

# As per NEP 2020



**S. Z. S. P. Mandal's**  
**Shri Pancham Khemraj Mahavidyalaya,**  
**Sawantwadi-416510**  
**(Autonomous)**  
**Affiliated to University of Mumbai**



## **Title of the Programme Science**

**B.Sc. (Chemistry)**

1. F.Y.B.Sc.	2024-2025
2. S.Y.B.Sc.	2025-2026
3. T.Y.B.Sc.	2026-2027

**Syllabus for**  
**Semester I**  
**and**  
**Semester II**

Reference: GR dated 16<sup>th</sup> May 2023 for Credit structure

Sr. No.	Headings	Particulars
1	Title of the Program	<b>Science- Chemistry</b>
2	Eligibility	H.S.C. with Science Stream
3	Duration of the Programme	1- Certificate 2- Diploma 3- Degree
4	Scheme of Examination	60 External : 40 Internal Separate passing in External and Internal examination
5	Standard of Passing	40.00%
6	Programme Academic Level	4.5 Certificate 5.0 Diploma 5.5 Degree
7	Pattern	Semester Pattern
8	Status	New
9	To Be Implemented from the academic year	4.5 Certificate <b>2024-2025</b> 5.0 Diploma <b>2025-2026</b> 5.5 Degree <b>2026-2027</b>

## Preamble

### 1. Introduction

Shri Pancham Khemraj Mahavidyalaya (S.P.K.M.), Sawantwadi (Autonomous) believes in implementing several measures to bring equity, efficiency and excellence in higher education system in conformity to the guidelines laid down by the University Grants Commission (UGC). In order to achieve these goals, all efforts are made to ensure high standards of education by implementing several steps to enhance the teaching- learning process, examination and evaluation techniques and ensuring the all-round development of learners.

The four-year course in B.Sc. Chemistry has been designed to have a progressive and innovative curriculum in order to equip our learners to face the future challenges in the field of higher education. In semesters I and II learners are introduced to the basic areas of Chemistry such as Thermodynamics, Periodic table, Chemical Kinetics, Reaction and Mechanism.

In semesters III and IV the course content is made more rigorous by introducing the details of each of the above area. In semesters V and VI, course are designed to help in specialization in the core areas of Chemistry such as Molecular spectroscopy, Nuclear Chemistry, Chemical thermodynamics, Chemical kinetics, Molecular Symmetry and Chemical Bonding, Solid state Chemistry, Electrochemistry polymers, Quantum chemistry with Renewable energy resources Chemistry of inner transition elements, Theories of the metal-ligand bond, Organometallic chemistry, Mechanism of organic reactions , Stereochemistry, Synthesis of organic compounds, Quality in Analytical Chemistry, Chemical Calculations, Optical Methods, Electro analytical techniques and Applied components dyes and drugs. The practical course has been designed to help the student have a firm grip on the theoretical concepts through relevant experiments in each course.

### 2. Objectives:

- To help learners in developing a scientific attitude through the Chemistry curriculum that involves basic and core areas of Chemistry along with the recent scientific and technological advancements in applied areas of Chemistry
- To enhance knowledge of Chemistry through problem solving, tutorials and seminars
- To develop practical skills in Chemistry using a range of an activities such as projects in experimental Chemistry, study tours, industrial and research institutes visit.
- To inculcate a research attitude by involving learners in simple research projects review of research articles/papers, participation in scientific events etc.
- To help learners in developing analytical abilities and skills so as to address real world problems
- To help learners to plan a progressive and successful career in Chemistry, education and industry

3. **Program Outcome:** After successful completion of this programme learners will be able to

- Develop the knowledge of basic concepts of different branches of science required for postgraduate studies.
- Inculcate the skills useful in science laboratories for pursuing jobs in Industries.
- Introduce learners to the concepts useful for environment protection.
- Follow interdisciplinary approach for developing scientific temperament.
- Identify, formulate and analyze scientific problems and reach concrete solutions for societal benefits.

**Program Specific Outcome:** After successful completion of this programme (Chemistry)

learners are able to

- Develop the knowledge of basic concepts in chemistry.
- Inculcate the skills useful in chemistry laboratory.
- Introduce learners to the green chemistry needs and concepts.
- Identify, formulate and analyze scientific problems and reach concrete solutions for societal benefits using various principles of chemical sciences.

**Expected Outcome**

- Acquire & explore essential skills to succeed in various chemical industries.
- Get a hold on higher educational opportunities like post-graduation in chemistry.
- Pursue higher studies in interdisciplinary areas such as biochemistry, genetics, pathology etc.
- Explore research areas in chemistry and related fields.

#### 4. Credit Structure of the Programme (Semester I & II)

**Shri Pancham Khemraj Mahavidyalaya, Sawantwadi**

Proposed First Year Curriculum as per NEP 2020

**Department of Chemistry**

**Proposed Structure for Mandatory/OE/VSE/SEC/VEC/IKS**

Semester	Paper Code	Paper Title	Type	Credits
<b>I</b> (Level 4.5)	<b>S101CHT (Mandatory)</b>	General Chemistry-I	<b>Theory</b>	<b>2</b>
	<b>S102CHP (Mandatory)</b>	Chemistry Practical-I	<b>Practical</b>	<b>2</b>
	<b>CHVS01 (VSC)</b>	Experimental Chemistry-I	<b>Voc. Skill</b>	<b>2</b>
	<b>CHSE01 (SEC)</b>	Industrial Chemistry-I	<b>Skill</b>	<b>2</b>
	<b>CHIK01 (IKS)</b>	Alchemy	<b>IKS</b>	<b>2</b>
	<b>CHVE01 (VEC)</b>	Environmental Chemistry	<b>VEC</b>	<b>2</b>
<b>II</b> (Level 4.5)	<b>S103CHT (Mandatory)</b>	General Chemistry-II	<b>Theory</b>	<b>2</b>
	<b>S104CHP (Mandatory)</b>	Chemistry Practical-II	<b>Practical</b>	<b>2</b>
	<b>CHVS02 (VSC)</b>	Experimental Chemistry-I	<b>Voc. Skill</b>	<b>2</b>
	<b>CHSE02 (SEC)</b>	Industrial Chemistry-II	<b>Skill</b>	<b>2</b>
	<b>CHOE01</b>	Cosmetics	<b>Generic Ele.</b>	<b>2</b>

**Title of the Programme – B.Sc. Chemistry**

## Letter Grades and Grade points

Semester GPA/Program CGPA/Semester Program	Percentage of Marks	Alpha- sign / letter grade result
9.00-10.00	90.0-100	<b>O</b> (Outstanding)
8.00-<9.00	80.0-90.0	<b>A+</b> (Excellent)
7.00-<8.00	70.0-80.0	<b>A</b> (Very Good)
6.00-<7.00	60.0-70.0	<b>B+</b> (Good)
5.50-<6.00	55.0-60.0	<b>B</b> (Above Average)
5.00-<5.50	50.0-55.0	<b>C</b> (Average)
4.00-<5.00	40.0-50.0	<b>P</b> (Pass)
Below <4.00	Below 40.0	<b>F</b> (Fail)
AB (absent)		Absent

## DEPARTMENT OF CHEMISTRY

### Syllabus

#### Proposed Syllabus for CBCS

#### F. Y. B. Sc. Major Chemistry

#### Structure of the Course:

The structure of major courses (with codes) for Semester -I and II for F. Y. B.Sc.

(Chemistry) NP2020 is given below

#### MAJOR SUBJECTS

Semester	Course Code	Course title	No of Credits	No of Lectures In Hours
<b>I</b>	<b>S101CHT</b> <b>(Mandatory)</b>	General Chemistry-I	<b>2</b>	30
	<b>S102CHP</b> <b>(Mandatory)</b>	Chemistry Practical-I	<b>2</b>	60
<b>II</b>	<b>S103CHT</b> <b>(Mandatory)</b>	General Chemistry-II	<b>2</b>	30
	<b>S104CHP</b> <b>(Mandatory)</b>	Chemistry Practical-II	<b>2</b>	60



## SEMESTER-I

### **COURSE TITLE: - GENERAL CHEMISTRY-I**

**Course Code: S101CHT**

#### **Pre-requisites:**

Knowledge of Chemical Thermodynamics, Chemical Kinetics, Chemical Calculations, Ionic Equilibrium.

**Course Objectives:** To introduce students to;

- Understand basic concepts of chemistry.
- Recognize the importance of basics chemical thermodynamic.
- Learn the rate and order of reactions.
- Classify the electrolytes based on their dissociation phenomenon
- Learn about the concentration units and preparation of solutions.

**Desired Outcomes:** After the completion of this course, learners will be able to:

- ✓ Understand the basics of thermodynamic properties.
- ✓ Analyze the rate and orders of reactions by using different methods.
- ✓ Evaluate different physical properties of liquids by using diverse techniques.
- ✓ Prepare solutions of different concentrations from solid and liquid analyte.
- ✓ Differentiate strong and weak electrolytes based on knowledge of degree of ionization.
- ✓ Calibrate the volumetric apparatus required for the day-to-day Practicals.

