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. 2023-2024
2. S.Y.B.Sc. 2024-2025
3. T.Y.B.Sc. 2025-2026

Syllabus for

Semester I
and
Semester II

Reference: GR dated 16th May 2023 for Credit structure

Sr. No.	Headings	Particulars
1	Title of the Program	**Science- Chemistry**
2	Eligibility	H.S.C. with Science Stream
3	Duration of the Programme	1- Certificate 2- Diploma 3- Advance Diploma 4- Research 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 Advance Diploma 6.0 Research Degree
7	Pattern	Semester Pattern
8	Status	New
9	To Be Implemented from the academic year	4.5 Certificate **2023-2024** 5.0 Diploma **2024-2025** 5.5 Advance Diploma **2025-2026** 6.0 Research Degree **2026-2027**

Preamble

1. Introduction

Shri Pancham Khemraj Mahavidyalaya (S.P.K.M.), Sawantwadi (Autonomous) believes in implementing several measures to bringequity, 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 oflearners.

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 helpthe 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 inexperimental 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 forsocietal 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 Major / Minor/OE/VSE/SEC/VEC/IKS

Semester	Paper Code	Paper Title	Type	Credits
I (Level 4.5)	**S101CHT (Major)**	Physical and AnalyticalChemistry-I	**Theory**	**2**
	S102CHT (Major)	Inorganic and OrganicChemistry -I	**Theory**	**2**
	S103CHP (Major)	Chemistry Practical-I	**Practical**	**2**
	S104CHT (Minor)	Fundamental Chemistry-I	**Theory**	**2**
	S105CHT (Minor)	Fundamental Chemistry - II	**Theory**	**2**
	CHOE01 (GE/OE)	Cosmetics (सौंदर्य प्रसाधने)	**Generic Ele.**	**2**
	CHVS01 (VSC)	Experimental Chemistry-I	**Voc. Skill**	**2**
	CHSE01 (SEC)	Industrial Chemistry-I	**Skill**	**2**
II (Level 4.5)	**S106CHT (Major)**	Physical and AnalyticalChemistry-II	**Theory**	**2**
	S107CHT (Major)	Inorganic and OrganicChemistry -II	**Theory**	**2**
	S108CHP (Major)	Chemistry Practical-II	**Practical**	**2**
	S109CHT (Minor)	Fundamental Chemistry-I	**Theory**	**2**
	S110CHT (Minor)	Fundamental Chemistry-II	**Theory**	**2**
	S111CHT (Minor)	Experimental Chemistry-II	**Practical**	**2**
	CHOE02	Perfumery (सुगंधित द्रव्ये)	**Generic Ele.**	**2**
	CHOE03	Environmental Science (T+P)	**Open Ele.**	**2**
	CHSE02 (SEC)	Industrial Chemistry -II	**Skill Enh.**	**2**
	CHIK01	ALCHEMY	**IKS**	**2**

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	**O** (Outstanding)
8.00-<9.00	80.0-90.0	**A+** (Excellent)
7.00-<8.00	70.0-80.0	**A** (Very Good)
6.00-<7.00	60.0-70.0	**B+** (Good)
5.50-<6.00	55.0-60.0	**B** (Above Average)
5.00-<5.50	50.0-55.0	**C** (Average)
4.00-<5.00	40.0-50.0	**P** (Pass)
Below <4.00	Below 40.0	**F** (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) NEP-2020 is given below

MAJOR SUBJECTS

Semester	Course Code	Course title	No of Credits	No of Lectures In Hours
I	**S101CHT (Major)**	Physical and AnalyticalChemistry-I	**2**	30
	S102CHT (Major)	Inorganic and OrganicChemistry -I	**2**	30
	S103CHP (Major)	Chemistry Practical-I	**2**	60

SEMESTER-I

COURSE TITLE: - PHYSICAL AND ANALYTICAL 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 physical and analytical 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 Content

UNIT	Description	Lectures
I (Physical Chemistry)	**Chemical Thermodynamic**	
	1.1:Introduction to Thermodynamics **1.1.1 Thermodynamic terms:-** 1. System, 2. surrounding, 3. boundaries, 4. types of system, 5. Intensive and Extensive properties, 6. State functions and 7. path functions, **1.1.2 Thermodynamic processes**. **1.1.3** First law of thermodynamics: 1. Concept of heat (q), 2. Work (w), 3. Internal energy (U), 4. Enthalpy, 5. Heat capacity, 6. Relation between heat capacities, 7. Sign conventions, **1.1.4** Calculations of Heat, work, Internal energy and Enthalpy (H).	**8**

	1.1.5 Thermo Chemistry: 1. Heat of reactions, 2. Standard states, 3. Enthalpy of formation of molecules, 4. Enthalpy of combustion and its applications **1.1.6** Calculations of bond energy, bond dissociation energy and resonance energy from thermo chemical data, **1.1.7** Kirchhoff's equation (Numerical problems expected wherever necessary).	
	1.2 Chemical Kinetics **1.2.1 : Introduction** 1. Rate of reaction, 2. Rate constant, 3. Measurement of reaction rates, 4. Order and molecularity of reaction, **1.2.2** Integrated Rate equation of First Order and Second order reactions (with equal initial concentration of reactants) **1.2.3.** Determination of order of reaction by 1) Integration method 2) Graphical method 3) Ostwald's isolation method 4) Half time method, **1.2.4.** Effect of temperature on the rate of reaction, **1.2.5.** Concept of activation energy and its calculation from Arrhenius equation (derivation not expected). (Numerical problems expected wherever necessary)	**7**
II **(Analytical Chemistry)**	**Analytical Methods**	
	2.1 Calibration of Apparatus: 1. Introduction and objectives of calibration of volumetric apparatus, 2. Categories of glassware's as class A and class B, 3. Calibration of standard volumetric flask, 4. Calibration of pipette and 5. Calibration of burette.	**4**

	2.2 Chemical Calculations: **2.2.1** Methods of expressing concentration of solutions: 1. Normality, 2. Molality, 3. Molarity, 4. Formality, 5. Mole fractions, 6. Weight ratio, 7. Volume ratio, 8. Weight to volume ratio, 9. Parts per million (ppm), ppb, milimol, miliequivalace, Preparation of solutions (Numerical problems expected wherever necessary).	**5**
	2.3 Ionic Equilibria: **2.3.1** Strong and weak electrolytes, Degree of ionization, factors affecting degree of ionization, Ionization constant and Ionic product of water, **2.3.2** Ionization of weak acids and bases, **2.3.3** Dissociation constants of monoprotic acids. 1. pH scale, 2. Buffer solutions, 3. Types of buffers, 4. Derivation of Henderson equation for acidic and basic buffers, Buffer action, buffer capacity (Numerical problems expected, wherever necessary)	**6**
	References: 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, 5th edition, John Wiley Publication, 1989.	
	Total	**30**

SEMESTER-I

COURSE TITLE: - INORGANIC & ORGANIC CHEMISTRY –I

Course Code: S102CHT

Pre-requisites:

Knowledge of Atomic Structure, Periodic table and periodicity and comparative chemistry of main group elements.

