Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Four Year B.Sc.Degree Program in CHEMISTRY

(Faculty of Science & Technology)

CBCS Syllabus

F.Y.B.Sc. (Chemistry) Semester -I

For Department of Chemistry

Tuljaram Chaturchand College, Baramati

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2023-2024

(Eligibility : 12th Science)

Title of the Programme: F.Y.B.Sc. (Chemistry)

Preamble

AES's Tuljaram Chaturchand College has made the decision to change the syllabus of across various faculties from June, 2023 by incorporating the guidelines and provisions outlined in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moralcapacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcome approach for the development of the students.By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2020 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Chemistry and related subjects, the Board of Studies in Chemistryat Tuljaram Chaturchand College, Baramati - Pune, has developed the curriculum for the first semester of F.Y.B.Sc.Chemistry, which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designed under the framework of the Choice Based Credit System (CBCS), taking into consideration the guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report, Government of Maharashtra's General Resolution dated 20th April and 16th May 2023, and the Circular issued by SPPU, Pune on 31st May 2023.

The CBCS Course curriculum of the discipline of Chemistry is well designed and very promising. A degree in Chemistry subject equips students with the knowledge and skills necessary for a diverse range of fulfilling career paths.The core course would help to enrich the subject knowledge of the students and increase their confidence level in the field of both academia and industry. Open electives (OE) make sustainable integration among the various

interdisciplinary courses to fulfil the vision and mission of designing the course. The introduction of Skill Enhancement Courses (SEC) would help to gain more powerful knowledge not only in their core Chemistry subject but also in interrelated multidisciplinary subjects both theoretically and practically. The inclusion of Skill Enhancement Course (SEC) and Vocational Skill Course (VSC) has brought an opportunity in front of students to gain knowledge on various naturally and industrially important useful materials and also helps them to familiar and expert in handling different chemistry based software after proper training. In brief the student graduated with this type of curriculum would be able to disseminate subject knowledge along with necessary skills to suffice their capabilities for academia, research, entrepreneurship and industry. By acquiring these comprehensive skills and knowledge, graduates are well-prepared to embark on rewarding careers that contribute to a better understanding of the subject and address the challenges of our ever-changing lifestyle.

Overall, revising the Chemistry syllabus in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

Programme Specific Outcomes (PSOs)

PSO1: Core competency: The chemistry graduates are expected to gain knowledge of the fundamental concepts of chemistry and applied chemistry through theory and practical. These fundamental concepts would be reflected in the latest understanding of the field to keep continues its progression.

PSO2: Communication skills: Chemistry graduates are expected to possess minimum standards of communication skills to read and understand documents so that they can solve their problems very methodically, independently and with logical argument. Graduates are expected to build good communication skill so that they can easily share their idea/finding/concepts to others.

PSO3: Critical thinking:Chemistry graduates are expected to achieve critical thinking ability to design, carry out, record and analyse the results of chemical reactions. They can have that

much potential and confidence that they can overcome many difficulties with the help of their sharp scientific knowledge and logical approaches.

PSO4: Psychological skills: Chemistry graduates are expected to possess basic psychological skills so that they can deal with individuals and students of various socio-cultural, economic and educational levels. Psychological skills are very important for proper mind setting during performing, observing and giving conclusion of a particular reaction. It is also important for self-compassion, self-reflection, interpersonal relationships, and emotional management.

PSO5: Problem-solving: Graduates are expected to be well trained with problem-solving philosophical approaches that are pertinent across the disciplines.

PSO6: Analytical skill development and job opportunity: Chemistry graduates are expected to possess sufficient knowledge how to synthesize a chemical compound and perform necessary characterization and analysis in support of the formation of the product by using modern analytical tools and advanced technologies. Because of this course curriculum chemistry graduates have lot of opportunity to get job not only in academic and administrative field but also in industry.

PSO7: Research motivation: Chemistry graduates are expected to be technically well trained with modern devices and Chemistry based software and has powerful knowledge in different disciplines of Chemistry so they can easily involve themselves in theory and laboratory-based research activities.

PSO8: Teamwork:Graduates are expected to be team players, with productive co-operations involving members from diverse socio-cultural backgrounds.

PSO9: Digital Literacy: Graduates are expected to be digitally literate for them to enroll and increase their core competency via e-learning resources such as MOOC and other digital tools for lifelong learning.

PSO10: Social Awareness: As an inhabitant of this green world it is our duty to make our planet clean and suitable for living to all. In this context Chemistry graduates are expected to be more aware about finding green chemical reaction routes for sustainable development. They are expected to maintain good laboratory practices and safety.

Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Board of Studies (BOS) in Chemistry

From 2022-23 to 2024-25

Sr.No.	Name	Designation
1.	Prof. Dr. Sanjay R. Kale	Chairman
2.	Mr. Shrikrushna T. Salunke	Member
3.	Mr. Bhimrao R. Torane	Member
4.	Mr. Maharudra A. Dudhe	Member
5.	Mr. Ravikiranamrut R. Gandhi	Member
6.	Dr. Vaibhav P. Landge	Member
7.	Dr. Yogesh N. Indulkar	Member
8.	Dr. Rahul S. Bhondwe	Member
9.	Dr. Nilam C. Dige	Member
10.	Prof.Dr. Namdev M. Bhujbal	Vice-Chancellor Nominee
11.	Prof. Dr. Dattaprasad M. Pore	Expert from other University
12.	Dr. Vijay T. Vader	Expert from other University
13.	Mr. Nitin B. Gawade	Industry Expert
14.	Dr. Hanmant R. Gurav	Meritorious Alumni
15.	Mr. Ajay C. Pomane	Student Representative
16.	Mr. Prathamesh P. Bhosale	Student Representative

Credit Distribution Structure for F.Y.B.Sc.-2023-2024 (Chemistry)

Level	Semester	Major		Minor	OE	VSC, SEC, (VSEC)	AEC, VEC, IKS	OJT, FP, CEP, CC, RP	Cum. Cr/Sem	Degree/ Cum. Cr.
		Mandatory	Electives							
4.5										UG Certificate 44 credits
	I	**CHE-101-MJM** Physical and Inorganic Chemistry – I (2 credits)	--	--	**CHE-116-OE** Chemistry of Soil and Water (2 credits)	**CHE-121-VSC** Introduction to Agricultural Chemistry (2 credits)	**ENG-131-AEC** Functional English-I (2 credit)	**CC1** (2 credit)	22	
		CHE-102-MJM Organic and Inorganic Chemistry – I (2 credits)			**CHE-117-OE** Chemical analysis of Soil and Water (2 credits)	**CHE-126-SEC** Organic Qualitative Analysis (2 credits)	**CHE-135-VEC** Environmental Science (2 credits)			
		CHE-103-MJM Chemistry Practical – I (2 credits)					**CHE-137-IKS** Indian Heritage of Chemistry (2 credits)			
	II	**CHE-151-MJM** Physical and Inorganic Chemistry – II (2 credits)	--	**CHE-161-MN** Basic Analytical Chemistry (2 credits)	**CHE-166-OE** Introduction to Dairy Chemistry (2 credits)	**CHE-171-VSC** Computation in Chemistry (2 credits)	**ENG-181-AEC** Functional English-II (2 credit)	**CC2** (2 credit)	22	
		CHE-152-MJM Organic and Inorganic Chemistry – I				**CHE-176-SEC** Inorganic Qualitative	**CHE-185-VEC** Digital and Technological			

		(2 credits) **CHE-153-MJM** Chemistry Practical – II (2 credits)			**CHE-167-OE** Chemical analysis of Milk and Milk products (2 credits)	Analysis (2 credits)	Solution (2 credits)			
	Cum Cr.	**12**	--	**02**	**08**	**08**	**10**	**04**	**44**	

*** 1 credit = 15 Hr.**

Course Structure for F.Y.B.Sc..Chemistry(2023 Pattern)

Sem	Course Type	Course Code	Course Name	Theory / Practical	Credits
I	Major Mandatory	CHE-101-MJM	Physical and Inorganic Chemistry –I	Theory	02
	Major Mandatory	CHE-102-MJM	Organic and Inorganic Chemistry – I	Theory	02
	Major Mandatory	CHE-103-MJM	Chemistry Practical – I	Practical	02
	Open Elective (OE)	CHE-116-OE	Chemistry of Soil and Water	Theory	02
	Open Elective (OE)	CHE-117-OE	Chemical analysis of Soil and Water	Practical	02
	Vocational Skill Course (VSC)	CHE-121-VSC	Introduction to Agricultural Chemistry	Theory	02
	Skill Enhancement Course (SEC)	CHE-126-SEC	Organic Qualitative Analysis	Practical	02
	Ability Enhancement Course (AEC)	ENG-131-AEC	Functional English-I	Theory	02
	Value Education Course (VEC)	CHE-135-VEC	Environmental Science	Theory	02
	Indian Knowledge System (IKS)	CHE-137-IKS	Indian Heritage of Chemistry	Theory	02
	Co-curricular Course (CC)	CC1	To be selected from the Basket	Theory	02
	Total Credits Sem I				**22**
II	Major Mandatory	CHE-151-MJM	Physical and Inorganic Chemistry –II	Theory	02
	Major Mandatory	CHE-152-MJM	Organic and Inorganic Chemistry –II	Theory	02
	Major Mandatory	CHE-153-MJM	Chemistry Practical – II	Practical	02
	Minor	CHE-161-MN	Basic Analytical Chemistry	Theory	02
	Open Elective (OE)	CHE-166-OE	Introduction to Dairy Chemistry	Theory	02
	Open Elective (OE)	CHE-167-OE	Chemical analysis of Milk and Milk products	Practical	02
	Vocational Skill Course (VSC)	CHE-171-VSC	Computation in Chemistry	Practical	02
	Skill Enhancement Course (SEC)	CHE-176-SEC	Inorganic Qualitative Analysis	Practical	02
	Ability Enhancement Course (AEC)	ENG-181-AEC	Functional English-II	Theory	02
	Value Education Course (VEC)	CHE-185-VEC	Digital and Technological Solution	Theory	02
	Co-curricular Course (CC)	CC2	To be selected from the Basket	Theory	02
	Total Credits Semester II				22
	Cumulative Credits Semester I and Semester II				**44**