#### **Course Objectives:**

To Introduce students to:

- Systematic and coherent understanding of the fundamental concepts in
- Inorganic Chemistry and Organic Chemistry.
- Understand the basic knowledge of periodic table and Atomic Structure.
- Classification of elements in the periodic table.
- Comparative chemistry of Main Group Elements.
- The concepts of Nomenclature of Organic Compounds.
- Bonding and Structure of organic compounds.
- Fundamentals of organic reaction mechanism .
- Basic concept of stereochemistry.

**Course Outcomes:** On successful completion of this course students will be able to:

- Understand the basic theories of atomic structures.
- Students will be able to understand the concept of atomic orbitals.
- Calculate the effective nuclear charge according to Slater's Rule.
- Predict the oxidation states of main group elements.
- Assign the correct IUPAC name to the organic compounds and write the structure from their IUPAC name.
- Identify the hybridization of carbon in the given molecule.
- Write the mechanism using fundamental concepts of writing mechanism.
- Understand the advanced concepts in stereochemistry using the fundamental chemistry.
- ✓

#### **Course Content**

UNIT	Description	Lectures
<b>I</b> (Physical Chemistry)	<b>1.1 Ionic Equilibria:</b> Strong and weak electrolytes, Degree of ionization, factors affecting degree of ionization, Ionization constant and Ionic product of water, Ionization of weak acids and bases,	<b>2</b>
	<b>1.2 Chemical Calculations:</b> Methods of expressing concentration of solutions: Normality, Molarity, Molality, Mole fractions, ppm, ppb. Preparation of solutions (Dilution). (Numerical problems expected wherever necessary)	<b>2</b>
	<b>1.3 Chemical Kinetics:</b> Rate of reaction, rate constant, measurement of reaction rates, order and molecularity of reaction, Integrated rate equation of first order and Second order reactions (with equal initial concentration of reactants) . Determination of order of reaction by a) Integration method b) Graphical method c) Ostwald's isolation method d) Half time method (Numerical problems expected wherever necessary)	<b>6</b>
	<b><u>References:</u></b> 1. Atkins, P.W. and Julio de Paulo, Atkins'' Physical Chemistry, Oxford University Press, UK, Indian Edition 9, 2011. 2. Samuel Glasstone, Thermodynamic for chemist, East West Press Pvt.Ltd, Edition 3, (1947) ISBN: 9788176710145 3. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007). 4. Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004). 5. K.L. Kapoor A textbook of Physical Chemistry 3rd Ed. vol.1,2Macmillan Publishing Co., NewDelhi(2001) 6. Vogel''s Textbook of Quantitative Chemical Analysis, 5 <sup>th</sup> edition, John Wiley Publication, 1989.	

UNIT	Description	Lectures
<b>II</b> (Inorganic Chemistry)	<b>Introduction to Inorganic Chemistry</b> <b>1.1 Atomic structure (6L)</b> <b>1.1.1 Historical perspectives of the atomic structure:</b> <b>J. J. Thomson Model,</b> Rutherford's Atomic Model- alpha particle scattering experiment, Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Structure of hydrogen atom. <b>1.1.2 Hydrogenic atoms:</b> 1. Simple principles of Quantum Mechanics 2. Atomic orbitals i) Shells, subshells and orbitals ii) Electron spin iii) Radial shapes of orbitals iv) Hydrogenic Energy Levels v) Angular shapes of orbitals. vi) Aufbau principle, vii) Hund's rule of maximum multiplicity and viii) Pauli exclusion principle	<b>10</b>
	<b>2.1 Periodic Table and periodicity (4L)</b> <b>2.1.1 Long form of Periodic Table:</b> <b>Classification :</b> 2.1.1.1 Main Group, 2.1.1.2 Zero Group Elements 2.1.1.3 Transition Elements and 2.1.1.4 Inner transition elements. <b>2.1.2 Periodicity in the following properties:</b> 2.1.2.1 Atomic and ionic size, 2.1.2.2 Electron gain enthalpy, 2.1.2.3 Ionization enthalpy, 2.1.2.4 Effective nuclear charge (Slater's rule), 2.1.2.5 Electronegativity, Pauling and 2.1.2.6 Mullikan methods (Numerical problems expected, wherever applicable).	
<b>Module -III</b> <b>3.1</b>  <b>3.2</b>	<b>Organic Chemistry</b> <b>3.1 Classification and Nomenclature of Organic Compounds: (5L)</b> <b>Nomenclature of mono and bi-functional aliphatic compounds on the basis of priority order of the following classes of compounds:</b> Alkanes, alkenes, alkynes, haloalkanes, alcohols, ethers, aldehydes, ketones, carboxylic acids. <b>3.2 Stereochemistry: (5L)</b> Projection formulae: Flying Wedge projection, Fischer Projection, Newman and Sawhorse Projection formulae (erythro, threo isomers of tartaric acid and 2,3 - dichlorobutane) and their interconversions; <b>Geometrical isomerism in alkene:</b> cis- trans and syn-anti isomerism R/S nomenclature, E/Z notations with C.I.P rules. <b>Conformational analysis of alkanes</b> (ethane, and n-butane); Relative stability with energy profile diagrams.	

**(Reference Book:**

1. Concise Graduate Chemistry – I, II, III & IV, University Text Book of Chemistry, University of Mumbai.
2. Morrison, R. T. and Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt Ltd.(Pearson Education).2012
3. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
4. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
5. Eliel, E. L. and Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994
6. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.
7. Mc Murry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013
8. Paula Y Bruice, Organic Chemistry, 7th Ed, Pearson education, Asia.2014
9. Bahl and Bahl, Advanced Organic chemistry by S. Chand publication.2010
10. Peter Sykes. Guidebook to the mechanism in Organic chemistry ,6 th edition
11. D. Nasipuri.Stereochemistry of Organic Compounds,Principles and Applications, Second Edition.

**Total = 30**

## EXAMINATION PATTERN FOR MAJOR SUBJECTS

### A) Continuous Internal Assessment (40 Marks):

Sr. No.	Particulars	Marks
1	One Assignment.	05
2	One offline class test.	10
3	Active participation in routine class/practical's.	05
	Overall conduct as a responsible learner, mannerism and articulation and exhibit of leadership qualities in organizing related academic activities	
	<b>Total</b>	<b>20</b>

### B) Semester End Examination (30 Marks):

#### Question Paper Pattern

- These examinations shall be of **one hours** duration. Maximum marks **30**.
- There shall be four questions each of **10 marks**. **Question 1** will be based on entire syllabus with **Eight MCQs**, **Seven questions** on match the column and **Seven questions** based on **true/false**. **Questions 2 and 3** will be based on **Unit-I and Unit II respectively**. **Questions 4** will be based on **Unit- I and II**.
- All questions shall be compulsory with internal choice of any **Three out of six** within the questions. (Each question will be of **20 to 24 marks** with options.)
- Question may be subdivided into sub-questions A, B, C, D & E the allocation of marks depends on the weight age of the topic.

#### Distribution of external 60 marks

Qn.	Sub-on	Particulars	Unit	Marks with options	Total Marks for qn
1	A	Choose the Correct answer and rewrite the statement. <b>(Attempt any four out of six)</b>	<b>I, II,III</b>	06	<b>10</b>
	B	Match the Columns.		03	
	C	State whether the statement is true or false		03	
2	A,B,C,D	Answer the following <b>(Attempt any two out of four)</b>	<b>I, III</b>	20	<b>10</b>
3	A,B,C, D	Answer the following <b>(Attempt any two out of four)</b>	<b>I, II</b>	20	<b>10</b>
		<b>Total</b>		<b>52</b>	<b>30</b>

### C) Semester End Practical Examination (50 marks):

#### Scheme of examination:

- There will be no internal assessment for practical.
- A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination of the semester or a certificate from the Head of the Department/Institute to the effect that the candidate has completed the practical course of that semester of F.Y.B.Sc. Chemistry as per the minimum requirement
- The practical examination will be conducted in **ONE SESSIONS** of three hours each.
- The learners will be evaluated based on the experiments performed during the examination.
- The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for the skill and understanding of Chemistry.

### Examination Pattern Distribution of Marks in Practical Examination

<b>Sr. No.</b>	<b>Particulars</b>	<b>Marks</b>
1	Experiment	30
	Viva voce	10
2	Certified journal	10
	<b>Total Marks</b>	<b>50</b>

## SEMESTER-I

### Course Title: BASIC CHEMISTRY PRACTICAL-1

#### Course Code: S102CHP

#### **M3CHP1: Chemistry Practical 1**

##### **Physical Chemistry**

To prepare 0.1 N succinic acid and standardize the NaOH solution of different concentrations.

To standardize Sodium thiosulphate solution.