Course Objectives:

To Introduce students to:

- Systematic and coherent understanding of the fundamental concepts in
- InorganicChemistry 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
I (Inorganic Chemistry)	**Introduction to Inorganic Chemistry**	
	1.1 Atomic structure (8L) **1.1.1 Historical perspectives of the atomic structure:** J. J. Thomson Model, Rutherford's Atomic Model- alpha particle scattering experiment, Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Structure of hydrogen atom. **1.1.2 Hydrogenic atoms:** 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	**15**
	1.2 Periodic Table and periodicity (4L) **1.2.1 Long form of Periodic Table:** **Classification :** 1. Main Group, 2. Zero Group Elements 3. Transition Elements and 4. Inner transition elements. **1.2.2 Periodicity in the following properties:** 1. Atomic and ionic size, 2. Electron gain enthalpy, 3. Ionization enthalpy, 4. Effective nuclear charge (Slater's rule), 5. Electronegativity, Pauling and 6. Mullikan methods (Numerical problems expected, wherever applicable).	
	1.3 Comparative Chemistry of Main Group Elements (3L): 1.3.1 Properties of Main Group Elements- 1) Metallic and Non-metallic nature, 2) Oxidation States. 1.3.2 Anomalous behavior of Second Period elements, 1.3.3 Diagonal relationship of Second & Third Period Elements 1.3.4 Allotropy. Types of Allotropy 1.3.5 Allotropy of Carbon, Phosphorous, Tin. 1.3.6 Catenation, 1.3.7 Some important compounds- **$NaHCO_3$, Na_2CO_3, $CaCO_3$, CaO, NaOH, NaCl.** 1.3.8 Oxides of Nitrogen, Sulfur, Oxygen w.r.t Environmental aspect	

III (Organic Chemistry)	**2.1 Nomenclature of Organic Compounds (3L):** Review of basic rules of IUPAC nomenclature. Nomenclature of mono and bi-functional aliphatic compounds on the basis of priority order of the following classes of compounds: alkanes, alkenes, alkynes, halo alkanes, alcohols, ethers, aldehydes, ketones, carboxylic acids, carboxylic acid derivatives (acid halides, esters, anhydrides, amides), nitro compounds, nitriles and amines; including their cyclic analogues.	**15**
	2.2 Bonding and Structure of organic compounds (4L): **Hybridization**: sp^3, sp^2, sp hybridization of carbon in Organic compounds (alcohol, ether, aldehyde, ketone, carboxylic acid, ester, cyanide) **Overlap of atomic orbitals:** Overlaps of atomic orbitals to form sigma and pi bonds, shapes of organic molecules. **Shapes of molecules;** Influence of hybridization on bond properties (as applicable to ethane, ethene, ethyne).	
	2.3 Fundamentals of organic reaction mechanism (5L): **Electronic Effects:** Inductive, electromeric, resonance and mesomeric effects, hyper conjugation; Dipole moment. Steric effect **Bond fission:** Homolytic and Heterolytic fission with suitable examples. Electrophiles and Nucleophiles; **Types (primary, secondary, tertiary, allyl, benzyl),: shape and their relative stability of reactive intermediates:** Carbocations, Carbanions and Free radicals. **Introduction to types of organic reactions:** Addition, Elimination and Substitution reaction. (With one example of each)	
	2.4 Stereochemistry I (3L) **Stereochemistry I:** Projection formulae: Flying Wedge projection, Fischer Projection, Newman and Sawhorse Projection formulae (of erythro, threo isomers of tartaric acid and 2,3 -dichlorobutane) and their interconversions; **Geometrical isomerism in alkene and cycloalkanes**: cis–trans and syn-anti isomerism E/Z notations with C.I.P rules. **Optical Isomerism:** Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two similar and dissimilar chiral-centres, Diastereoisomers, meso structures, racemic mixture and resolution (methods of resolution not expected). **Relative and absolute configuration**: D/L and R/S designations. **Conformational analysis of alkanes** (ethane, propane and n-butane); Relative stability with energy 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	

SEMESTER-I

Course Title: BASIC CHEMISTRY PRACTICAL-1

Course Code: S103 CHP

Leaning Outcome: On successful completion of this course learners will be able to:

1. Handle Electronic Balance and calibrate the glass apparatus used for various experiments.
2. Apply the Concepts of Rate of Reaction and Volumetric Analysis through experiments.
3. Standardize different solutions using suitable primary standard.
4. Prepare the solution of desired concentrations.
5. Perform gravimetric analysis using crucibles.

List of the experiments:

•	**Physical Chemistry Experiments**
1.	To calibrate the volumetric apparatus used in titrimetric analysis.
2.	To prepare 0.1 N succinic acid and standardize NaOH of two different concentrations.
3.	To determine the rate constant for the hydrolysis of ester using HCl as catalyst.
4.	To determine the amount of strong acid in the given solution by titrating against strong base conductometrically.
5.	To determine the dissociation constant of weak acid (Ka) using Henderson's equation and the method of incomplete titration pH metrically.
•	**Inorganic Chemistry Experiments**
1.	Commercial analysis of a) Organic acid. b) Mineral Acid
2.	Titration using double indicator: analysis of solution of Na_2CO_3 and $NaHCO_3$.
3.	Redox Titration: To determine the percentage of copper(II) present in a given sample by titration against a standard aqueous solution of sodium thiosulfate (iodometry titration)
•	**Organic Chemistry Experiments**
1.	Purification of any two organic compounds by recrystallization selecting suitable solvent. (Provide 1g.). Learners are expected to report a) Solvent for recrystallization. b) Mass and the melting point of purified compound.
2.	Chromatography Separation of a mixture of two organic compound by ascending Thin Layer Chromatography.

Reference Books:

1. Systematic experimental Physical chemistry – T. K. Chondhekar & S.W. Rajbhoj, Anjali Publications, Aurangabad.
2. Experiments in chemistry – D.V. Jahagirdhar, Himalaya Publishing House.
3. Spectrometric Identification of Organic Compounds- R.M.Silverstein, G.C.Bassler, Wiley: New York, 5th edition.
4. Experiments and Techniques in Organic Chemistry-D.J.Pasto, C.R.Johnson, Prentice-Hall: Englewood Cliffs.

- All Experiments are compulsory for the Semester-I.
- Write the Experiments Paper wise in Journa**l**.Certified journal is a must to be eligible for appearing term end examination.

EXAMINATION PATTERN FOR MAJOR SUBJECTS

A) Continuous Internal Assessment (40 Marks):

Sr. No.	Particulars	Marks
1	One Assignment.	10
2	One offline class test.	20
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
	Total	**40**

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 marls

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

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
	Total Marks	**50**

S. Z. S. P. Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA SAWANTWADI

DIST: SINDHUDURG- 416 510, MAHARASHTRA

Syllabus for Approval

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

(Minor Course)

SEMESTER-I

w.e.f. Academic Year 2023-24

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. CHEMISTRY (MINOR COURSE)
2.	Eligibility for Admission	12th 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 2023-2024

Date:

Signature
HoD,
Dept. of Chemistry

PREAMBLE:

S. P. K. Mahavidyalaya, Sawantwadi (Autonomous) believes in implementing several measures to bringequity, 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 oflearners.

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 helpthe student have a firm grip on the theoretical concepts through relevant experiments in each course.

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 a 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 reviewof 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 forsocietal 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 forsocietal 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.

DEPARTMENT OF CHEMISTRY

Syllabus

Proposed Syllabus for CBCS

F. Y. B. Sc.: Minor Chemistry

Structure of the Course:

The structure of major courses (with codes) for Semester -I and II for F. Y. B. Sc. (Chemistry) NEP-2020 is given below

MINOR SUBJECTS

Semester	Course Code	Course title	No. of Credits	No of Lectures In Hours
I	**S104 CHT (Minor)**	Physical and AnalyticalChemistry-I	**2**	30
	S105 CHT (Minor)	Inorganic and OrganicChemistry -I	**2**	30

SEMESTER-I

Course Title: - Physical and Analytical Chemistry-I

Course Code: S104 CHT

Pre-requisites:

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

Course Objectives: To introduce students to;

1. Understand basic concepts of physical and analytical chemistry.
2. Recognize the importance of basics chemical thermodynamic.
3. Learn the rate and order of reactions.
4. Classify the electrolytes based on their dissociation phenomenon
5. Learn about the concentration units and preparation of solutions.