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc Chemistry (2023 Pattern)

Name of the Programme: B.Sc. Chemistry

Programme Code: USCHE

Class: F.Y.B.Sc

Semester: I

Course Type: Major Mandatory (Theory)

Course Code: CHE-101-MJM

Course Title: Physical and Inorganic Chemistry I

No. of Credits: 02

No. of Teaching Hours: 30

Course Objectives:

1. To introduce basic concepts in atomic structure: Bohr model, energy level diagrams, hydrogen spectra, basic of quantum chemistry.
2. To adequate students with states of matter and their properties.
3. To learn details about gaseous and liquid states, the related mathematical expressions and their applications
4. To understand details about solid state, the different crystal systems and the mathematical expressions with application
5. To identify the basics of mole concept and requirements in Chemical Stoichiometry
6. To aware the students about methods of expressing concentration of solution and principle of standardization of solution
7. To learn basic of redox reactions and balancing of them by different methods

Course Outcomes:

By the end of the course, students will be able to:

CO1. This course makes understanding of assumptions of Bohr model, atomic spectra, and related mathematical calculations.

CO2. Student should able to understand the principles of quantum mechanics and its applications.

CO3. Student will be able to analyze failure of classical mechanics and

importance of quantum mechanics

CO4. Student should able to explain the different states of matter, their properties and measurement

CO5. Student will be familiar to liquid crystals and their applications

CO6. Students should able to know concepts like mole, molecular weight, equivalent weight, GMV relationship and their applications in chemistry.

CO7. Student should be aware with preparation and standardization of solution and their use in chemical analysis.

CO8. Student will be understand the balancing the redox reactions by different methods.

Topics and Learning Points

Teaching Hours

UNIT 1: Atomic structure **07**

Historical perspectives of the atomic structure; Bohr's theory, Derivation of atomic radius and energy, energy level diagram of hydrogen atom and limitations of Bohr's theory, atomic spectrum of hydrogen atom, Origin of Quantum Mechanics: Failure of Classical mechanics-black body radiation, photoelectric effect, electron diffraction, Quantization of energy, de Broglie's hypothesis, Heisenberg's uncertainty principle, Numerical

UNIT 2: Gaseous and Liquid States **07**

Introduction: States of matter and their properties.

Gaseous state: Significance of ideal and kinetic gas equation (no derivation),

Real Gases-Compressibility factor, van der Waal's equation of state, critical constants, correlation between critical constants and van der Waal's constants.

Liquid state: Properties of liquids, Vapour pressure and its measurement by isoteniscopic method, Viscosity and its measurements by Ostwald's viscometers,

Liquid crystals: Introduction, their types and applications in various fields.

UNIT 3: Solid State **06**

Definition of space lattice, unit cell;

Laws of crystallography – (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices (iii) Law of symmetry, Symmetry elements in crystals.

Fundamental crystal systems, Characteristic of simple cubic, face-centered cubic and body centered cubic systems, Inter-planar distances in cubic crystals,

X-ray diffraction by crystals, Derivation of Bragg equation, Determination of crystal structure of NaCl, Numerical

UNIT 4: Chemical Stoichiometry **05**

Mole Concept-Determination of molecular weight by gram molecular volume relationship, problems based on mole concept. Methods of expressing concentration-strength, normality, molarity, molality, mole fraction, % w/v, % w/w, % v/v, ppt, ppm, ppb,

Standardization of solutions, primary and secondary standard substances, preparation of standard solutions of acids and bases, problems based on acid-base titrations only

UNIT 5: Oxidation–Reduction **05**

Definitions to related terms like oxidation, reduction, oxidizing agent, reducing agent, oxidation number, valency, Balancing of redox reactions using oxidation number method and ion electron method, Problems based on equivalent weight of oxidant and reductant.

References:

1. Physical Chemistry, P. W. Atkins, ELBS, 5th Edition.
2. Principles of Physical Chemistry, Marron and Prutton, 4th Edition.
3. Physical Chemistry, G. M. Barrow 4th Edition.
4. Quantum Chemistry, I. Levine, 5th Edition.
5. Essentials of Physical Chemistry, Bahl and Tuli,
6. Principles of Physical Chemistry, Puri, Sharma and Phathania
7. Mathematical Preparation of Physical Chemistry, F. Daniel, McGraw Hill.
8. Concise Inorganic Chemistry, J. D. Lee, 5th Edition
9. Concept and Models of Inorganic Chemistry, Douglus and Daniel, 3rd Edition
10. Inorganic Chemistry, James Hughey 1.