To determine the rate constant for the hydrolysis of ester using HCl as catalyst.

Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature (Any two solutions).

##### **Inorganic Chemistry**

###### **Volumetric analysis**

To determine the strength of commercial acid sample (HCl).

To estimate the content of  $\text{Na}_2\text{CO}_3$  and  $\text{NaHCO}_3$  in the given sample using double indicator.

Gravimetric analysis

To determine the percent purity of sample of  $\text{BaSO}_4$  containing  $\text{NH}_4\text{Cl}$

To determine the percent purity of ZnO containing  $\text{ZnCO}_3$ .

##### **Organic Chemistry**

Purification of organic compounds by recrystallization selecting suitable solvent (minimum 2 Organic compounds to be given)

(Students are expected to report a) Solvent for recrystallization. b) Percentage Yield and the melting points of the purified compound.)

Basic principles involved in characterization of Organic compound (minimum 4 Solid Organic compounds)

(Students should perform Preliminary Tests, Solubility Test, obtain melting point and recrystallize the compound with given solvent)

## Examination Pattern

### A) Semester End Practical Examination (50 marks):

#### Scheme of examination:

- There will be no internal assessment for practical.
- A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination of the semester or a certificate from the Head of the Department/Institute to the effect that the candidate has completed the practical course of that semester of F.Y.B.Sc. Chemistry as per the minimum requirement
- The practical examination will be conducted in **ONE SESSIONS** of three hours each.
- The learners will be evaluated based on the experiments performed during the examination.
- The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for the skill and understanding of Chemistry.

#### Distribution of Marks in Practical Examination

Sr. No.	Particulars	Marks
1	Experiment	30
	Viva voce	10
2	Certified journal	10
	<b>Total Marks</b>	<b>50</b>





**S. Z. S. P. Mandal's**  
**SHRI PANCHAM KHEMRAJ MAHA VIDYALAYA**  
**SAWANTWADI**  
DIST: SINDHUDURG- 416 510, MAHARASHTRA

**Syllabus for Approval**  
**Programme:- F. Y. B. Sc. Chemistry**  
**Vocational Skill Course [CHVS 01]**  
**SEMESTER-I**  
**w.e.f. Academic Year 2024-25**

**Choice Based Credit System F.Y.B. Sc. Chemistry Syllabus**



# University of Mumbai

S. Z. S. P. Mandal's

**SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA  
SAWANTWADI**

**(An Autonomous College)**

DIST: SINDHUDURG- 416 510, MAHARASHTRA

**DEPARTMENT OF CHEMISTRY**

Syllabus for Approval

Sr. No.	Heading	Particulars
1.	Title of the Course	F. Y. B. Sc.
2.	Eligibility for Admission	12 <sup>th</sup> Science of all recognized Board
3.	Passing Marks	40%
4.	Ordinance/Regulations (if any)	
5.	No. of Years/Semesters	One Semesters
6.	Level	UG
7.	Pattern	Semester (60:40)
8.	Status	Revised
9.	To be implemented from Academic Year	From Academic Year 2023-2024

Date:

Signature  
HoD,  
Dept. of Chemistry

**Shri Pancham Khemraj Mahavidyalaya, Sawantwadi**  
Proposed First Year Curriculum as per NEP 2020  
**Department of Chemistry**  
**Structure for Vocational Skill Course**

Semester	Paper Code	Paper Title	Type	Credits/Hr
I	VSCHE 01	Experimental Chemistry	Practical	2/60Hr

**Vocational Skill Course:  
Experimental Chemistry  
Semester – I**

Unit	Description	Hours
<b>II</b> <b>(Practical Component)</b>	<p><b>2.1 Calibration of Laboratory Glassware</b></p> <ol style="list-style-type: none"> <li>1. Calibration of Burette</li> <li>2. Calibration of Pipette</li> <li>3. Calibration of Standard Measuring Flask</li> <li>4. Calibration of Thermometer (Demonstration)</li> </ol> <p><b>2.2 Calibration of Laboratory Instruments</b></p> <ol style="list-style-type: none"> <li>1. Calibration of pH meter</li> <li>2. Calibration of Conductometer</li> <li>3. Calibration of Colorimeter</li> <li>4. Calibration of Potentiometer (Demonstration)</li> </ol>	<b>60</b>
	<p><b>2.2 Standardization of Different Solution</b></p> <ol style="list-style-type: none"> <li>1. NaOH</li> <li>2. EDTA</li> <li>3. KMnO<sub>4</sub></li> </ol> <p><b>2.3 Organic Preparation</b></p> <ol style="list-style-type: none"> <li>1. Preparation of Acetanilide</li> <li>2. Oxidation of aldehyde</li> <li>3. Preparation of Hydrazone derivative of Aldehyde</li> </ol> <p><b>2.4 Volumetric Estimation</b></p> <ol style="list-style-type: none"> <li>1. Estimation of Magnesium</li> <li>2. Determination of SAP Value</li> </ol>	

**Minimum 80 percent of practical must be completed in each term**

## Examination Pattern

### B) Semester End Practical Examination (50 marks):

#### Scheme of examination:

- There will be no internal assessment for practical.
- A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination of the semester or a certificate from the Head of the Department/Institute to the effect that the candidate has completed the practical course of that semester of F.Y.B.Sc. Chemistry as per the minimum requirement
- The practical examination will be conducted in **ONE SESSIONS** of three hours each.
- The learners will be evaluated based on the experiments performed during the examination.
- The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for the skill and understanding of Chemistry.

#### Distribution of Marks in Practical Examination

Sr. No.	Particulars	Marks
1	Experiment	30
	Viva voce	10
2	Certified journal	10
	<b>Total Marks</b>	<b>50</b>

AC ITEM NO. :AC



S. Z. S. P. Mandal's

**SHRI PANCHAM KHEMRAJ MAHA VIDYALAYA SAWANTWADI**

DIST: SINDHUDURG- 416 510, MAHARASHTRA

**SKILL ENHANCEMENT COURSE (SEC)**

**SEMESTER-I**

**Syllabus for Approval**

**Programme:- F. Y. B. Sc. Chemistry**

**w.e.f. Academic Year 2024-25**

**Choice Based Credit System F. Y. B. Sc. Chemistry Syllabus**

**OBJECTIVES:**

- To help learners in developing a scientific attitude through the Chemistry curriculum that involves basic and core areas of Chemistry along with the recent scientific and technological advancements in applied areas of Chemistry
- To enhance knowledge of Chemistry through problem solving, tutorials and seminars
- To develop practical skills in Chemistry using a range of activities such as projects in experimental Chemistry, study tours, industrial and research institutes visit.
- To inculcate a research attitude by involving learners in simple research projects review of research articles/papers, participation in scientific events etc.
- To help learners in developing analytical abilities and skills so as to address real world problems
- To help learners to plan a progressive and successful career in Chemistry, education and industry

**Program Outcome:** After successful completion of this programme learners will be able to

- Develop the knowledge of basic concepts of different branches of science required for postgraduate studies.
- Inculcate the skills useful in science laboratories for pursuing jobs in Industries.
- Introduce learners to the concepts useful for environment protection.
- Follow interdisciplinary approach for developing scientific temperament.
- Identify, formulate and analyze scientific problems and reach concrete solutions for societal benefits.

**Program Specific Outcome:** After successful completion of this programme (Chemistry) learners are able to

- Develop the knowledge of basic concepts in chemistry.
- Inculcate the skills useful in chemistry laboratory.
- Introduce learners to the green chemistry needs and concepts.
- Identify, formulate and analyze scientific problems and reach concrete solutions for societal benefits using various principles of chemical sciences.
- Acquire & explore essential skills to succeed in various chemical industries.
- Get a hold on higher educational opportunities like post-graduation in chemistry.
- Pursue higher studies in interdisciplinary areas such as biochemistry, genetics, pathology etc.
- Explore research areas in chemistry and related fields.



**Structure of the Course:**

The structure of Skill Enhancement Course (SEC) for **Semester I and II** for F.Y.B.Sc. (Chemistry) NEP-2020 is given below:

**SKILL ENHANCEMENT COURSE (SEC)**

<b>Semester</b>	<b>Course Code</b>	<b>Course Title</b>	<b>No of Credits</b>	<b>No of Lectures in Hours</b>
<b>I</b>	<b>SECHE 01</b>	Industrial Chemistry -I : Qualitative Analysis and Chemical Handling	02	30

**SEMESTER-I****SKILL ENHANCEMENT COURSES (SEC)-1**

**Course Title: Industrial Chemistry-I: Qualitative Analysis**

**Course Code: SECHE 01**

**Course Objectives:**

1. To understand basic principles involved in quantitative and qualitative analysis.
2. To differentiate between organic and inorganic compounds.
3. To analyze various organic and inorganic compounds.
4. To categorize compounds into groups.