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

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

Course Content

UNIT	Description	Lectures
I **(Physical Chemistry)**	**1.1 Chemical Thermodynamic-I:** Thermodynamic terms; System, surrounding, boundaries, types of system, Intensive and Extensive properties, State functions and path functions, Thermodynamic processes. First law of thermodynamics: 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). **Thermo Chemistry:** Heat of reactions, standard states, enthalpy of formation of molecules, enthalpy of combustion and its applications, calculations of bond energy, bond dissociation energy and resonance energy from thermo chemical data, Kirchhoff's equation (Numerical problems expected wherever necessary).	**8L**

	1.2 Chemical Kinetics 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, Effect of temperature on the rate of reaction, Concept of activation energy and its calculation from Arrhenius equation (derivation not expected). (Numerical problems expected wherever necessary)	**7L**
	References: 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, Thermodynamics and Chemical Equilibria, 3rd Ed. vol.1,2, 3, Macmillan Publishing Co., New Delhi (2001)	
II **(Analytical Chemistry)**	**2.1 Calibration of Apparatus:** Introduction and objectives of calibration of volumetric apparatus, Categories of glassware's as class A and class B, Calibration of standard volumetric flask, calibration of pipette and calibration of burette.	**4 L**
	2.2 Chemical Calculations: Methods of expressing concentration of solutions: Normality, molality, Molarity, Formality, Mole fractions, Weight ratio, Volume ratio, Weight to volume ratio, ppm, ppb (Numerical problems expected wherever necessary).	**5L**
	2.3 Ionic Equilibria: 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, Dissociation constants of monoprotic acids. pH scale, Buffer solutions, types of buffers, Derivation of Henderson equation for acidic and basic buffers, Buffer action, buffer capacity (Numerical problems expected, wherever necessary)	**6L**

	References: 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, 5th edition, John Wiley Publication, 1989.	
	Total	**30 L**

SEMESTER-I

Course Title:- Inorganic & Organic Chemistry –I

Course Code : S105 CHT

Pre-requisites:

Knowledge of Atomic Structure, Periodic table and periodicity and comparative chemistry of main group elements.

Course Objectives:

To introduce students to

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

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

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

Course Content

UNIT	Description	Lectures
I **(Inorganic Chemistry)**	**2.1 Atomic structure (8L)** **2.1.1 Historical perspectives of the atomic structure:** J. J. Thomson Model, Rutherford's Atomic Model- alpha particle scattering experiment, Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Structure of hydrogen atom. **2.1.2 Hydrogenic atoms:** 1. Simple principles of quantum mechanics 2. Atomic orbitals i) Shells, subshells and orbitals ii) Electron spin iii) Radial shapes of orbitals iv) Angular shapes of orbitals. Aufbau principle, Hund's rule of maximum multiplicity and Pauli exclusion principle	**15 L**
	2.2 Periodic Table and periodicity (4L) **2.2.1 Long form of Periodic Table:** Classification for elements as main group, transition and inner transition elements. **2.2.2 Periodicity in the following properties:** Atomic and ionic size, electron gain enthalpy, ionization enthalpy, effective nuclear charge (Slater's rule), electronegativity, Pauling and Mulliken methods (Numerical problems expected, wherever applicable).	
	2.3 Comparative chemistry of Main Group Elements (3L): Metallic and non-metallic nature, oxidation states. Anomalous behavior of second period elements, allotropy of carbon, catenation, diagonal relationship. Some important compounds- **$NaHCO_3$, Na_2CO_3, CaO, $CaCO_3$.**	
	Reference Books: 1. Concise Graduate Chemistry – I, II, III & IV, University Text Book of Chemistry, University of Mumbai. 2. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991. 3. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry, Oxford, 1970 4. Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962. 5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India	
II **(Organic Chemistry)**	**2.1 Nomenclature of Organic Compounds (3L):** Review of basic rules of IUPAC nomenclature. Nomenclature of mono and bi-functional aliphatic compounds on the basis of priority order of the following classes of compounds: alkanes, alkenes, alkynes, haloalkanes, alcohols, ethers, aldehydes, ketones, carboxylic acids, carboxylic acid derivatives (acid halides, esters, anhydrides, amides), nitro compounds, nitriles and amines; including their cyclic analogues.	**15L**

	2.2 Bonding and Structure of organic compounds (4L): Hybridization: sp^3, sp^2, sp hybridization of carbon in Organic compounds (alcohol, ether, aldehyde, ketone, carboxylic acid, ester, cyanide)	
	2.3 Fundamentals of organic reaction mechanism (5L):	
	Electronic Effects: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation; Dipole moment. **Bond fission:** Homolytic and Heterolytic fission with suitable examples. Electrophiles and Nucleophiles; **Types (primary, secondary, tertiary, allyl, benzyl),: shape and their relative stability of reactive intermediates:** Carbocations, Carbanions and Free radicals. **Introduction to types of organic reactions:** Addition, Elimination and Substitution reaction. (With one example of each)	
	2.4 Stereochemistry I (3L) Flying-Wedge Projection, Fischer Projection, Newman and Sawhorse Projection formulae and their interconversions (for isomers of tartaric acid and 2,3 dichlorobutane) **Optical Isomerism**: Optical Activity, Specific Rotation (numerical problems), Chirality/Asymmetry, Enantiomers, Molecules with two similar and dissimilar chiral-centres, Distereoisomers, meso structures, racemic mixture and resolution (methods of resolution not expected).	
	(**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 = 30L	

EXAMINATION PATTERN FOR MAJOR SUBJECTS

A) Continuous Internal Assessment (40 Marks):

Sr. No.	Particulars	Marks
1	One Assignment.	10
2	One offline class test.	20
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 **Six MCQs**, **Six questions** on match the column and **Six questions** basedon 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 within the questions. (Each question will be of **18 to 20 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 marls

Qn.	Sub-Qn	Particulars	Unit	Marks with options	Total Marks for qn
1	**A**	Choose the Correct answer and rewrite the statement**. (Attempt any five out of seven)**	**I, II**	07	15
	B	Match the Columns**. (Attempt any five out of seven)**		07	
	C	State whether the statement is true or false. **(Attempt any five out of six)**		06	
2	**A,B,C,D , E**	Answer the following (Attempt **any three out of five**)	**I**	20	15
3	**A,B,C, D,E**	Answer the following (Attempt **any three out of five**)	**II**	20	15
4	**A,B,C,D ,E**	Answer the following (Attempt **any three out of five**)	**I& II**	20	15
		Total		**80**	**60**

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
	Total Marks	**50**

S. Z. S. P. Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA SAWANTWADI

DIST: SINDHUDURG- 416 510, MAHARASHTRA

Syllabus for Approval

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

Vocational Skill Course [VSCHE 01]

SEMESTER-I

w.e.f. Academic Year 2023-24

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	12th 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 – I: Physical Chemistry

1) To prepare 0.1 N succinic acid and standardize the NaOH solution of different concentrations.
2) To determine the rate constant for the hydrolysis of ester using HCl as catalyst.
3) To determine enthalpy of dissolution of salt (KNO_3)
4) Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature (Any two solutions).

Unit II: Inorganic Chemistry

1) Commercial analysis of (any two) a) Mineral Acid
   b) Organic Acid
   c) Salt of weak acid and strongbase.
2) Titration using double indicator: analysis of solution of $Na_2CO_3$and $NaHCO_3$
3) **Redox Titration:** To determine the percentage of copper(II) present in a given sample by titration against a standard aqueous solution of sodium thiosulfate (Iodometry titration)

Unit III Organic Chemistry

1. Purification of organic compounds by recrystallization selecting suitable solvent (minimum 2 organic compounds to be given)
   (Learners are expected to report a) Solvent for recrystallization. b) Percentage Yield and the melting points of the purified compound.)