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc Chemistry (2023 Pattern)

Name of the Programme: B.Sc. Chemistry

Programme Code: USCHE

Class: F.Y.B.Sc

Semester: I

Course Type: Major Mandatory (Theory)

Course Code: CHE-102-MJM

Course Title: Organic and Inorganic Chemistry I

No. of Credits: 02

No. of Teaching Hours: 30

Course Objectives:

1. To know the fundamental concepts which govern the structure, bonding, properties and reactivity of organic molecules such as covalent character, hybridization, bond angles, bond energies, bond polarities and shapes of molecules.
2. Students are expected to know common and IUPAC names.
3. Students know the methods of preparation and chemical reactions of alkanes, alkenes, alkynes and homo cyclic, aromatic hydrocarbons and application of Huckels rule.
4. The students are expected to know structure, nomenclature, preparation and reactions of organic compounds.
5. To understand the use of possible reagents to bring about the given conversion with possible product and identify the major and minor products.
6. To know silent features of periodic table with reference to S-block elements (symbols electronic configuration, trends and properties).
7. To learn Separation method by using crown ether, compounds and applications of S block elements.

Course Outcomes:

By the end of the course, students will be able to:

CO1. This course makes understanding of structure, bonding, and reactivity of

organic molecules.

CO2. Students are able to draw of organic molecules, and organic compounds.

CO3. Students are expected to methods of preparation and chemical reactions of alkanes, alkenes, alkynes and aromatic hydrocarbons and application of Huckels rule.

CO4. Students should understand the basic properties of organic compounds

CO5. Students should know the method of naming organic compounds

CO6. To understand the aliphatic and aromatic hydrocarbons.

CO7. Students should know details about S block elements.

Topics and Learning Points

Teaching Hours

UNIT 1: Chemical Bonding and Reactivity of Organic Molecules **08**

Covalent bond, Hybridization - SP, SP^2 and SP^3 hybridization, Bond length, Bond angle, Bond energy, Inter and Intra molecular force, Inductive effects, Resonance effects, Steric effect and their applications.

UNIT 2: Chemistry of Hydrocarbons **12**

A. Alkanes :

Introduction, Nomenclature, Physical properties, Preparations of alkanes from G.R., Wurtz reaction and from alkenes, Reactions of alkanes- halogenation and pyrolysis of alkanes.

B. Alkene:

Introduction, Nomenclature,Physical properties,Preparations of Alkenesfrom alkyl halides and reduction of alkynes, Reactions of alkenes- Hydrogenation, Hydro-halogenation of alkenes, Ozonolysis.

C. Alkynes:

Introduction, Nomenclature, Physical properties, Preparation, Reactions of alkynes

D. Aromatic hydrocarbon:

Introduction to homo cyclic aromatic hydrocarbons (benzene), Classification, Kekules structure of benzene, Huckels rule of aromaticity, Reactions of benzene –Sulphonation, Nitration, Halogenation, Friedel Craft reactions.

UNIT 3: Chemistry of s-block elements **08**

Recapitulation of periodic table (salient features), special position of Hydrogen in the long form of periodic table, properties of S-block elements with reference to electronic configuration, extraction, trends in properties.

UNIT 4: Crown Ethers **02**

Introduction to crown ether and cryptans, separation of s- block elements using crown ethers.

References:

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Printice-Hall Of India Limited, New Delhi, 1992.
2. B. Y. Paula, Organic Chemistry, 3rd Edition, Pearson Education, Inc.(Singapore), New Delhi, reprint, 2002.
3. T. W. Graham Solomons, Organic Chemistry, 6th edition, John Wiley and sons, 1996.
4. Jerry March, Advanced Organic Chemistry, 4th Edition, John Wiley And Sons, New York, 1992.
5. S. H. Pine, Organic Chemistry, 5th Edition, Mcgraw Hill International Edition, Chemistry Series, New York, 1987.
6. Concise Inorganic Chemistry- J. D. Lee, 2nd Edition- Relevant pages.
7. Concept & model of Inorganic Chemistry- Douglas McDoniels, 3rd Edn.
8. New guide to Modern Valance Theory- G. I. Brown, 3rd Edn.
9. Inorganic Chemistry –James Hughey

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc Chemistry (2023 Pattern)

Name of the Programme: B.Sc. Chemistry

Programme Code: USCHE

Class: F.Y.B.Sc

Semester: I

Course Type: Major Mandatory (Practical)

Course Code: CHE-103-MJM

Course Title: Chemistry Practical I

No. of Credits: 02

No. of Teaching Hours: 60

Course Objectives:

1. To introduce chemical and laboratory safety.
2. To adequate students with graph of various functions.
3. To learn basic of chemistry practical from all the discipline of chemistry.
4. To learn the estimation of compounds.
5. To know the synthesis of derivatives.
6. To learn the volumetric analysis.
7. To know the preparation of solutions.