**Course Outcome:** On successful completion of this course students will be able to:

1. Understand the basic concepts involved in quantitative and qualitative analysis.
2. Students will be able to understand the principles of titrimetric analysis.
3. Predict the chemical type, elements and functional groups of organic compounds.

**Practical in Skill Enhancement Course**  
**Practical's in Qualitative Analysis**  
**Number of Credit: 02**

Unit	Description of experiments	Lectures in hours
<b>I</b>	<p><b>1.1 TITRIMETRIC ANALYSIS</b></p> <ol style="list-style-type: none"> <li>1. To determine chemical oxygen demand of the industrial waste water.</li> <li>2. To estimate the amount of magnesium in talcum powder by complexometric analysis.</li> <li>3. To determine the amount of copper in s given sample by iodometric titration.</li> </ol> <p><b>1.2 GRAVIMETRIC ANALYSIS</b></p> <ol style="list-style-type: none"> <li>1. To determine the amount of iron in by gravimetric analysis.</li> <li>2. To determine the percentage purity of sodium carbonate in a mixture of sodium carbonate and sodium bicarbonate.</li> </ol>	<b>60 L</b>
	<b>1.2 Chemical Handling &amp; Safety Measures</b>	
	<ol style="list-style-type: none"> <li>1. Handling of acids and bases</li> <li>2. Handling of instruments</li> <li>3. Preparation of solutions based on different units of concentration</li> <li>4. Calibrations of Apparatus</li> </ol>	
	<b>1.3 Organic Preparation</b>	
	<ol style="list-style-type: none"> <li>1. Preparation of Phthalic Anhydride</li> <li>2. Preparation of Methyl Salicylate</li> </ol>	
	<b>1.4 Preparation of Buffer solutions and determination of their pH</b>	
	<p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. College Inorganic Chemistry, Himalaya Publishing House</li> <li>2. Concepts in Inorganic Chemistry, Chetana Publications Pvt. Ltd.</li> <li>3. Vogel's Textbook of Practical Organic Chemistry, Fifth Edition, B. S. Furniss.</li> </ol>	

## Examination Pattern

### Distribution of Marks in SEC Practical Examination

<b>Sr. No.</b>	<b>Particulars</b>	<b>Marks</b>
1	Experiment	30
	Viva voce	10
2	Certified journal	10
	<b>Total Marks</b>	<b>50</b>



**S. Z. S. P. Mandal's**  
**SHRI PANCHAM KHEMRAJ MAHA VIDYALAYA**  
**SAWANTWADI**  
DIST: SINDHUDURG- 416 510, MAHARASHTRA

**Syllabus for Approval**

**Programme:- F. Y. B. Sc. Chemistry**

**INDIAN KNOWLEDGE SYSTEM (IKS)**

**ALCHEMY-Chemistry of Ancient India [CHIK-01]**

**w.e.f. Academic Year 2024-25**

**Choice Based Credit System F.Y.B.Sc. Chemistry Syllabus**



# University of Mumbai

S. Z. S. P. Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA

SAWANTWADI

(An Autonomous College)

DIST: SINDHUDURG- 416 510, MAHARASHTRA

DEPARTMENT OF CHEMISTRY

Syllabus for Approval

Sr. No.	Heading	Particulars
1.	Title of the Course	F. Y. B. Sc.
2.	Eligibility for Admission	12 <sup>th</sup> Science of all recognized Board
3.	Passing Marks	40%
4.	Ordinance/Regulations (if any)	
5.	No. of Years/Semesters	One Semesters
6.	Level	UG
7.	Pattern	Semester
8.	Status	Revised
9.	To be implemented from Academic Year	From Academic Year 2024-2025

Date:

Signature  
HoD,  
Dept. of Chemistry

**Shri Pancham Khemraj Mahavidyalaya, Sawantwadi**  
Proposed First Year Curriculum as per NEP 2020  
**Department of Chemistry**  
**Structure for Indian Knowledge System**

Semester	Paper Code	Course Title	Unit	Topics	Credits	No. of Lectures
II	CHIK-01	ALCHEMY- Chemistry of Ancient India	1	Introduction and history	2	30
			2	Physico –Chemical Concepts In Ayurveda		
			3	Equipment"s Used In Ancient Chemistry		

**Course Outcomes:**

India has a very ancient tradition of chemistry. In ancient India, chemistry was called “Rasayana” in Sanskrit, the language in vogue. Rasayana derived its name from “Rasa,” which means “extract,” maybe from roots, leaves, and stems of plants. In ancient text, amazing information are available on metals, ores, their quarries, compound and alloys. There are also details of hundreds of devices used in chemical experiments in “Rasayan Shastra” which we call „Chemistry“. There have been many chemists in the past, the creations of some of them are as – Nagarjuna , Vagbhatt, Govindacharya, Somdev etc. In any early civilization, metallurgy has remained an activity from the Bronze Age and the Iron Age, to all other civilizations that followed.

**Course Objectives:** To provide the learner with knowledge Benefits of Rasayana, Material and Process with respect to the types of formulations, evaluation and regulatory aspects.

**Course Outcome:** Upon completion of the course, the learner shall be able to:

1. Discuss the various raw materials for Rasyana.
2. Understand the toxicological aspects.
3. Discuss the various physico –chemical concepts in Ayurveda products w.r.t. raw materials, functional and physiochemical evaluation.
4. Alchemy is a fundamental part of the heritage chemistry of continuing human attempt to explore, control, and make use of the natural world.

**SEMESTER- I**  
**INDIAN KNOWLEDGE SYSTEM (IKS)**  
**ALCHEMY- Chemistry of Ancient India: CHIK-01 (Credit-02)**

UNIT	Syllabus	No. of Hours
1	<p>ALCHEMY –Introduction and history</p> <p><b>Rasayana-</b> Benefits of Rasayana, Material And Process,</p> <p>➤ History and details of Suvarna bhasma (Gold), Raupya bhasma (Silver), Tamra Bhasma (Copper), Naga bhasma (Lead).</p>	<b>10</b>
2	<p>PHYSICO –CHEMICAL CONCEPTS IN AYURVEDA</p> <p>Starting of Cosmic evolution, Evolution of matter, molecular and atomic motion, heat and application of force.</p>	<b>10</b>
3	<p>EQUIPMENTS USED IN ANCIENT CHEMISTRY</p> <p>Musa(crucible), Patala Kosthika (Under Ground Oven), Maha Puta (Underground Cooking Metal), Bhandra Puta (Oven), Urdhva Patana Yantra ( Apparatus for sublimation), Tiryak Patana Yantra (Distillation Assembly)</p>	<b>10</b>

### Scheme of Examination

**A) Internal Assessment:**

<b>Sr. No.</b>	<b>Particulars</b>	<b>Marks</b>
1	One assignment/test/Seminar/Presentation	10
2	Class attendance	05
3	Subject based activity	05
<b>Total Marks</b>		20

**B) External Assessment:**

<b>Sr. No.</b>	<b>Particulars</b>	<b>Marks</b>
1	EXTERNAL	30





S. Z. S. P. Mandal's  
**SHRI PANCHAM KHEMRAJ  
MAHAVIDYALAYASAWANTWADI  
(AUTONOMOUS)**  
DIST: SINDHUDURG- 416 510, MAHARASHTRA

**Syllabus for Approval**  
**Programme:- F. Y. B. Sc. Chemistry**  
**VALUE EDUCATION COURSE**  
**w.e.f. Academic Year 2024-25**

**Choice Based Credit System S. Y. B. Sc. Chemistry Syllabus**



# University of Mumbai

S. Z. S. P. Mandal's

**SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA  
SAWANTWADI**

**(An Autonomous College)**

DIST: SINDHUDURG- 416 510, MAHARASHTRA

**DEPARTMENT OF CHEMISTRY**

Syllabus for Approval

Sr. No.	Heading	Particulars
1.	Title of the Course	S. Y. B. Sc.
2.	Eligibility for Admission	F. Y. B. Sc.
3.	Passing Marks	40%
4.	Ordinance/Regulations (if any)	
5.	No. of Years/Semesters	Two Semesters
6.	Level	UG
7.	Pattern	Semester (60:40)
8.	Status	Revised
9.	To be implemented from Academic Year	From Academic Year 2024-2025

Date:

Signature  
HoD,  
Dept. of Chemistry

**Shri Pancham Khemraj Mahavidyalaya, Sawantwadi**  
Proposed First Year Curriculum as per NEP 2020  
**Department of Chemistry**  
**Syllabus Structure for Value Education Course**

<b>Semester</b>	<b>Paper Code</b>	<b>Paper Title</b>	<b>Type</b>	<b>Credits</b>
<b>I</b>	<b>CHVE-01</b>	Environmental Impacts of Volatile Oxides	<b>T</b>	<b>2</b>

**Program Outcomes:**

Students will demonstrate an understand major concepts of Environment in association with multidisciplinary subjects such as physics, chemistry and mathematics etc. Understood the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevance in the day-to-day life. Effective Communication- Development of various communication skills such as reading, listening, speaking, etc., which we will help in expressing ideas and views clearly and effectively. Social Interaction- Development of scientific outlook not only with respect to science subjects but also in all aspects related to life. Effective Citizenship- Imbibe moral and social values in personal and social life leading to highly cultured and civilized personality. Ethics- Follow the ethical principles and responsibilities to serve the society. Environment and Sustainability- Understand the issues of environmental contexts and sustainable development. Self-directed and Lifelong learning- Students will be capable of self- paced and self-directed learning aimed at personal development and for improving knowledge/skill development.