2. Basic principles of Organic compound characterization (minimum 4 Solid organic compounds)
   (Learners should perform Preliminary Tests, Solubility Test, obtain melting point and recrystallize the compound with given solvent)

Minimum 80 percent of practical must be completed in each term

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
	Total Marks	**50**

AC ITEM NO. :**AC**

S. Z. S. P. Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA 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 2023-24

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 a 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 reviewof 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 forsocietal 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 forsocietal 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)

Semester	Course Code	Course Title	No of Credits	No of Lectures in Hours
I	**SECHE 01**	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
I	**1.1 QUALITATIVE ANALYSIS OF INORGANIC COMPOUNDS**	**60 L**
	Semi-micro analysis of ANY Five inorganic salt. Cations (from amongst): Pb^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Cu^{2+}, Cd^{2+}, Fe^{2+}, Ni^{2+}, Mn^{2+}, Mg^{2+}, Al^{3+}, Cr^{3+}, K^{+}, NH_4^{+} Anions (from amongst): CO_3^{2-}, S^{2-}, $SO3^{2-}$, $NO2^{-}$, $NO3^{-}$, Cl^{-}, Br^{-}, I^{-}, $SO4^{2-}$, $PO4^{3-}$ (Scheme of analysis should avoid use of sulphide ion in any form for precipitation / separation of cations.)	
	1.2 Chemical Handling & Safety Measures	
	1. Handling of acids and bases	
	2. Handling of instruments	
	3. Preparation of solutions based on different units of concentration	
	4. Calibrations of Apparatus	
	1.3 **Organic Preparation** 1. Preparation of Phthalic Anhydride 2. Preparation of Methyl Salicylate	
	1.4 **Analysis of water sample** 1) pH 2) TDS 3) Conductivity	
	1.5 Preparation of Buffer solutions and determination of their pH	
	References: 1. College Inorganic Chemistry, Himalaya Publishing House 2. Concepts in Inorganic Chemistry, Chetana Publications Pvt. Ltd. 3. Vogel's Textbook of Practical Organic Chemistry, Fifth Edition, B. S. Furniss.	

Examination Pattern
Distribution of Marks in SEC Practical Examination

Sr. No.	Particulars	Marks
1	Experiment	30
	Viva voce	10
2	Certified journal	10
	Total Marks	**50**

S. Z. S. P. Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA SAWANTWADI

DIST: SINDHUDURG- 416 510, MAHARASHTRA

Syllabus for Approval

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

OPEN ELECTIVE

COSMETICS: OECHE01

SEMESTER-I

w.e.f. Academic Year 2023-24

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	12th 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 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 Open Elective

Semester	Paper Code	Paper Title	Type	Credits
I	OECHE-01 (GE/OE)	Cosmetics (सौंदर्य प्रसाधने)	T	2

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 filed work. The course manly 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 fíelds 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.

SEMESTER-I

OPEN ELECTIVE:

COSMETICS (सौंदर्य प्रसाधने) : OECHT 01 (Credit 02) [30 L]

COURSE CODE	SYLLABUS
OECHT 01	**COSMETICS:** **Introduction:** History of Cosmetics, A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours, Facial Make-up, Eye-Products, Lip Products Raw materials in cosmetics : Water, Oils, Fats, Waxes
	References: **Books recommended:** 1. Ann Eaton and Flurence Openshaw, Cosmetic Make – Up and Manicure. 2. A Professional Guide to Hair Dressing and Beauty Therapy by VeenaPitre 3. The Science of Cosmetics by John V. Simmons 4. Complete Beauty Book by Helen Foster 5. Vogue- Body and Beauty Book by Bronwen Meredith 6. A Guide for Health & Beauty Therapist Vol.-1 Face, hands and feet by Gaynor Winyard 6. Foucher's Perfumes, Cosmetics and Soaps – 10th Edition

Scheme of Examination

A) Internal Assessment of 20 Marks:

Sr. No.	Particulars	Marks
1	One Assignment/test/Seminar	10
2	Class attendance	05
3	One subject based activity/viva based on the course	05
	Total Marks	**20**

External Assessment of 30 Marks:

Sr. No.	Particulars	Marks
1	One theory test	30
	Total Marks	**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. 2023-2024
2. S.Y.B.Sc. 2024-2025
3. T.Y.B.Sc. 2025-2026

Syllabus for

Sem I and Sem II

Reference : GR dated 16th May 2023 for Credit structure

Sr. No.	Headings	Perticulars
1	Title of the Program	**Science- Chemistry**
2	Eligibility	H.S.C. with Science Stream
3	Duration of the Programme	1- Certificate 2- Diploma 3- Advance Diploma 4- Research 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 Advance Diploma 6.0 Research Degree
7	Pattern	Semester Pattern
8	Status	New
9	To Be Implemented from the academic year	4.5 Certificate **2023-2024** 5.0 Diploma **2024-2025** 5.5 Advance Diploma **2025-2026** 6.0 Research Degree **2026-2027**

Preamble

1. Introduction

Shri Pancham Khemraj Mahavidyalaya (S.P.K.M.), Sawantwadi (Autonomous) believes in implementing several measures to bringequity, 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 oflearners.

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 helpthe 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 a 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 forsocietal 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 (Sem I & II)

Shri Pancham Khemraj Mahavidyalaya, Sawantwadi
Proposed First Year Curriculum as per NEP 2020
Department of Chemistry

Proposed Structure for Major / Minor/OE/VSE/SEC/VEC/IKS/VEC

Semester	Paper Code	Paper Title	Type	Credits
I (Level 4.5)	**S101CHT (Major)**	Physical and AnalyticalChemistry-I	**Theory**	**2**
	S102CHT (Major)	Inorganic and OrganicChemistry -I	**Theory**	**2**
	S103CHP (Major)	Basic Chemistry Practical-I	**Practical**	**2**
	S104CHT (Minor)	Fundamental Chemistry-I	**Theory**	**2**
	S105CHT (Minor)	Fundamental Chemistry - II	**Theory**	**2**
	CHOE01 (GE/OE)	Cosmetics (सौंदर्य प्रसाधने)	**Generic Ele**	**2**
	CHVS01 (VSC)	Experimental Chemistry-I	**Voc. Skill**	**2**
	CHSE01 (SEC)	Industrial Chemistry-I	**Skill**	**2**
II (Level 4.5)	**S106CHT (Major)**	Physical and AnalyticalChemistry-II	**Theory**	**2**
	S107CHT (Major)	Inorganic and OrganicChemistry -II	**Theory**	**2**
	S108CHP (Major)	Basic Chemistry Practical-II	**Practical**	**2**
	S109CHT (Minor)	Fundamental Chemistry-I	**Theory**	**2**
	S110CHT (Minor)	Fundamental Chemistry-II	**Theory**	**2**
	S111CHT (Minor)	Experimental Chemistry-II	**Practical**	**2**
	CHOE02	Perfumery (सुगंधित द्रव्ये)	**Generic Ele.**	**2**
	CHOE03	Environmental Science (T+P)	**Open Ele.**	**2**
	CHSE02 (SEC)	Industrial Chemistry -II	**Skill Enh.**	**2**
	CHIK01	ALCHEMY	**IKS**	**2**

Title of the Programme – B.Sc. Chemistry

Letter Grades and Grade points

Semster GPA/Program CGPA/Semester Program	Percentage of Marks	Alpha- sign / letter grade result
9.00-10.00	90.0-100	**O** (Outstanding)
8.00-<9.00	80.0-90.0	**A+** (Excellent)
7.00-<8.00	70.0-80.0	**A** (Very Good)
6.00-<7.00	60.0-70.0	**B+** (Good)
5.50-<6.00	55.0-60.0	**B** (Above Average)
5.00-<5.50	50.0-55.0	**C** (Average)
4.00-<5.00	40.0-50.0	**P** (Pass)
Below <4.00	Below 40.0	**F** (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) NEP-2020 is given below

MAJOR SUBJECTS

Semester	Course Code	Course title	No of Credits	No of Lectures In Hours
II	**S106CHT (Major)**	Physical and AnalyticalChemistry-II	**2**	30
	S107CHT (Major)	Inorganic and OrganicChemistry -II	**2**	30
	S108CHP (Major)	Chemistry Practical-II	**2**	60

SEMESTER-II

COURSE TITLE: - PHYSICAL AND ANALYTICAL CHEMISTRY-II
COURSE CODE: S 106 CHT

Pre-requisites:

Knowledge of Chemical Thermodynamics, Gaseous State, Liquid State, Electrochemistry, Molecular Spectroscopy.