Course Outcomes:

By the end of the course, students will be able to:

CO1. Students will get advantage while performing experiment in laboratory in terms of safety.

CO2. Students will be able to apply mathematical knowledge in graphical representation of experimental data.

CO3. Basic experiments in all discipline of chemistry gives understanding of applications of theory which is learn in theory courses.

CO4. Students should able to prepare the organic derivatives.

CO5. Students should able to estimate the organic compounds volumetrically.

CO6. Develop the ability of solution preparation.

CO7. Develop the experimental skills.

Topics and Learning Points

Teaching Hours = Total 60

UNIT 1: Chemical and Lab Safety

1. Introduction to laboratory. (Do's and Don'ts in laboratory)
2. Precautions in handling of hazardous substances.
3. Safety symbols on label of pack of chemicals and its meaning.
4. Understanding of MSDS of few hazardous chemicals.

UNIT 2: Physical chemistry

1. Plotting of function (linear/logarithm/exponential function).
2. Determine the gas constant R in various units by eudiometer method.
3. Determine the relative viscosity of given organic liquids by viscometer.
4. Determine ΔH for the following chemical reactions

$Zn\ (s) + CuSO_4\ (aq) \rightarrow Cu(s) + ZnSO_4\ (aq)$

$3Mg\ (s) + 2FeCl_3\ (aq) \rightarrow 2Fe(s) + 3MgCl_2\ (aq)$

5. Determination of heat capacity of calorimeter for different volumes.

UNIT 3: Inorganic chemistry

1. Standardization of NaOH solution and find the strength of given HCl solution.
2. Standardization of $KMnO_4$ solution and find the strength of given solution.
3. Determine the hardness of water from a given water sample by EDTA method.
4. Analysis of mixed alkali by volumetric method.
5. Determine the number of water molecules of BaCl2.2H2O/MgSO4.7H2O.

UNIT 4: Organic chemistry

1. Determine the amount of acetic acid in commercial vinegar volumetrically.
2. Measure the R_f values by Thin layer chromatographic method.
3. Estimation of Acetone/ Aniline volumetrically.
4. Preparation of Aspirin from salicylic acid.
5. Semicarbazone derivatives of aldehydes and ketones.

References:

1. J.N. Gurthu and R. Kapoor, *Advanced Experimental Chemistry (Organic)*, S. Chand and Co., 1987.
2. B.S. Furniss, A.J. Hannaford, P.W. G. Smith and A.R. Tatchell, *Vogel's Text Book of Practical Organic Chemistry*. 5th Edn., Pearson Education, 2005.
3. Practical Physical Chemistry, J B Yadav.
4. Essentials practical Physical Chemistry, Rajboj and Chandhekar.
5. *Vogel's Text Book of Practical Inorganic Chemistry*. 5th Edn., Pearson Education, 2005.

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc Chemistry (2023 Pattern)

Name of the Programme: B.Sc. Chemistry

Programme Code: USCHE

Class: F.Y.B.Sc

Semester: I

Course Type: Open Elective (Theory)

Course Code: CHE-116-OE

Course Title: Chemistry of Soil and Water

No. of Credits: 02

No. of Teaching Hours: 30

Course Objectives:

1. To know the chemistry and composition of soil.
2. To introduce the classical concepts of soil chemistry and to familiarize students with modern developments in chemistry of soils
3. To impart basic knowledge about soil physical properties
4. To impart knowledge about soil fertility and its control.
5. To know the concept of physical and chemical properties of water.
6. To create awareness among the students about the pollution of soil and water
7. To understand the importance of purification and conservation of water

Course Outcomes:

By the end of the course, students will be able to:

CO1. Gain knowledge on concepts and principles of Soil chemistry

CO2. Understand various soil physical, chemical and biological properties and their impact.

CO3. Aware on Soil quality and health

CO4. Imparts knowledge on essential nutrients, soil fertility, nutrient transformations in soil

CO5. To know the chemistry and composition of water.

CO6. To explain the importance of maintaining fresh, unpolluted drinking water supplies.

CO7. List and describe new and existing water remediation technologies.

Topics and Learning Points

Teaching Hours

UNIT 1: Introduction of Soil **05**

Origin and nature of soils.Physical properties of soil; soil colour. texture, structure, pore size, bulk density, water holding capacity. Soil types and their distribution.

UNIT 2: Soil chemistry and fertility **05**

Soil colloids, cation exchange, organic carbon, Carbon - Nitrogen ratio, soil fertility.

Soil reaction: acidity, alkalinity, conductivity, redox - potential.

UNIT 3: Soil erosion **05**

Definition, Control of erosion, Soil conservation practices, Soil pollution causes and remedies.

UNIT 4: Chemistry of water **05**

The water molecule, properties of pure water, fresh water and sea water.