**COURSE OBJECTIVES:**

- To study about environment and ecosystems
- To study about different types of natural resource.
- Knowledge and concept of biodiversity and its conservation.
- Basic knowledge and concept of causes, effect and control of different type of environmental pollution.
- To study population growth and its impact on environment

**COURSE OUTCOMES (CO):** After completion of the course, a student will be able to COURSE OUTCOME :

C01 - Gain knowledge about environment and ecosystem.

C02 - Students will learn about natural resource, its importance and environmental impacts of human activities on natural resource.

C03-Gain knowledge about the conservation of biodiversity and its importance.

C04 Aware students about problems of environmental pollution, its impact on human and ecosystem and control measures.

C05- Students will learn about increase in population growth and its impact on environment

**SEMESTER-I: VALUE EDUCATION COURSE**  
**Environmental Impacts of Volatile Oxides: CHVE-01**  
**(Credit 02) [30 L]**

<b>CHVE-01</b>	<p>Introduction</p> <p>Environmental Impact of -</p> <ol style="list-style-type: none"> <li>1) Oxides of Carbon</li> <li>2) Oxides of Nitrogen</li> <li>3) Oxides of Sulphur</li> <li>4) Oxides of Phosphorous</li> </ol>
	<p><b>References:</b></p> <ol style="list-style-type: none"> <li>1) Environmental Science, A. K. De, New Age International Publication .</li> <li>2) E. Stocchi: <i>Industrial Chemistry</i>, Vol -I, Ellis Horwood Ltd. UK.</li> <li>2) P.C. Jain, M. Jain: <i>Engineering Chemistry</i>, Dhanpat Rai &amp; Sons, Delhi.</li> <li>3) Sharma, B.K. &amp; Gaur, H. <i>Industrial Chemistry</i>, Goel Publishing House, Meerut (1996).</li> </ol>

**Scheme of Examination**

**A) Internal Assessment:**

Sr. No.	Particulars	Marks
1	One assignment/test/Seminar/Presentation	10
2	Class attendance	05
3	Subject based activity	05
<b>Total Marks</b>		20

**B) External Assessment:**

Sr. No.	Particulars	Marks
1	EXTERNAL	30

# As per NEP 2020



S. Z. S. P. Mandal's  
Shri Pancham Khemraj Mahavidyalaya,  
Sawantwadi-416510  
(Autonomous)  
Affiliated to University of Mumbai



## Title of the Programme Science

B.Sc. (Chemistry)

1. F.Y.B.Sc.	2024-2025
2. S.Y.B.Sc.	2025-2026
3. T.Y.B.Sc.	2026-2027

## Syllabus for Semester- II

Reference : GR dated 16<sup>th</sup> May 2023 for Credit structure

Sr. No.	Headings	Perticulars
1	Title of the Program	<b>Science- Chemistry</b>
2	Eligibility	H.S.C. with Science Stream
3	Duration of the Programme	1- Certificate 2- Diploma 3- Degree 4- Research Degree
4	Scheme of Examination	30 External : 20 Internal Separate passing in External and Internal examination
5	Standard of Passing	40.00%
6	Programme Academic Level	4.5 Certificate 5.0 Diploma 5.5 Advance Diploma 6.0 Research Degree
7	Pattern	Semester Pattern
8	Status	New
9	To Be Implemented from the academic year	4.5 Certificate <b>2024-2025</b> 5.0 Diploma <b>2025-2026</b> 5.5 Degree <b>2026-2027</b>

## Preamble

### 1. Introduction

Shri Pancham Khemraj Mahavidyalaya (S.P.K.M.), Sawantwadi (Autonomous) believes in implementing several measures to bring equity, efficiency and excellence in higher education system in conformity to the guidelines laid down by the University Grants Commission (UGC). In order to achieve these goals, all efforts are made to ensure high standards of education by implementing several steps to enhance the teaching- learning process, examination and evaluation techniques and ensuring the all-round development of learners.

The four-year course in B.Sc. Chemistry has been designed to have a progressive and innovative curriculum in order to equip our learners to face the future challenges in the field of higher education. In semesters I and II learners are introduced to the basic areas of Chemistry such as Thermodynamics, Periodic table, Chemical Kinetics, Reaction and Mechanism.

In semesters III and IV the course content is made more rigorous by introducing the details of each of the above area. In semesters V and VI, course are designed to help in specialization in the core areas of Chemistry such as Molecular spectroscopy, Nuclear Chemistry, Chemical thermodynamics, Chemical kinetics, Molecular Symmetry and Chemical Bonding, Solid state Chemistry, Electrochemistry polymers, Quantum chemistry with Renewable energy resources Chemistry of inner transition elements, Theories of the metal-ligand bond, Organometallic chemistry, Mechanism of organic reactions , Stereochemistry, Synthesis of organic compounds, Quality in Analytical Chemistry, Chemical Calculations, Optical Methods, Electro analytical techniques and Applied components dyes and drugs. The practical course has been designed to help the student have a firm grip on the theoretical concepts through relevant experiments in each course.

### 2. Objectives:

- To help learners in developing a scientific attitude through the Chemistry curriculum that involves basic and core areas of Chemistry along with the recent scientific and technological advancements in applied areas of Chemistry
- To enhance knowledge of Chemistry through problem solving, tutorials and seminars
- To develop practical skills in Chemistry using a range of activities such as projects in experimental Chemistry, study tours, industrial and research institutes visit.
- To inculcate a research attitude by involving learners in simple research projects review of research articles/papers, participation in scientific events etc.
- To help learners in developing analytical abilities and skills so as to address real world problems
- To help learners to plan a progressive and successful career in Chemistry, education and industry



3. **Program Outcome:** After successful completion of this programme learners will be able to

- Develop the knowledge of basic concepts of different branches of science required for postgraduate studies.
- Inculcate the skills useful in science laboratories for pursuing jobs in Industries.
- Introduce learners to the concepts useful for environment protection.
- Follow interdisciplinary approach for developing scientific temperament.
- Identify, formulate and analyze scientific problems and reach concrete solutions for societal benefits.

**Program Specific Outcome:** After successful completion of this programme (Chemistry)

learners are able to

- Develop the knowledge of basic concepts in chemistry.
- Inculcate the skills useful in chemistry laboratory.
- Introduce learners to the green chemistry needs and concepts.
- Identify, formulate and analyze scientific problems and reach concrete solutions for societal benefits using various principles of chemical sciences.

**Expected Outcome**

- Acquire & explore essential skills to succeed in various chemical industries.
- Get a hold on higher educational opportunities like post-graduation in chemistry.
- Pursue higher studies in interdisciplinary areas such as biochemistry, genetics, pathology etc.
- Explore research areas in chemistry and related fields.

## **SEMESTER-II**

### **COURSE TITLE: - General Chemistry-II**

### **COURSE CODE: S103CHT**

#### **Pre-requisites:**

Knowledge of Chemical Thermodynamics, Gaseous State, Liquid State, Electrochemistry, Molecular Spectroscopy, concepts of qualitative analysis, Acid-Base theories and Chemical bond and reactivity, basic concepts of organic chemistry.

#### **Course Objectives:** To introduce students to

- Understand the direction of reactions and variation of thermodynamic properties.
- Learn about the ideal and real gases and its behaviors.
- Evaluate physical properties of liquid state.
- Understand basic electrochemistry and its applications in the electrolytic solutions
- Determine equilibrium constant and to predict direction of chemical reactions.
- Systematic and coherent understanding of the fundamental concepts of qualitative analysis.
- Importance of reagent papers for testing the radicals.
- Understand the various theories of Acids and Bases.
- Concepts of Chemistry of Aliphatic Hydrocarbons.
- Comparison between Aliphatic and Aromatic compounds.
- Important characteristics of organic compounds.
- Concepts of projection formulae and inter-conversion.

#### **Desired Outcomes:** After the completion of this course, learners will be able to:

- Understand the ideal and non-ideal behavior of gaseous reactions.
- Differentiate various thermodynamic properties and its applications.
- Evaluate different thermodynamic parameters by heat of reaction data.
- Compare the weak and strong electrolytes based on conductance measurement
- Determine the thermodynamic properties and its variations with temperature and pressure.
- Determine the conductance of solutions and its applications.
- Differentiate the various spectroscopic techniques.
- Understand the basic theories of Acids and Bases.
- Students will be able to understand the concept of common ion effect.
- Comparison between ionic and covalent bonds.
- Classify compounds into aromatic, non –aromatic and anti aromatic.
- Predict the correct method of preparation of alkenes, alkynes.
- Identify the product and complete the reaction of alkenes and alkynes.
- Carry out inter-conversion of projection formulae.

