.2 Splitting of d orbitals in octahedral, square planar and tetrahedral crystal fields 1.1.3 Distortions from the octahedral geometry: (i) effect of ligand field (ii) Jahn-Teller distortions. 1.1.4 Crystal field splitting parameters Δ; its calculation and factors affecting it in octahedral complexes, Spectrochemical series. 1.1.5 Crystal field stabilization energy (CFSE), calculation of CFSE for octahedral complexes with d0 to d10 metal ion configurations. 1.1.6 Consequences of crystal field splitting on various properties such as ionic radii, hydration energy. 1.1.7 Evidences for covalence in metal complexes: (i) intensities of d-d transitions (ii) ESR spectrum of $[IrCl_6]^{2-}$ (iii) Nephelauxetic effect. **1.2 Molecular Orbital Theory for coordination compounds (4L)** 1.2.1 Identification of the central metal orbitals and their symmetry suitable for formation of σ bonds with ligand orbitals. 1.2.2 Construction of ligand group orbitals. 1.2.3 Construction of σ-molecular orbitals for an ML6 complex. Examples like $[FeF_6]^{-4}$, $[Fe(CN)_6]^{-4}$, $[FeF_6]^{-3}$, $[Fe(CN)_6]^{-3}$, $[CoF_6]^{-3}$, $[Co(NH_3)_6]^{+3}$	01	15

	1.3 Properties of Coordination Compounds (3L) 1.3.1 Thermodynamic and kinetic stability of metal complexes with examples. 1.3.2 Stability constants: stepwise and overall stability constants and their interrelationship. 1.3.3 Factors affecting thermodynamic stability. (Factors related to nature of central metal atom, nature of ligand, chelate effect to be discussed). 1.3.4 Ligand substitution reactions: Associative and Dissociative mechanisms. Anation reactions.		
2	**2.1 Organometallic Compounds of main group metal (2L)** 2.1.1 General synthetic methods of organometallic compounds 2.1.2 Some chemical reactions of organometallic compounds **2.2 Metallocenes (2L)** Ferrocene: Synthesis, properties, structure and bonding on the basis of VBT. **2.3 Catalysis (2L)** 2.3.1 Comparison between homogeneous and heterogeneous catalysis 2.3.2 Basic steps involved in homogeneous catalysis 2.3.3 Mechanism of Wilkinson's catalyst in hydrogenation of alkenes. **2.4 Metallurgy (4L)** 2.4.1 General steps of metallurgy: Concentration of ore, calcinations, roasting, reduction and refining. 2.4.2 Metallurgy of copper: occurrence, physicochemical principles, Extraction of copper from pyrites & refining by electrolysis. **2.5 Chemistry of Group 18 (4L)** 2.5.1 General characteristics and trends in physical and chemical properties 2.5.2 Isolation of noble gases 2.5.3 Compounds of Xenon (oxides and fluorides) with respect to preparation and structure (VSEPR) 2.5.4 Uses of noble gases	01	15

	2.6 Introduction to Bioinorganic Chemistry (1L) 2.6.1 Essential and non-essential elements in biological systems. 2.6.2 Biological importance of metal ions such as Na^{+}, K^{+}, Fe^{+2}/Fe^{+3} and Cu^{+2}		
	Total	**02**	**30**

Access to the Course

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

Methods of Assessment

The assessment pattern would be 40:60, 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:

1. D. Banerjea, Coordination chemistry, Tata McGraw Hill, New Delhi, (1993).
2. D. F. Shriver and P. W. Atkins, Inorganic chemistry, 3rd Ed., Oxford University Press, (1999).
3. N. N. Greenwood and E. Earnshaw, Chemistry of elements, Pergamon Press, Singapore, (1989).
4. W. L. Jolly, Modern inorganic chemistry, 2nd Ed. McGraw Hill Book Co., (1991).
5. B. E. Douglas and H. McDaniel, Concepts and models in inorganic chemistry, 3rd Ed., John Wiley & Sons, Inc., New York, (1994).
6. G. N. Mukherjee and A. Das, Elements of bioinorganic chemistry, Dhuri and Sons, Calcutta, (1988).
7. R. W. Hay, Bioinorganic chemistry, Ellis Harwood, England, (1984).
8. R. C. Mehrotra and A. Singh, Organometallic chemistry: A unified approach, Wiley Eastern, New Delhi, (1991).

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