Composition of waters: surface water, ground water and sea water. Dissolved gasses: Factors affecting natural waters. Acid, base, salts: Hydrogen ions, modern concept of pH and buffer.

UNIT 5: Water pollution **05**

Definition of water pollution, types of water pollutants,sources of water pollutants, trace element in water, water quality parameters and standards

UNIT 6: Purification of water **05**

Drinking water, Treatment of domestic and industrial water.

References:

Analytical Chemistry-Alka Gupta (Pragati Prakashan)

2. Soil chemicals Analysis - P.R. Hesse

3. Soil testing manual by department of agriculture and cooperation, India

4. Fundamentals of Soil --- V.N.Sahai

5. Text book of Soil science—R.K.Mehra

6. Mark M. Benjamin, 2015, Water chemistry, Waveland Press, second edition

7. Water Chemistry,Vernon L. Snoeyink and David Jenkins, John Wiley & Sons, 1980.

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc Chemistry (2023 Pattern)

Name of the Programme: B.Sc. Chemistry

Programme Code: USCHE

Class: F.Y.B.Sc

Semester: I

Course Type: Open Elective (Practical)

Course Code: CHE-117-OE

Course Title: Chemical Analysis of Soil and Water

No. of Credits: 02

No. of Teaching Hours: 60

Course Objectives:

1. To inculcate the importance of safety in chemical laboratory
2. To educate the students about units of measurements and its applications.
3. To develop the skill about preparation of solutions and handling the apparatus
4. To develop basic understanding regarding soil testing in the students.
5. To enhance their skills about water analysis.
6. To gain theoretical as well as practical knowledge on soil health and soil quality indices
7. To educate the students on the subject of significance of water and soil in human ecology

Course Outcomes:

By the end of the course, students will be able to:

CO1. Understand importance of chemical safety and Lab safety while performing experiments in laboratory

CO2. Learn units and its conversions and apply in experimental analysis.

CO3. Prepare solutions by dissolving solute in solvent and by diluting the stock solution

CO4. Know the process of collection of soil and water samples

CO5. Learn the different techniques to prepare and analyze the soil samples

CO6. Learn various soil test methods and Clear understanding of soil health and soil quality indices

CO7. Understand the role of water testing inwater quality parameters like pH, ECD, Hardness, alkalinity, TDS etc.

Topics and Learning Points

Teaching Hours = Total 60

Experiments/Practicals

1. Introduction to laboratory and apparatus used for analysis
2. Safety rules and regulations to be follow in laboratory
3. Units of measurements and its inter conversions
4. Preparation of some basic solutions by weighing solid solutes and dissolving in solvents
5. Preparation of some solutions by diluting stock solutions with solvents
6. Collection of soil samples from fields and study of soil sampling tools. (Field work)
7. Soil sample preparation
8. Determination of maximum water holding capacity of soil
9. Determination of bulk density of soil
10. Determination of pH of soil and classification as acidic or basic soils
11. Determination of conductivity of soiland hence total soluble salt contents
12. Collection of water samples (Field work)
13. Determination of total hardness of water
14. Determination of alkalinity of water
15. Determination of pH of water
16. Determination of conductivity of water and hence total soluble salt contents
17. Determination of TDS in water

References:

1. Laboratory Mannual of Water and Wastewater Analysis, D.R. Khanna, R. Bhutiani, Daya Publishing House, Delhi, 2008

2. Chemical and Biological Methods for Water Pollution Studies, R.K. Trivedy, P.K.Goel, Oriental Printing Press, Aligarh, 1986

3. Practical Methods in Ecology and Environmental Science, R.K.Trivedy, P.K.Goel, C.L.Trishal, Environmental Publications, Arad (India) 1987

4. Practical Manual on Soil Physics– A method manual, Kadam, J. R., Shinde P. B., 2005, Department of Agricultural Chemistry and Soil Science

5. Basic Principles of Practical Chemistry, V. Venkateswaran, R. Veeraswamy,A. R. Kulandaivelu, Sultan Chand & Sons, New Delhi, 2nd Ed., 2004.

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc Chemistry (2023 Pattern)

Name of the Programme: B.Sc. Chemistry

Programme Code: USCHE

Class: F.Y.B.Sc

Semester: I

Course Type: Vocational Skill Course (Theory)

Course Code: CHE-121-VSC

Course Title: Introduction to Agricultural Chemistry

No. of Credits: 02

No. of Teaching Hours: 30

Course Objectives:

1. To develop knowledge of Agriculture knowledge
2. To develop scientific attitude.
3. Student will understand and analyze current event and issues.
4. Students will able to develop agriculture topics.
5. To develop the knowledge about pesticides.
6. Students will able to understand about fertilizer.
7. To develop knowledge about Agricultural Chemistry

Course Outcomes:

By the end of the course, students will be able to:

CO1. Student should understand the detail Agriculture chemistry

CO2. To learn the advanced chemistry.

CO3. Students should gain knowledge on concept of soil science.