<b>Module I</b>	<b>Physical Chemistry</b>
<b>1.1</b>	<b>Liquid State - II: (2L)</b> <b>Surface tension:</b> Introduction, methods of determination of surface tension by Drop number method (Numericals expected)
<b>1.2</b>	<b>Gaseous State (3L)</b> Kinetic theory of gases, Maxwell-Boltzmann's distribution of velocities (Qualitative discussion), Ideal gas laws, Deviation from ideal gas laws, Ideal and real gases, Reasons for deviation from ideal gas laws, Compressibility factor, Boyle's temperature, van der Waals equation of state (Derivation). (Numericals expected)
<b>1.3</b>	<b>Electrochemistry (2L)</b> Conductance, specific conductance, equivalent conductance, molar conductance, Variation of molar conductance with concentration of strong and weak electrolyte. (Numericals expected)
<b>1.4</b>	<b>Chemical Thermodynamics (3L)</b> <b>Thermodynamic Terms:</b> System, surrounding, boundaries, types of system, Intensive and Extensive properties, Thermodynamic processes. <b>First law of thermodynamics:</b> Concept of heat (q), work (w), internal energy (U), enthalpy, heat capacity, relation between heat capacities, sign conventions, calculations of heat, work, internal energy and enthalpy (H) (Numerical problems expected)
<b>Module II</b>	<b>Inorganic Chemistry</b>
<b>2.1</b>	<b>Concept of Qualitative Analysis: (5L)</b> Testing of Gaseous Evolutes, Role of Papers impregnated with Reagents in qualitative analysis (with reference to papers impregnated with starch iodide, potassium dichromate, lead acetate, dimethylglyoxime and oxine reagents). Precipitation equilibria, Formation of precipitates like AgCl, AgBr, AgI and BaSO <sub>4</sub> effect of common ions, uncommon ions, oxidation states, buffer action.
<b>2.2</b>	<b>Chemical Bond and Reactivity: (5 L)</b> 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, applications and limitations of VSEPR theory.
<b>Module III</b>	<b>Organic Chemistry</b>
<b>3.1</b>	<b>Fundamentals of Organic Reaction Mechanism: (5L)</b> <b>Basic terms and concepts:</b> Homolytic and Heterolytic fission with curly arrows with suitable examples. Electrophiles and Nucleophiles. <b>Types (primary, secondary, tertiary, allyl, benzyl), shape and their relative stability of the following reactive intermediates:</b> i. Carbocations ii. Carbanions and iii. Free radicals <b>Introduction to types of organic reactions:</b> Addition, Elimination and Substitution reaction. (With one example of each)
<b>3.2</b>	<b>Bonding and Structure of Organic Compounds: (5L)</b> <b>Hybridization:</b> sp <sup>3</sup> , sp <sup>2</sup> , sp hybridization of carbon and nitrogen; sp <sup>3</sup> and sp <sup>2</sup> hybridizations of oxygen in Organic compounds (alcohol, ether, aldehyde, ketone, carboxylic acid, ester, cyanide, amine and amide) <b>Overlap of atomic orbitals:</b> Overlaps of atomic orbitals to form sigma and pi bonds, shapes of organic molecules. <b>Shapes of molecules:</b> Influence of hybridization on bond properties (as applicable to ethane, ethene, ethyne).

## Semester II Practical M3 S104 CHP: Chemistry Practical-II

### Physical Chemistry

To determine the amount of strong acid in the given solution by titrating against strong base conductometrically.

To determine the dissociation constant of weak acid ( $K_a$ ) using Henderson's equation and the method of incomplete titration pH metrically.

To determine enthalpy of dissolution of salt ( $KNO_3$ )

To standardize commercial sample of HCl using borax and to write material safety data of the chemicals involved.

### Inorganic Chemistry

#### Qualitative analysis of simple salts: (4 mixtures to be analyzed)

Semi-micro inorganic qualitative analysis of a sample containing two cations and two anions (from amongst):

*Cations (from amongst):*  $Pb^{2+}$ ,  $Ba^{2+}$ ,  $Ca^{2+}$ ,  $Sr^{2+}$ ,  $Mg^{2+}$ ,  $K^+$ ,  $NH_4^+$

*Anions (from amongst):*  $CO_3^{2-}$ ,  $SO_4^{2-}$ ,  $NO_2^-$ ,  $NO_3^-$ ,  $Cl^-$ ,  $Br^-$ ,  $I^-$ ,  $PO_4^{3-}$

(Scheme of analysis should avoid use of sulphide ion in any form for precipitation/ separation of cations.)

Below are the representative mixture combinations, besides these any other combination will also be taken.

Probable mixture combination:

$MgSO_4 + KCl$

$CaCl_2 + KNO_3$

$CaCO_3 + Mg(NO_3)_2$

$BaSO_4 + NH_4Cl$

### Organic Chemistry

**Characterization of organic compounds** containing C, H, (O), N, S, X elements (6 solid/liquid Organic compounds)

(Preliminary Tests, Solubility/Miscibility Test, Detection of Elements, Detection of Functional group and determination of Physical constant)

### Reference Books: Physical Chemistry

Concise Graduate Chemistry – I, II, III & IV, University Text Book of Chemistry, University of Mumbai.

Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 10<sup>th</sup> Ed., Oxford University Press (2014).

Castellan, G. W. Physical Chemistry 4<sup>th</sup> Ed. Narosa (2004).

Keith J. Laidler & John H. Meiser, Physical Chemistry, 2<sup>nd</sup> Ed. (2004)

Puri B. R., Sharma L. R. & Pathania M. S. Principles of Physical Chemistry, Vishal Publishing Company, 2008

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Mortimer, R. G. Physical Chemistry 3<sup>rd</sup> Ed. Elsevier: NOIDA, UP (2009).

Engel, T. & Reid, P. *Physical Chemistry 3<sup>rd</sup> Ed.*, Prentice-Hall (2012).

McQuarrie, D. A. & Simon, J. D. *Molecular Thermodynamics* Viva Books Pvt. Ltd.: New Delhi (2004).

Levine, I. N. *Physical Chemistry* 6<sup>th</sup> Ed., Tata Mc Graw Hill (2010).

Laboratory Experiments in Chemistry I & II, University Practical Book of Chemistry, University of Mumbai.

Athawale, V. D. & Mathur, P. *Experimental Physical Chemistry* New Age International: New Delhi (2001).

Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: New

Delhi (2011).

Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8<sup>th</sup> Ed.*; McGraw-Hill: New York (2003).

Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3<sup>rd</sup> Ed.*; W.H. Freeman & Co.: New York (2003).

### **Inorganic Chemistry**

Concise Graduate Chemistry – I, II, III & IV, University Text Book of Chemistry, University of Mumbai.

Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.

Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry, Oxford, 1970

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Laboratory Experiments in Chemistry I & II, University Practical Book of Chemistry, University of Mumbai.

Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.

Advanced Inorganic Chemistry, 17th Edition, by Satyaprakash, G.D.Tuli and R. D. Madan, 2022.

### **Organic Chemistry**

- 1) Concise Graduate Chemistry – I, II, III & IV, University Text Book of Chemistry, University of Mumbai.
- 2) Morrison, R. T. and Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt Ltd. (Pearson Education). 2012
- 3) Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
- 4) Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt Ltd. (Pearson Education).
- 5) Eliel, E. L. and Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994
- 6) Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.
- 7) Mc Murry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013
- 8) Paula Y Bruice, Organic Chemistry, 7th Ed, Pearson education, Asia. 2014
- 9) Graham Solomon, Fryhle, Snyder, Organic Chemistry, Wiley publication. 12<sup>th</sup> Ed, 2016
- 10) Bahl and Bahl, Advanced Organic chemistry by S. Chand publication. 2010
- 11) Peter Sykes. Guidebook to the mechanism in Organic chemistry, 6th edition
- 12) D. Nasipuri. Stereochemistry of Organic Compounds, Principles and Applications, Second Edition
- 13) Organic Chemistry: A problem solving approach by Lakshmi Ravishankar and Gomathi Shridhar, Narosa Publisher, 2023.
- 14) Laboratory Experiments in Chemistry I & II, University Practical Book of Chemistry, University of Mumbai.
- 15) Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009).
- 16) Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012).
- 17) Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.