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.
- Learn the interaction of light with matter with respect to different phenomena.

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.

Course Content

UNIT	Description	Lectures
I	**Chemical Thermodynamics**	
	1.1 Chemical Thermodynamics -II: 1.1.1 Second law of thermodynamics, 1.1.2 Concept of entropy, 1.1.3 Physical significance of entropy, 1.1.4 Concept of free energy, 1.1.5 Helmholtz and Gibbs free energy, 1.1.6 Variation of free energy with temperature and pressure, 1.1.7 Spontaneity and Physical significance of free energy. 1.1.8 Reversible and irreversible reactions 1.1.9 Equilibrium constant Kp and Kc and its relation 1.1.10 Thermodynamic derivation of equilibrium constant	**5**

	1.2 Gaseous State: 1.2.1 Kinetic theory of gases, 1.2.2 Maxwell-Boltzmann's distribution of velocities (Qualitative discussion), 1.2.3 Ideal gas laws, 1.2.4 Deviation from ideal gas laws, 1.2.5 Ideal and Real gases, 1.2.6 Reasons for deviation from ideal gas laws, 1.2.7 Compressibility factor, 1.2.8 Boyle's temperature, 1.2.9 van der Waals equation of state, 1.2.10 Critical phenomena, 1.2.11 Relation between critical constants and Vander Waals constants. (Numerical problems expected wherever necessary)	**6**
	1.3 Liquid State: **1.3.1 Surface tension:** 1. Introduction, 2. Methods of determination of surface tension by drop number method **1.3.2 Viscosity:** 1. Introduction, 2. Coefficient of viscosity, 3. Relative viscosity, 4. Specific viscosity, 5. Reduced viscosity, 6. Determination of viscosity by Ostwald viscometer **1.3.3 Refractive index:** 1. Introduction, 2. Molar refraction and polarizability, 3. Determination of refractive index by Abbe's Refractometer. (Numerical problems expected wherever necessary) **1.3.4 Liquid Crystals** 1. Introduction, 2. Classification, and structure of thermotropic phases 3. (nematic, smectic, cholesteric) 4. Applications of liquid crystals	**4**
I I	**2.1. Chemical Equilibrium:** 2.1.1 Reversible and irreversible reactions, 2.1.2 Equilibrium constants (Kc and Kp), 2.1.3 Relationship between Kc and Kp. 2.1.4 Thermodynamic derivation of equilibrium constant (Numerical problems expected wherever necessary)	**4**

	2.2. Electrochemistry-I: 2.2.1 Terms involve in Electrochemistry – I 1. Conductance, 2. Specific conductance, 3. Equivalent conductance, 4. Molar conductance, 2.2.2 Variation of molar conductance with concentration of strong and weak electrolyte. Reversible electrodes, Electrode potential, standard electrode potential (Numerical problems expected wherever necessary).	**7**
	2.3. Molecular Spectroscopy: 2.3.1 Electromagnetic radiation, Electromagnetic Spectrum, 2.3.2 Planck's equation, 2.3.3 Interaction of Electromagnetic Radiation with matter; 2.3.4 Absorption, Emission, Scattering, Electronic, Vibrational and Rotational transitions, 2.3.5 Beers Law, Lamberts Law, Beer-Lamberts law, validity of Beer- Lamberts law.	**4**
	References: **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.** Samuel Glasstone, An iIntroduction to Electrochemistry, vol.1,2,3 acmillan Publishing Co., New Delhi(2001) **6.** C. N. Banwell, E. M. MaCASH, Fundamentals of MolecularSpectroscopy,Fourth Edition.	

SEMESTER-II

COURSE TITLE:- INORGANIC & ORGANIC CHEMISTRY-II

Course Code: S107 CHP

Pre-requisites:

Knowledge of concepts of qualitative analysis, Acid-Base theories and Chemical bond and reactivity, basic concepts of organic chemistry.

Course Objectives:

To introduce students to

- 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.

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

- 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.

Course Content

UNIT	Description	Lectures
I	**2.1 Concept of Qualitative Analysis (4L):** 2.1.1 Testing of Gaseous Evolutes, 2.1.2 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). 2.1.3 Precipitation Equilibria, 2.1.4 Formation of precipitates like AgCl, AgBr, AgI and $BaSO_4$ Effect of following terms on precipitation of ionic compounds.– 1) Common ions 2) Uncommon ions, 3) Oxidation states, 4) Buffer action, 5) Complexing agents (Balanced chemical equations) **2.2 Acid Base Theories (4L):** Arrhenius, Lowry- Bronsted, Lewis, Solvent – Solute concept of acids and bases, Usanovich concept, Hard and Soft acids and bases, Applications of HSAB.	**15**

	2.3 Chemical Bond and Reactivity (3L): Types of chemical bond, comparison between ionic and covalent bonds, polarizability (Fajan's Rule), basic VSEPR theory for ABn type molecules with and without lone pair of electrons and limitations of VSEPR theory.	
	2.4 Oxidation Reduction Chemistry: (**4L**) 2.4.1 Introduction, Reduction potentials, 2.4.2 **Redox potentials: half reactions**; balancing redox equations. 2.4.3 Introduction to **Frost Diagrams , Latimer Diagram** 2.4.4 **Applications of Redox Chemistry**; Redox reagents in Volumetric analysis; a) I_2 b) $KMnO_4$	
II	**2.1.1 Carbon-Carbon sigma bonds (6L):** **Chemistry of alkanes:** Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity. **2.1.2 Carbon-Carbon pi bonds:** **Formation of alkenes and alkynes by elimination reactions:** Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. **Reactions of alkenes:** Electrophilic additions and their mechanisms (Markownikoff/ Anti-Markownikoff addition), Mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.	**15**
	2.2 Aromatic Hydrocarbons (5L):	
	Aromaticity: Hückel'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-Craft alkylation/acylation with their mechanism, Directing effects of the groups using distribution of electron density concept.	
	2.3 Stereochemistry-II (4L):	
	Relative and absolute configuration: D/L, Erythro/Threo and R/S designations, Methods of naming geometric isomers – E/Z and Syn/Anti designations	
	(**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. (PearsonEducation). 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 andApplications, Second Edition.	

SEMESTER-II

COURSE TITLE: CHEMISTRY PRACTICAL -2

Course Code: S108CHP

Expected Leaning Outcome: On successful completion of this course learners will be able to:

1. Handle Electronic Balance for Various Experiments.
2. Measure accurate Volume and Analysis for Volumetric Analysis through experiments.
3. Prepare some Organic Derivatives and their Percentage Yield with accurate melting point.