CO4. Students should learn about soil physical, chemical , biological properties.

CO5. Students should understand their impact on plant growth.

CO6. Understand the methods and types of soil.

CO7. Students should understand essential nutrients, soil fertility

CO8. Understand various micro and macronutrients and enhancement techniques.

Topics and Learning Points

Teaching Hours

UNIT 1: Chemistry of pesticides **10**

Classification of pesticides with respect to chemical composition, chemistry of some commonly Pesticide and their impact on environment, pesticide contamination of food. Effect of concentration on pesticide transport, retention and leaching. Biodegradation of pesticides, effect on microbial activity, microbial adaptation. Toxicological properties of pesticides and nutrient transformations, precautions in pesticide use.

UNIT 2: Soil and water pollution **06**

Pollution problems associated with agriculture, nature and extent. Nature and sources of pollutants- agricultural, industrial, urban wastes, fertilizers and pesticides, acid rains, oil spills etc;.

Sewage and industrial effluents - their composition and effect on soil properties/health, and plant growth and human beings; soil as sink for waste disposal. Pesticides - their classification, behavior in soil and effect on soil microorganisms. Toxic elements -remote sensing applications in monitoring and management of soil and water pollution.

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UNIT 3: Soil fertility and fertilizer **08**

Soil fertility and soil productivity; factors affecting soil fertility; nutrient sources - fertilizers and manures; essential plant nutrients functions and deficiency symptoms. Chemistry and transformation of nutrient elements including micronutrients in soil and their role in plant nutrition-their sources, forms, retention behaviour and movement: correction of micronutrient deficiencies in plants. Common soil test methods for fertilizer recommendations; quantity-intensity relationships: soil test crop response correlations and response functions. Principles of fertilizer application and residual effects of fertilizers and organic manures; Fertilizer use efficiency; soil quality in relation to sustainable agriculture.

UNIT 4: Soil chemistry **06**

Modern concept of soil; Soil as a disperse system. Concept and importance of soil solution; chemistry of soil water. dynamic nature of soil; soil and plant nutrition.Soil colloids: inorganic and organic colloids,electrometric properties of soil colloids; sorption properties of soil colloids, soil organic matter-fractionation of soil organic matter and different fractions, clay-organic interactions. lon exchange processes in soil; clay-membrane electrodes and anion and ligand exchange- innersphere and outer- sphere surface complex formation.

References:

1. Analytical Procedures in soil science and agricultural Chemistry :Sudharmal Devi C.R.
2. Soil science and agricultural Chemistry:Dharmendra Singh Yashona and Satish Bhagwatrao Aher
3. Agricultural Chemistry:Thomas Anderson
4. Principles of Agricultural Chemistry:C.S.Fraps

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc Chemistry (2023 Pattern)

Name of the Programme: B.Sc. Chemistry

Programme Code: USCHE

Class: F.Y.B.Sc

Semester: I

Course Type: Skill Enhancement Course (Practical)

Course Code: CHE-126-SEC

Course Title: Organic Qualitative Analysis

No. of Credits: 02

No. of Teaching Hours: 60

Course Objectives:

1. To learn analytical skills in organic qualitative analysis.
2. To perform practical techniques for the identification of unknown solid and liquid compounds.
3. To enable the students to check the purity of organic compounds by determining the melting or boiling points.
4. The students should be able to plan the experimental analysis.
5. The students should be able to execute the analysis.
6. To learn a suitable method of purification of organic compound.
7. To enable to perform the analysis in microscale.

Course Outcomes:

By the end of the course, students will be able to:

CO1. Identify and apply the method for purification of compound

CO2. Develop experimental skills.

CO3. Analyze the organic compounds by taking all the necessary precautions

CO4. Purify the organic compounds by using suitable method with their conformation

CO5. Develop the ability to know the hazardous and non-hazardouschemical compounds

CO6. Understand the importance of wastage of organic compound

CO7. Understand the suitable method for purification of compounds.

Topics and Learning Points

Teaching Hours = Total 60

UNIT 1: Organic qualitative analysis of water soluble/ miscible compounds

(Four compounds 2S, 2L)

Nature, Type, Preliminary Test, Physical Constant

UNIT 2: Organic qualitative analysis of water insoluble/ Immiscible compounds

(Two compounds 1S, 1L)

Nature, Type, Preliminary Test, Physical Constant

UNIT 3: Organic qualitative analysis of compounds

(Three compounds 2S, 1L)

Element Detection, Functional Group and Physical Constant.

UNIT 4: Purification of Organic compounds (02 compounds of each technique)

1. Crystallization 2.Sublimation 3. Distillation

References:

1. N.S. Gnanapragasam and G. Ramamurthy, *Organic Chemistry – Lab manual*, S. Viswanathan Co. Pvt., 1998.
2. J.N. Gurthu and R. Kapoor, *Advanced Experimental Chemistry (Organic)*, S. Chand and Co., 1987.
3. B.S. Furniss, A.J. Hannaford, P.W. G. Smith and A.R. Tatchell, *Vogel's Text Book of Practical Organic Chemistry*. 5th Edn., Pearson Education, 2005.
4. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.