## EXAMINATION PATTERN FOR MAJOR SUBJECTS

### A) Continuous Internal Assessment (40 Marks):

Sr. No.	Particulars	Marks
1	One Assignment.	20
2	One offline class test.	10
3	Active participation in routine class/practical"s.	05
4	Overall conduct as a responsible learner, mannerism and articulation and exhibit of leadership qualities in organizing related academic activities	05

### B) Semester End Examination (60 Marks):

#### Question Paper Pattern

1. These examinations shall be of **Two Hours** duration. Maximum marks **60**.
2. There shall be four questions each of **15 marks**. **Question 1** will be based on entire syllabus with **Eight MCQs**, **Seven questions** on match the column and **Seven questions** based on true/false. **Questions 2 and 3** will be based on **Unit-I and Unit II respectively**. **Questions 4** will be based on **Unit- I and II**.
3. All questions shall be compulsory with internal choice of any **Three out of six** within the questions. (Each question will be of **20 to 24 marks** with options.)
4. Question may be subdivided into sub-questions A, B, C, D & E the allocation of marks depends on the weight age of the topic.

#### Distribution of external 60 marks

Qn.	Sub-on	Particulars	Unit	Marks with options	Total Marks for qn
1	A	Choose the Correct answer and rewrite the statement. <b>(Attempt any five out of eight)</b>	I, II	08	15
	B	Match the Columns. <b>(Attempt any five out of seven)</b>		07	
	C	State whether the statement is true or false. <b>(Attempt any five out of seven)</b>		07	
2	A,B,C,D, E, F	Answer the following <b>(Attempt any three out of five)</b>	I	20	15
3	A,B,C, D, E, F	Answer the following <b>(Attempt any three out of five)</b>	I	20	15
4	A,B,C,D, E, F	Answer the following <b>(Attempt any three out of five)</b>	I&II	20	15
		<b>Total</b>		<b>82</b>	<b>60</b>

### C) Semester End Practical Examination (50 marks):

#### Scheme of Examination:

- There will be no internal assessment for practical.
- A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination of the semester or a certificate from the Head of the Department/Institute to the effect that the candidate has completed the practical course of that semester of F.Y.B.Sc. Chemistry as per the minimum requirement
- The practical examination will be conducted in **ONE SESSIONS** of three hours each.
- The learners will be evaluated based on the experiments performed during the examination.
- The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for the skill and understanding of Chemistry.

#### Examination Pattern Distribution of Marks in Practical Examination

Sr. No.	Particulars	Marks
1	Experiment	30
	Viva voce	10
2	Certified journal	10
	<b>Total Marks</b>	<b>50</b>



**S. Z. S. P. Mandal's**  
**SHRI PANCHAM KHEMRAJ MAHA VIDYALAYA**  
**SAWANTWADI**  
DIST: SINDHUDURG- 416 510, MAHARASHTRA

**Syllabus for Approval**  
**Programme:- F. Y. B. Sc. Chemistry**  
**Vocational Skill Course [CHVS02]**  
**SEMESTER-II**  
**w.e.f. Academic Year 2024-25**

**Choice Based Credit System F.Y.B. Sc. Chemistry Syllabus**





# University of Mumbai

S. Z. S. P. Mandal's

**SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA  
SAWANTWADI**

**(An Autonomous College)**

DIST: SINDHUDURG- 416 510, MAHARASHTRA

**DEPARTMENT OF CHEMISTRY**

Syllabus for Approval

Sr. No.	Heading	Particulars
1.	Title of the Course	F. Y. B. Sc.
2.	Eligibility for Admission	12 <sup>th</sup> Science of all recognized Board
3.	Passing Marks	40%
4.	Ordinance/Regulations (if any)	
5.	No. of Years/Semesters	One Semesters
6.	Level	UG
7.	Pattern	Semester (60:40)
8.	Status	Revised
9.	To be implemented from Academic Year	From Academic Year 2024-2025

Date:

Signature  
HoD,  
Dept. of Chemistry

**Shri Pancham Khemraj Mahavidyalaya, Sawantwadi**  
Proposed First Year Curriculum as per NEP 2020  
**Department of Chemistry**  
**Structure for Vocational Skill Course**

Semester	Paper Code	Paper Title	Type	Credits/Hr
<b>II</b>	<b>CHVS02</b>	Experimental Chemistry	<b>Practical</b>	<b>2/60Hr</b>

**Vocational Skill Course:  
Experimental Chemistry  
Semester – II**

Unit	Description	Hours
<b>II (Practical Component)</b>	1. Collection of soil samples (minimum three) from nearby area and determine pH from the same 2. Collection of soil samples (minimum three) from nearby area and determine Conductance from the same 3. Determination of Total hardness of water sample 4. Estimation of Vitamin C (Ascorbic Acid) in lemon squash sample. 5. Estimation of Calcium in milk powder by complexometric titration. 6. Estimation of acetic acid in preservative (Vinegar) potentiometry. 7. Detection of contaminants or adulterants in the following food samples (Any one adulterant) Milk Tea Powder Turmeric powder. Chili Powder  8. Estimation of Cu by Complexometrically 9. Estimation of Zn by Complexometrically  <b>10 Preparation:</b>  i) Preparation of Schiff base ii) Preparation of Aspirin iii) Preparation of Methyl Salicylate	<b>60</b>

**Minimum 80 percent of practical must be completed in each term**

## Examination Pattern

### C) Semester End Practical Examination (50 marks):

#### Scheme of examination:

- There will be no internal assessment for practical.
- A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination of the semester or a certificate from the Head of the Department/Institute to the effect that the candidate has completed the practical course of that semester of F.Y.B.Sc. Chemistry as per the minimum requirement
- The practical examination will be conducted in **ONE SESSIONS** of three hours each.
- The learners will be evaluated based on the experiments performed during the examination.
- The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for the skill and understanding of Chemistry.

#### Distribution of Marks in Practical Examination

Sr. No.	Particulars	Marks
1	Experiment	30
	Viva voce	10
2	Certified journal	10
	<b>Total Marks</b>	<b>50</b>

AC ITEM NO. :AC



S. Z. S. P. Mandal's

**SHRI PANCHAM KHEMRAJ MAHA VIDYALAYA SAWANTWADI**

DIST: SINDHUDURG- 416 510, MAHARASHTRA

**SKILL ENHANCEMENT COURSE (SEC)**

**SEMESTER-I**

**Syllabus for Approval**

**Programme:- F. Y. B. Sc. Chemistry**

**w.e.f. Academic Year 2024-25**

**Choice Based Credit System F. Y. B. Sc. Chemistry Syllabus**

**OBJECTIVES:**

- To help learners in developing a scientific attitude through the Chemistry curriculum that involves basic and core areas of Chemistry along with the recent scientific and technological advancements in applied areas of Chemistry
- To enhance knowledge of Chemistry through problem solving, tutorials and seminars
- To develop practical skills in Chemistry using a range of activities such as projects in experimental Chemistry, study tours, industrial and research institutes visit.
- To inculcate a research attitude by involving learners in simple research projects review of research articles/papers, participation in scientific events etc.
- To help learners in developing analytical abilities and skills so as to address real world problems
- To help learners to plan a progressive and successful career in Chemistry, education and industry

**Program Outcome:** After successful completion of this programme learners will be able to

- Develop the knowledge of basic concepts of different branches of science required for postgraduate studies.
- Inculcate the skills useful in science laboratories for pursuing jobs in Industries.
- Introduce learners to the concepts useful for environment protection.
- Follow interdisciplinary approach for developing scientific temperament.
- Identify, formulate and analyze scientific problems and reach concrete solutions for societal benefits.

**Program Specific Outcome:** After successful completion of this programme (Chemistry) learners are able to

- Develop the knowledge of basic concepts in chemistry.
- Inculcate the skills useful in chemistry laboratory.
- Introduce learners to the green chemistry needs and concepts.
- Identify, formulate and analyze scientific problems and reach concrete solutions for societal benefits using various principles of chemical sciences.
- Acquire & explore essential skills to succeed in various chemical industries.
- Get a hold on higher educational opportunities like post-graduation in chemistry.
- Pursue higher studies in interdisciplinary areas such as biochemistry, genetics, pathology etc.
- Explore research areas in chemistry and related fields.

**Structure of the Course:**

The structure of Skill Enhancement Course (SEC) for **Semester I and II** for F.Y.B.Sc. (Chemistry) NEP-2020 is given below:

**SKILL ENHANCEMENT COURSE (SEC)**

<b>Semester</b>	<b>Course Code</b>	<b>Course Title</b>	<b>No of Credits</b>	<b>No of Lectures in Hours</b>
<b>II</b>	<b>CHSE02</b>	Industrial Chemistry -II : Qualitative Analysis and Chemical Handling	02	30

**SEMESTER-II****SKILL ENHANCEMENT COURSES (SEC)-1**

**Course Title: Industrial Chemistry-I: Qualitative Analysis**

**Course Code: SECHE 01**

**Course Objectives:**

5. To understand basic principles involved in quantitative and qualitative analysis.
6. To differentiate between organic and inorganic compounds.
7. To analyze various organic and inorganic compounds.
8. To categorize compounds into groups.