List of the experiments:

Physical Chemistry Experiments
1. To determine the rate constant for the saponification reaction between ethyl acetate and NaOH.
2. To verify Beer-Lambert's law, using $KMnO_4$ solution by colorimetric method.
3. To standardize commercial sample of HCl using borax and to write material safety data of the chemicals involved.
Inorganic Chemistry Experiments
1. Qualitative analysis: (at least 4 mixtures to be analyzed) Semi-micro inorganic qualitative analysis of a sample containing two cations and two anions. Cations (from amongst): Pb^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Cu^{2+}, Cd^{2+}, Fe^{2+}, Ni^{2+}, Mn^{2+}, Mg^{2+}, Al^{3+}, Cr^{3+}, K^+, NH_4^+ Anions (from amongst): CO_3^{2-}, S^{2-}, $SO3^{2-}$, $NO2^-$, $NO3^-$, Cl^-, Br^-, I^-, $SO4^{2-}$, $PO4^{3-}$ (Scheme of analysis should avoid use of sulphide ion in any form for precipitation / separation of cations.)
2. Gravimetric analysis: a) To determine the percent purity of sample of $BaSO_4$ containing NH_4Cl. b) To determine the percent purity of ZnO containing $ZnCO_3$.
Organic Chemistry Experiments
1. Characterization of organic compound containing C, H, (O), N, S, X elements. (minimum 6 compounds)
Reference Books: **1.** Systematic experimental Physical chemistry – T. K. Chondhekar & S.W. Rajbhoj, Anjali Publications, Aurangabad**.** **2.** Experiments in chemistry – D.V. Jahagirdhar,Himalaya Publishing House. **3.** Spectrometric Identification of Organic Compounds- R.M.Silverstein, G.C.Bassler, Wiley: New York,5th edition. **4.** Experiments and Techniques in Organic Chemistry-D.J.Pasto, C.R.Johnson, Prentice-Hall: Englewood Cliffs.

All Experiments are compulsory for the Semester-II. Experiments must be written in Journa**l**. Certified journal is a must to be eligible for appearing term end examination.

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** basedon **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 marls

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

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
	Total Marks	**50**

Committee for Creation of Syllabus

Sr. No.	Name	College Name	Designation	Signature
1	Asso. Prof. S.L.Vairage	S.P.K.Mahavidyalaya, Sawantwadi	Chairman BOS	
2	Dr. D.B.Shinde	S.P.K.Mahavidyalaya, Sawantwadi	Member	
3	Dr. U.C.Patil	S.P.K.Mahavidyalaya, Sawantwadi	Member	
4	Dr. A.P.Nikum	S.P.K.Mahavidyalaya, Sawantwadi	Member	
5	Dr. Y.A.Pawar	S.P.K.Mahavidyalaya, Sawantwadi	Member	
6	Prof.Rashinkar Gajanan S.	Shivaji University, Kolhapur	Subject Expert Nominated by AC other University	
7	Prof. Deshmukh Shamkumar P	Dayanand college, Solapur	Subject Expert Nominated by AC other University	
8	Dr. Sankpal Sagar T.	Athalye Sapre Pitre College,Devrukh	Expert Nominated by VC	
9	Dr. Sonawane Atul E	Vice President (Tech) Indo Amines, Ltd Mumbai	Representative from Industry	
10	Mr. Parab Prathamesh P	S.P.K.Mahavidyalaya, Sawantwadi	Post Graduate Meritorious Alumini	
11	Dr. Disale Shamrao T.	Kankavli College, Kankavli	Expert from outside the college	

S. Z. S. P. Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA SAWANTWADI

DIST: SINDHUDURG- 416 510, MAHARASHTRA

Syllabus for Approval

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

(Minor Course)

SEMESTER-II

w.e.f. Academic Year 2023-24

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. CHEMISTRY (MINOR COURSE)
2.	Eligibility for Admission	12th 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 2023-2024

Date:

Signature
HoD,
Dept. of Chemistry

Shri Pancham Khemraj Mahavidyalaya, Sawantwadi

Proposed First Year Curriculum as per NEP 2020

Department of Chemistry

Proposed Structure for Major / Minor/OE/VSE/SEC/VEC/IKS/VEC

Semester	Paper Code	Paper Title	Type	Credits
I (Level 4.5)	**S101CHT (Major)**	Physical and AnalyticalChemistry-I	**Theory**	**2**
	S102CHT (Major)	Inorganic and OrganicChemistry -I	**Theory**	**2**
	S103CHP (Major)	Basic Chemistry Practical-I	**Practical**	**2**
	S104CHT (Minor)	Fundamental Chemistry-I: Physical and AnalyticalChemistry-I	**Theory**	**2**
	S105CHT (Minor)	Fundamental Chemistry – II: Inorganic and OrganicChemistry -I	**Theory**	**2**
	CHOE101 (GE/OE)	Cosmetics (सौंदर्य प्रसाधने)	**Generic Ele**	**2**
	CHVS101 (VSC)	Experimental Chemistry-I	**Voc. Skill**	**2**
	CHSE101 (SEC)	Industrial Chemistry-I	**Skill**	**2**
II (Level 4.5)	**S106CHT (Major)**	Physical and AnalyticalChemistry-II	**Theory**	**2**
	S107CHT (Major)	Inorganic and OrganicChemistry -II	**Theory**	**2**
	S108CHP (Major)	Basic Chemistry Practical-II	**Practical**	**2**
	S109CHT (Minor)	Fundamental Chemistry-I : Physical and AnalyticalChemistry-II	**Theory**	**2**
	S110CHT (Minor)	Fundamental Chemistry-II : Inorganic and OrganicChemistry -II	**Theory**	**2**
	S111CHP (Minor)	Experimental Chemistry-II	**Practical**	**2**
	CHOE102	Perfumery (सुगंधित द्रव्ये)	**Generic Ele.**	**2**
	CHOE103	Environmental Science (T+P)	**Open Ele.**	**2**
	CHSE102 (SEC)	Industrial Chemistry -II	**Skill Enh.**	**2**
	CHIK101	ALCHEMY	**IKS**	**2**

PREAMBLE:

S. P. K. Mahavidyalaya, Sawantwadi (Autonomous) believes in implementing several measures to bringequity, 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 oflearners.

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 helpthe student have a firm grip on the theoretical concepts through relevant experiments in each course.

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 a 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 reviewof 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 forsocietal 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 forsocietal 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.

DEPARTMENT OF CHEMISTRY

Syllabus

Proposed Syllabus for CBCS

F. Y. B. Sc.: Minor Chemistry

Structure of the Course:

The structure of major courses (with codes) for Semester -I and II for F. Y. B. Sc. (Chemistry) NEP-2020 is given below

MINOR SUBJECTS

Semester	Course Code	Course title	No. of Credits	No of Lectures In Hours
II	**S109CHT (Minor)**	Physical and AnalyticalChemistry-II	**2**	30
	S110CHT (Minor)	Inorganic and OrganicChemistry -II	**2**	30
	S111CHP (Minor)	Chemistry Practical-II	**2**	60

SEMESTER-II

Course Title: - Physical and Analytical Chemistry-II

Course Code: S109 CHT

Pre-requisites:

Knowledge of Chemical Thermodynamics, Gaseous State, Liquid State, Electrochemistry, Molecular Spectroscopy.

Course Objectives: To introduce students to

1. Understand the direction of reactions and variation of thermodynamic properties.
2. Learn about the ideal and real gases and its behaviors.
3. Evaluate physical properties of liquid state.
4. Understand basic electrochemistry and its applications in the electrolytic solutions
5. Determine equilibrium constant and to predict direction of chemical reactions.
6. Learn the interaction of light with matter with respect to different phenomena.

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

1. Understand the ideal and non-ideal behavior of gaseous reactions.
2. Differentiate various thermodynamic properties and its applications.
3. Evaluate different thermodynamic parameters by heat of reaction data.
4. Compare the weak and strong electrolytes based on conductance measurement
5. Determine the thermodynamic properties and its variations with temperature and pressure.
6. Determine the conductance of solutions and its applications.
7. Differentiate the various spectroscopic techniques.