CBCS Syllabus as per NEP 2020 for F.Y.B.Sc Chemistry (2023 Pattern)

Name of the Programme: B.Sc. Chemistry

Programme Code: USCHE

Class: F.Y.B.Sc

Semester: I

Course Type: Indian Knowledge System (Theory)

Course Code: CHE-137-IKS

Course Title: Indian Heritage of Chemistry

No. of Credits: 02

No. of Teaching Hours: 30

Course Objectives:

1. Creating awareness among the students about the true history and rich culture of India
2. Understanding the scientific value of the tradition and culture of India
3. Inculcating the students with a great sense of patriotism and nation-pride
4. Educating the students about India's contributionsfrom traditional to modern to the world of science andtechnology.
5. Appreciating the contribution of India in the development of chemistry and understand the role of chemistry in different spheres of life.
6. Converting the Indian wisdom into the applied aspect of the modern scientific paradigm
7. Promoting the students to do research in the chemistry field of the Indian knowledge system

Course Outcomes:

By the end of the course, students will be able to:

CO1. Identify the development of science in India.

CO2. Recognize the various scientific fields in which Indians have made their contributions

CO3. Draw linkages between modern Indian science and its rich scientific heritage.

CO4. Convert the Indian wisdom into the applied aspect of the modern scientific paradigm

CO5. Enumerate the important achievements of some of the great Indian scientists of all eras in the field of chemistry

CO6. Learn the process and apparatus used in ancient laboratories for the preparation of various products and appreciate the contribution of India in the development of chemistry

CO7. Choose the Indian knowledge system as a career at the professional and business level.

Topics and Learning Points

Teaching Hours

UNIT 1: Science and Technology in India **07**

Development of science in ancient India, Scientific and technological developments in medieval India, Science and technology in modern India,
Scientists of ancient India, Science and Scientists of medieval India, Scientists of Modern India

UNIT 2: Chemistry in India: A Survey **08**

Introduction, Early Chemical Techniques, Atomism in Vaiśeṣika, Chemistry in Early Literature, The Classical Age, Laboratory and Apparatus, the major chemical products that contributed to the development of chemistry – Metallurgy, glass, paper, soap, dyeing, cosmetic and perfumes, ink etc.

UNIT 3: Metallurgy in India **05**

Introduction, Metallurgy before and during the Harappan Civilization, Metallurgy after the Harappans, Iron Metallurgy, Wootz Steel, The Delhi Iron Pillar, Other Iron Pillars and Beams, zinc metallurgy, Social Context

UNIT 4: Ancient India's Contribution to Production of Dyes, Perfumes and Herbal Drugs **05**

Introduction, The Distillation of Perfumes, The Making of Dyes and Pigments, the smelting of metals, the making of drugs and herbal compounds, the cultivation and processing of spices

UNIT 5: Ayurveda for Life, Health and Wellbeing: A Survey **05**

Definition of Ayurveda, Integrative approach to healthcare, Balance of inner environment and personalized medicine, Harmony with the external environment, The principles of ayurvedic healing, The five elements in nature make up the human body, Treating diseases to restore health.

References:

1. Indian Culture and Heritage Secondary Course, material online available: https://www.drishtiias.com/images/pdf/secondary%20indian%20culture%20and%20heritage.pdf
2. Indian Contributions To Science, Compiled by VijnanaBharati, Third Edition 2018
3. Tangri.A, Bhattacharya.A and Sahgal.M. (2021) "Ancient India's Contribution to production of dyes, Perfumes and Herbal drugs.", Journal of Agricultural Research Pesticides and Biofertilizers, 1(4); DOI:http;//doi.org/05.2021/1.1017.
4. JyotiPathak, Chemistry In Ancient India, IRJMST Vol 7 Issue 3 [Year 2016] ISSN 2250 – 1959 (0nline) 2348 – 9367 (Print)
5. NCERT Knowledge Traditions and Practices of India - Class 11 - latest edition as per NCERT/CBSE

Examination Pattern / Evaluation Pattern

Teaching and Evaluation (for Major, Minor, AEC, VEC, IKS courses)

Course Credits	No. of Hours per Semester Theory/Practical	No. of Hours per Week Theory/Practical	Maximum Marks	CE 40 %	ESE 60%
1	15 / 30	1 / 2	25	10	15
2	30 / 60	2 / 4	50	20	30
3	45 / 90	4 / 6	75	30	45
4	60 / 120	4 / 8	100	40	60

Teaching and Evaluation (for VSC, SEC & CC courses)

- Evaluation to be done by Internal & External Experts
- No descriptive end semester written examination
- Evaluation to be done at Department level preferably prior to commencement of Theory /Practical Examinations
- Evaluation to be done on the Skills gained by student