**Course Outcome:** On successful completion of this course students will be able to:

4. Understand the basic concepts involved in quantitative and qualitative analysis.
5. Students will be able to understand the principles of titrimetric analysis.
6. Predict the chemical type, elements and functional groups of organic compounds.



## Skill Enhancement Course (SEC)

### Semester II: Title of the course

### Data Analysis in Chemistry

Sr. No.	Heading	Particulars
1	<b>Description the Course</b>	The aim of Skill Enhancement Courses (SECs) is to introduce the students with opportunities to develop required skills in Chemistry
2	<b>Vertical</b>	Skill Enhancement Course (SEC)
3	<b>Type</b>	Theory and Practical
4	<b>Credits</b>	2 Credits (1 Credit = 15 Hours for Theory) (1 Credit = 30 Hours for Practical)
5	<b>Hours Allotted</b>	45 Hours
6	<b>Marks Allotted</b>	50 Marks
7	<b>Course Objectives (CO)</b>	
	CO 1	To understand the significance of SI units in Chemistry and their role in standardizing measurements
	CO 2	To recognize the importance of statistical data analysis in Chemistry for drawing meaningful conclusions from experimental data
	CO 3	To apply rounding off techniques and determine significant figures to ensure accuracy and precision in reporting experimental results
	CO 4	To develop skills in selecting and applying appropriate statistical tests for data analysis
8	<b>Course Outcomes (OC)</b>	
		The student will be able to-
	OC 1	Apply SI units correctly for precise measurement and communication of chemical quantities and properties
	OC 2	Conduct statistical data analysis in Chemistry experiments, enabling informed decision-making and drawing reliable conclusions
	OC 3	Select the appropriate statistical test for analysis and interpret the results correctly
<b>Module</b>	<b>Description</b>	<b>Hours</b>

<b>II (Practical Component)</b>	<ol style="list-style-type: none"> <li>1. Determination unknown concentration of <math>\text{KMnO}_4</math> solution by calorimetrically</li> <li>2. Determination of Acid value of Oil</li> <li>3. Standardization of Sodium thiosulphate by using <math>\text{K}_2\text{Cr}_2\text{O}_7</math></li> <li>4. Standardization of EDTA by using <math>\text{ZnSO}_4</math></li> <li>5. Preparation of Bis(Dimethyl glaxomato) Nickel(II) by Green Method.</li> <li>6. Preparation of Succinic Anhydride</li> <li>7. Preparation of Methyl Salicylate</li> <li>8. Preparation of FAS (Mohr's Salt)</li> <li>9. Preparation of Benzoic Acid from Ethyl Benzoate</li> </ol>	<b>30</b>
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## Examination Pattern

### Distribution of Marks in SEC Practical Examination

Sr. No.	Particulars	Marks
1	Experiment	30
	Viva voce	10
2	Certified journal	10
	<b>Total Marks</b>	<b>50</b>



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DIST: SINDHUDURG- 416 510, MAHARASHTRA

**Syllabus for Approval**

**Programme:- F. Y. B. Sc. Chemistry**

**OPEN ELECTIVE ENVIRONMENTAL**

**POLLUTION: CHOE01**

**SEMESTER-II**

**w.e.f. Academic Year 2024-25**

**Choice Based Credit System F.Y.B.Sc. Chemistry Syllabus**



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**DEPARTMENT OF CHEMISTRY**

Syllabus for Approval

Sr. No.	Heading	Particulars
1.	Title of the Course	F. Y. B. Sc.
2.	Eligibility for Admission	12 <sup>th</sup> Science of all recognized Board
3.	Passing Marks	40%
4.	Ordinance/Regulations (if any)	
5.	No. of Years/Semesters	Two Semesters
6.	Level	UG
7.	Pattern	Semester (60:40)
8.	Status	Revised
9.	To be implemented from Academic Year	From Academic Year 2024-2025

Date:

Signature  
HoD,  
Dept. of Chemistry

**Shri Pancham Khemraj Mahavidyalaya, Sawantwadi**  
Proposed First Year Curriculum as per NEP 2020  
**Department of Chemistry**  
**Structure for Open Elective**

<b>Semester</b>	<b>Paper Code</b>	<b>Paper Title</b>	<b>Type</b>	<b>Credits</b>
<b>I</b>	<b>OECHE-01 (GE/OE)</b>	Environmental Pollution	<b>T</b>	<b>2</b>

**Course Outcomes:**

Cosmetics are products designed to cleanse, protect and change the appearance of external parts of our bodies. The key ingredients present in most cosmetics include water, emulsifiers, preservatives, thickeners, moisturisers, colours and fragrances. Ingredients can be naturally occurring or artificial, but any potential impact on our health depends mainly on the chemical compounds used as raw material.

The salient feature of this programme is the emphasis being laid on the overall development of student with major focus on application and field work. The course mainly focuses on Cosmetics, Advances in cosmetic product development, Perfume Chemistry, Learning of analytical techniques used in cosmetic and perfume industries etc. Students will get many opportunities of interactions with experts in these fields during the course tenure. The students can gain hands on experience in the field while doing internships in industries/research institutes/health sectors etc.

**Course Objectives:** To provide the learner with knowledge of cosmetics and perfumes with respect to the types of formulations, evaluation and regulatory aspects.

**Course Outcome:** Upon completion of the course, the learner shall be able to:

1. Discuss the various raw materials for cosmetics.
2. Understand the toxicological aspects.
3. Discuss the various cosmetics products w.r.t. raw materials, large scale manufacture and functional and physiochemical evaluation.
4. Know the regulatory guidelines and sensorial assessment for cosmetics.

**OPEN ELECTIVE**  
**ENVIRONMENT POLLUTION: OECHT 01 (Credit 02) [30 L]**

<b>OECH03</b>	<p><b>Environment Science:</b></p> <p>Fundamentals of Environmental Sciences Definition, Principles and Scope of Environmental Science. Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere.</p> <p>Environmental Pollution:</p> <p>Definition • Cause, effects and control measures of :-</p> <p>a) Air pollution</p> <p>b) Water pollution</p> <p>c) Soil pollution</p> <p>d) Marine pollution</p> <p>e) Noise pollution</p>
	<p><b>References:</b></p> <p>1) Environmental Science, A. K. De, New Age International Publication .</p> <p>2) E. Stocchi: <i>Industrial Chemistry</i>, Vol -I, Ellis Horwood Ltd. UK.</p> <p>2) P.C. Jain, M. Jain: <i>Engineering Chemistry</i>, Dhanpat Rai &amp; Sons, Delhi.</p> <p>3) Sharma, B.K. &amp; Gaur, H. <i>Industrial Chemistry</i>, Goel Publishing House, Meerut (1996).</p>

**Scheme of Examination**

**C) Internal Assessment:**

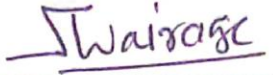
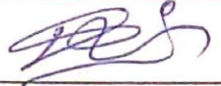
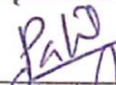
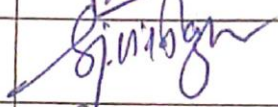
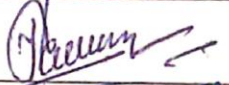


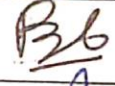
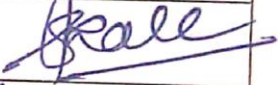
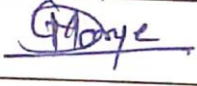

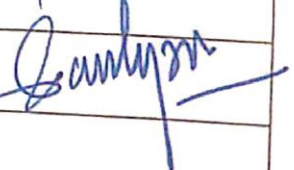
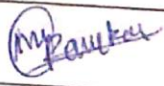
Sr. No.	Particulars	Marks
1	One assignment/test/Seminar/Presentation	10
2	Class attendance	05
3	Subject based activity	05
<b>Total Marks</b>		20

**D) External Assessment:**

Sr. No.	Particulars	Marks
1	EXTERNAL	30

## Committee for Creation of Syllabus

### Committee for Creation of Syllabus :

Sr. No.	Name	Designation	Signature
1	Asso. Prof. S.L.Vairage	Chairman BOS	
2	Dr. D. B. Shinde	Member	
3	Dr. U. C. Patil	Member	
4	Dr. A. P. Nikum	Member	
5	Dr. Y. A. Pawar	Member	
6	Mr. D. K. Malik	Member	
7	Mr. P. M. Dhuri	Member	
8	Mr. P. P. Parab	Member	
9	Mr. S. S. Kale	Member	
10	Miss. D.G. Morye	Member	
11	Prof. Rashinkar Gajanan S.	Subject Expert Nominated by AC other University	
12	Prof. Patil Suresh S.	Subject Expert Nominated by AC other University	
13	Dr. Sankpal Sagar T.	Expert Nominated by VC	
14	Mr. Duse Bhargav S.	Representative from Industry	
15	Mr. Govekar Prashant T.	Post Graduate Meritorious Alumini	
16	Dr. Disale Shamrao T.	Expert from outside the college	