Course Content

UNIT	Description	Lectures
I **(Physical Chemistry)**	**1.1 Chemical Thermodynamics -II:** Second law of thermodynamics, concept of entropy, Physical significance of entropy, Concept of free energy, Helmholtz and Gibbs free energy, Variation of free energy with temperature and pressure, Spontaneity and Physical significance of free energy.	**5 L**
	1.2 Gaseous State: 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, Critical phenomena, Relation between critical constants and vander Waals constants. (Numerical problems expected wherever necessary)	**6L**

	1.3 Liquid State: Surface tension: Introduction, methods of determination of surface tension by drop number method Viscosity: Introduction, coefficient of viscosity, relative viscosity, specific viscosity, reduced viscosity, determination of viscosity by Ostwald viscometer Refractive index: Introduction, molar refraction and polarizability, determination of refractive index by Abbe's refractometer. (Numerical problems expected wherever necessary)	**4L**
	References: 1. Atkins, P.W. and Julio de Paulo, Atkins'Physical Chemistry, Oxford University Press, UK, Indian Edition 2. Samuel Glasstone, Thermodynamic for chemist, East West PressPvt.Ltd, Edition 3, (1947) ISBN: 9788176710145 3. K. J. Laidlar, Chemical Kinetics, Third Edition, PearsonPublication, (2007) 4. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007). 5. Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004). 6. K.L. Kapoor A textbook of Physical Chemistry 3rd Ed. vol.1,2,3 Macmillan Publishing Co., New Delhi (2001)	
II **(Analytical Chemistry)**	**2.1. Chemical Equilibrium:** Reversible and irreversible reactions, equilibrium constants (Kc and Kp), relationship between Kc and Kp. Thermodynamic derivation of equilibrium constant (Numerical problems expected wherever necessary)	**4L**
	2.2. Electrochemistry-I: Conductance, specific conductance, equivalent conductance, molar conductance, Variation of molar conductance with concentration of strong and weak electrolyte. Reversible electrodes, Electrode potential, standard electrode potential (Numerical problems expected wherever necessary).	**7L**
	2.3. Molecular Spectroscopy: Electromagnetic radiation, electromagnetic spectrum, Planck's equation, Interaction of electromagnetic radiation with matter; Absorption, Emission, Scattering, Electronic, Vibrational and Rotational transitions, Beers Law, Lamberts Law, Beer-Lamberts law, validity of Beer- Lamberts law.	**4L**

References:

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. Samuel Glasstone, An introduction to Electrochemistry,

5. K.L. Kapoor A textbook of Physical Chemistry 3rd Ed. vol.1,2,3acmillan Publishing Co., New Delhi(2001)

6.C. N. Banwell, E. M. MaCASH, Fundamentals of MolecularSpectroscopy, Fourth Edition.

SEMESTER-II

Course Title:- Inorganic & Organic Chemistry-II

Course Code: S110 CHP

Pre-requisites:

Knowledge of concepts of qualitative analysis, Acid-Base theories and Chemical bond and reactivity, basic concepts of organic chemistry.

Course Objectives:

To introduce students to

1. Systematic and coherent understanding of the fundamental concepts of qualitative analysis.
2. Importance of reagent papers for testing the radicals.
3. Understand the various theories of Acids and Bases.
4. Concepts of Chemistry of Aliphatic Hydrocarbons.
5. Comparison between Aliphatic and Aromatic compounds.
6. Important characteristics of organic compounds.
7. Concepts of projection formulae and inter-conversion.

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

1. Understand the basic theories of Acids and Bases.
2. Students will be able to understand the concept of common ion effect.
3. Comparison between ionic and covalent bonds.
4. Classify compounds into aromatic, non –aromatic and anti aromatic.
5. Predict the correct method of preparation of alkenes, alkynes.
6. Identify the product and complete the reaction of alkenes and alkynes.
7. Carry out interconversion of projection formulae.

Course Content

UNIT	Description	Lectures
I (Inorganic Chemistry)	**2.1 Concept of Qualitative Analysis (8L):**	**15L**
	Testing of Gaseous Evolutes, Role of Papers impregnated with ents in qualitative analysis (with reference to papers impregnated with starchiodide, potassium dichromate, lead acetate, dimethylglyoxime and oxine reagents). Precipitation equilibria, Formation of precipitates like AgCl, AgBr, AgI and BaSO4 effect of common ions, uncommon ions, oxidation states, buffer action, complexing agents on precipitation of ionic compounds. (Balanced chemical equations)	
	2.2 Acid Base Theories (4L): Arrhenius, Lowry- Bronsted, Lewis, Solvent – Solute concept of acids and bases, Usanovich concept, Hard and Soft acids and bases, Applications of HSAB.	
	2.3 Chemical Bond and Reactivity (3L): Types of chemical bond, comparison between ionic and covalent bonds, polarizability (Fajan's Rule), basic VSEPR theory for ABn type molecules with and without lone pair of electrons and limitations of VSEPR theory.	

	Reference Books: 1. Concise Graduate Chemistry – I, II, III & IV, University Text Book of Chemistry, University of Mumbai. 2. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991. 3. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry, Oxford, 1970 4. Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962. 5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India	
II (Organic Chemistry)	**2.1 Chemistry of Aliphatic Hydrocarbons:**	**15 L**
	2.1.1 Carbon-Carbon sigma bonds (6L): **Chemistry of alkanes:** Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity. **2.1.2 Carbon-Carbon pi bonds:** **Formation of alkenes and alkynes by elimination reactions:** Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. **Reactions of alkenes:** Electrophilic additions and their mechanisms (Markownikoff/ Anti-Markownikoff addition), Mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.	
	2.2 Aromatic Hydrocarbons (5L):	
	Aromaticity: Hückel'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-Craft alkylation/acylation with their mechanism, Directing effects of the groups using distribution of electron density concept.	
	2.3 Stereochemistry-II (4L):	
	Relative and absolute configuration: D/L, Erythro/Threo and R/S designations, Methods of naming geometric isomers – E/Z and Syn/Anti designations	

	(**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. (PearsonEducation). 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.	

SEMESTER-II

Course Title: Chemistry Practical -2

Course Code: S111 CHP

Leaning Outcome: On successful completion of this course learners will be able to:

1. Handle Electronic Balance for Various Experiments.
2. Measure accurate Volume and Analysis for Volumetric Analysis through experiments.
3. Prepare some Organic Derivatives and their Percentage Yield with accurate melting point.

List of the experiments:

Physical Chemistry Experiments
1. To determine the rate constant for the saponification reaction between ethyl acetate and NaOH.
2. To verify Beer-Lambert's law, using $KMnO_4$ solution by colorimetric method.
3. To standardize commercial sample of HCl using borax and to write material safety data of the chemicals involved.
Inorganic Chemistry Experiments
1. Qualitative analysis: (at least 4 mixtures to be analyzed) Semi-micro inorganic qualitative analysis of a sample containing two cations and two anions. Cations (from amongst): Pb^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Cu^{2+}, Cd^{2+}, Fe^{2+}, Ni^{2+}, Mn^{2+}, Mg^{2+}, Al^{3+}, Cr^{3+}, K^{+}, NH_4^{+} Anions (from amongst): CO_3^{2-}, S^{2-}, SO_3^{2-}, NO_2^{-}, NO_3^{-}, Cl^{-}, Br^{-}, I^{-}, SO_4^{2-}, PO_4^{3-} (Scheme of analysis should avoid use of sulphide ion in any form for precipitation / separation of cations.)
2. Gravimetric analysis: a) To determine the percent purity of sample of $BaSO_4$ containing NH_4Cl. b) To determine the percent purity of ZnO containing $ZnCO_3$.
Organic Chemistry Experiments
1. Characterization of organic compound containing C, H, (O), N, S, X elements. (minimum 6 compounds)
Reference Books: **1.** Systematic experimental Physical chemistry – T. K. Chondhekar & S.W. Rajbhoj, Anjali Publications, Aurangabad**.** **2.** Experiments in chemistry – D.V. Jahagirdhar,Himalaya Publishing House. **3.** Spectrometric Identification of Organic Compounds- R.M.Silverstein, G.C.Bassler, Wiley: New York,5th edition. **4.** Experiments and Techniques in Organic Chemistry-D.J.Pasto, C.R.Johnson, Prentice-Hall: Englewood Cliffs.

All Experiments are compulsory for the Semester-II. Experiments must be written in Journa**l**. Certified journal is a must to be eligible for appearing term end examination.

EXAMINATION PATTERN FOR MAJOR/MINOR 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 marls

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

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
	Total Marks	**50**

AC ITEM NO. :**AC**

S. Z. S. P. Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA SAWANTWADI

DIST: SINDHUDURG- 416 510, MAHARASHTRA

SKILL ENHANCEMENT COURSE (SEC)

SEMESTER-II

Syllabus for Approval

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

w.e.f. Academic Year 2023-24

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 a 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 reviewof 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 forsocietal 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 forsocietal 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 II** for F.Y.B.Sc.(Chemistry) NEP-2020 is given below:

SKILL ENHANCEMENT COURSE (SEC)

Semester	Course Code	Course Title	No of Credits	No of Lectures in Hours
II	**SECHE 02**	Industrial Chemistry-II :Quantitative Analysis	02	30

SEMESTER-II

Skill Enhancement Course

Course Title: Industrial Chemistry-II: Quantitative Analysis

Course Code: SECHE 02

Course Objectives: To Introduce students to

1. Understand basic principles involved in quantitative analysis.
2. Learn the basic theory of gravimetric analysis.
3. The basic terms related to titrimetric analysis.
4. Compare different methods of determination of end point.

Course Outcomes:

After completion of this course, learners will be able to

1. Determine the amount of analyte in a chemical analysis.
2. Understand the principles of titrimetric analysis.
3. Distinguish between various types of titrimetric analysis.

Practical in Skill Enhancement Course

Practical's in Quantitative Analysis [Credit-02]

Unit	Description of experiments	Lectures in hours
	1.1 1. Determine the pH and nature of the salt solutions by using pH papers	**60 L**
	2. Study the variation in pH of Strong Base and Strong Acid titrimetric ally	
I	**1.2 TITRIMETRIC ANALYSIS**	
	1. To determine total hardness of water**.**	
	2. To estimate the amount of ibuprofen present in the given samples	
	3. To determine the amount of copper in given sample by iodometric titration.	
	4. To estimate the Acid neutralizing capacity of a given antacid	
	5. To Estimate the amount of Aspirin in commercial sample	
	1.3 Preparation	
	1. To prepare the Nickel (II) dimethyl glyaxomato by green method	
	2. To Prepare Succinic Anhydride	
	3. Preparation of Barium Chromate	
	4. To Prepare β–napthol aniline from aniline (Orange Red Dye)	
	5. To Prepare dibenzalacetone	
	1.4 Study of Analytical Tools	
	1.5 To determine the density of different liquid samples using specific gravity bottle	
	References: 1. College Inorganic Chemistry, Himalaya Publishing House 2. Concepts in Inorganic Chemistry, Chetana Publications Pvt. Ltd. 3. Vogel's Textbook of Practical Organic Chemistry, Fifth Edition, B. S. Furniss	

Examination Pattern
Distribution of Marks in SEC Practical Examination

Sr. No.	Particulars	Marks
1	Experiment	30
	Viva voce	10
2	Certified journal	10
	Total Marks	**50**

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SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA 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 2023-24

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

University of Mumbai

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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	12th 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 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 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- II

INDIAN KNOWLEDGE SYSTEM (IKS)

AlCHEMY- Chemistry of Ancient India: CHIK-01 (Credit-02)

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

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
	Total Marks	20

B) External Assessment:

Sr. No.	Particulars	Marks
1	One offline test	30
	Total Marks	30

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

Syllabus for Approval

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

OPEN ELECTIVE: SEMESTER-II

PERFUMERY: OECHE 02

w.e.f. Academic Year 2023-24

Choice Based Credit System(CBCS) 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	12th 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 Major / Minor

Semester	Paper Code	Paper Title	Type	Credits
II	OECHE-02 (GE/OE)	Perfumery (□□□□□□□ □□□□□□□□)	T+P	2

Course Outcomes:

Perfumery 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 filed work. The course manly 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 fíelds 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:

- To understand the basic concepts of perfumes and perfume chemistry.
- To learn the basics of cosmetics, comaceuticals and insight into hair-care products.
- To learn the basic concepts skin care cosmetics. To understand the basic concepts involving the characterization techniques used for cosmetics and perfume
- Discuss the various cosmetics products w.r.t. raw materials, large scale manufacture and functional and physiochemical evaluation.
- Know the regulatory guidelines and sensorial assessment for cosmetics.

SEMESTER-II
OPEN ELECTIVE: OECHE 02
PERFUMERY: OECHT 02 (Credit 02) [30 L]

	Syllabus
OECH02	Perfumery ➢ Raw materials in Perfumery ➢ History of Perfumes ➢ Indian and Global Perfumery Trends Powders, Emulsifiers, Thickeners and Gums Essential oils and their importance in Perfumery industries with reference to Eugenol, Geraniol, sandalwood oil, rose oil, 2-phenyl ethyl alcohol, Jasmone, Civetone, Muscone.
	Reference: 1. Complete Beauty Book by Helen Foster 2. Vogue- Body and Beauty Book by Bronwen Meredith 6. A Guide for Health & Beauty Therapist Vol.-1 Face, hands and feet by Gaynor Winyard 3. Foucher's Perfumes, Cosmetics and Soaps – 10^{th} Edition

Scheme of Examination

A) Internal Assessment of 20 Marks:

Sr. No.	Particulars	Marks
1	One Assignment/test	10
2	Class attendance	05
3	One subject based activity/viva based on the course	05
	Total Marks	**20**

External Assessment of 30 Marks:

Sr. No.	Particulars	Marks
1	One theory test	30
	Total Marks	**30**

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SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA SAWANTWADI

DIST: SINDHUDURG- 416 510, MAHARASHTRA

Syllabus for Approval

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

OPEN ELECTIVE: SEMESTER-II

ENVIRONMENTAL SCIENCE: OECHE 03

(□□□□□□□□ □□□□□□□)

w.e.f. Academic Year 2022-23

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

University of Mumbai

S. Z. S. P. Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA

SAWANTWADI

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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	12th 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

Syllabus Structure for Open Elective

Semester	Paper Code	Paper Title	Type	Credits
II	**OECHE-03 (GE/OE)**	Environmental Science (□□□□□□□□ □□□□□□□)	**T**	**2**

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 :

CO1 - Gain knowledge about environment and ecosystem.

CO2 - Students will learn about natural resource, its importance and environmental impacts of human activities on natural resource.

CO3-Gain knowledge about the conservation of biodiversity and its importance.

CO4 Aware students about problems of environmental pollution, its impact on human and ecosystem and control measures.

CO5- Students will learn about increase in population growth and its impact on environment

SEMESTER-II

OPEN ELECTIVE

ENVIRONMENT SCIENCE: OECHT 03 (Credit 02) [30 L]

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

Scheme of Examination

A) Internal Assessment of 20 Marks:

Sr. No.	Particulars	Marks
1	One Assignment/test	10
2	Class attendance	05
3	One subject based activity/viva based on the course	05
	Total Marks	**20**

External Assessment of 30 Marks:

Sr. No.	Particulars	Marks
1	One theory test	30
	Total Marks	**30**