



॥ मा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड - ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

स्वामी रामानंद तीर्थ
मराठवाडा विद्यापीठ, नांदेड

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'B++' grade

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विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय
शैक्षणिक धोरण २०२० नुसार पदवी प्रथम
वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक
वर्ष २०२४-२५ पासून लागू करण्याबाबत.

परिपत्रक

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, या विद्यापीठा अंतर्गत येणा-या सर्व संलग्नित महाविद्यालयामध्ये शैक्षणिक वर्ष २०२४-२५ पासून पदवीस्तरावर राष्ट्रीय शैक्षणिक धोरण -२०२० लागू करण्याच्या दृष्टीकोनातून विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत येणा-या अभ्यासमंडळांनी तयार केलेल्या पदवी प्रथम वर्षाचे अभ्यासक्रमांना मा. विद्यापरिषदेने दिनांक १५ मे २०२४ रोजी संपन्न झालेल्या बैठकीतील विषय क्रमांक १५/५९-२०२४ च्या ठरावान्वये मान्यता प्रदान केली आहे. त्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील खालील बी. एस्सी प्रथम वर्षाचे अभ्यासक्रम (Syllabus) लागू करण्यात येत आहेत.

- 01 B. Sc. I year - Biotechnology
- 02 B. Sc. I year - Bio-informatics
- 03 B. Sc. I year - Biotechnology (Vocational)
- 04 B. Sc. I year- Dyes and Druge
- 05 B. Sc. I year - Industrial Chemistry
- 06 B. Sc. I year - Agrochemical and Fertilizers
- 07 B. Sc. I year - Chemistry (General)
- 08 B. Sc. I year - Analytical Chemisrty
- 09 B. Sc. I year - Biochemistry
- 10 B. Sc. I year - Statistics
- 11 B. Sc. I year - Zoology
- 12 B. Sc. I year - Biotechnolgy (NMD College Hingoli)

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या www.srtmun.ac.in या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड - ४३१ ६०६.

जा.क्र.:शै-१/एनइपी/विवत्रविपदवी/२०२४-२५/123
दिनांक २०.०६.२०२४

डॉ. सरिता लोसरवार
सहा.कुलसचिव

शैक्षणिक (१-अभ्यासमंडळ) विभाग

- प्रत : १) मा. आधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मुल्यमापन मंडळ, प्रस्तुत विद्यापीठ.
३) मा. प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) मा. प्राचार्य, न्यू मॉडल डिग्री कॉलेज हिंगोली.
५) सिस्टीम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. याना देवून कळविण्यात येते की, सदर परिपत्रक संकेतस्थळावर प्रसिध्द करण्यात यावे.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED



SYLLABUS

(As per NEP-2020)

Faculty of Science and Technology

Structure for Four Year Multidisciplinary Degree
Program with Multiple Entry and Exit

Subject: CHEMISTRY

In force from June - 2024

The subject of chemistry has reached center stage in view of the tremendous strides in technological developments worldwide and specifically India. The frontline developments in pharmaceuticals, semiconductors, solar and other renewable energy resources, communication and computational revolutions, rare earth materials and their new finds have opened limitless potential for chemistry. The need to develop new materials for changing needs of humans and green objectives for environment has brought the basic and applied chemistry in frontline again. The revised curriculum of Chemistry under NEP has broadly taken into consideration above needs of future and contemporary world. This curriculum would prepare the students to be future ready for the envisioned progress of the Nation.

PROGRAM OUTCOMES

The students graduating with degree having chemistry as a major or Minor should be able to acquire/have:

1. Core competency in subject chemistry and in allied subject areas.
2. Students are expected to have coherent understanding of fundamental principles, current trends as well as future opportunities in subject area.
3. Knowledge of basic principles in instrumental techniques used laboratory.
4. Capability to characterize, identify and separate components of unknown compounds using modern instrumental methods.
5. Competency in critical thinking after identifying assumption that frames our thinking and action, checking out their degree of accuracy, validity and finally our response from different Perspective.
6. Skill to apply role of chemistry in safe handling of chemicals, environmental issues and other societal concerns.
7. Awareness of different value systems including our own, understand moral dimensions of our decision and accept responsibility for them.
8. The ability to engage in lifelong learning in broadest context of socio-technological change
9. Ability to elicit views of others, mediate disagreements and come up with healthy conclusion in group discussion.

Distribution of credits for Chemistry

Faculty of Science and Technology

Four Year UG Syllabus structure

Semester Pattern (CBCS) effective from June, 2024

Subject: Chemistry

Total credits semester I and II: 08

Sem.		Paper Number	Name of the Course	Instruction Hrs. /Week	Total period	Internal CA	ESE	Total Marks	Credits
I	Optional -I	SCHECT 1101	Organic Chemistry + Inorganic Chemistry (Theory)	02	30	10	40	50	2
		SCHECP 1101	Organic Chemistry + Inorganic Chemistry (Practical)	04	60	10	40	50	2
	Generic Electives (other than Faculty)	SCHEGE 1101	Everyday Chemistry	02	30	10	40	50	2
	Skill Course (Basket - 3)	SCHESC 1101	Fundamentals of Chemistry Laboratory OR Water Pollution	03	45	10	40	50	1T + 1P
II	Optional -I	SCHECT 1151	Physical Chemistry + Inorganic Chemistry (Theory)	02	30	10	40	50	2
		SCHECP 1151	Physical Chemistry + Inorganic Chemistry (Practical)	04	60	10	40	50	2
	Generic Electives (other than Faculty)	SCHEGE 1151	Soil and Fertilizer Chemistry	02	30	10	40	50	2
	Skill Course (Basket - 3)	SCHESC 1151	Common Laboratory Techniques OR Soil Pollution	03	45	10	40	50	1T + 1P

NOTE:

- The syllabus is based on **two theory** periods per division and **four practical** periods per batch per week. Candidates should require passing separately in theory and practical examinations.
- End Semester Examination (ESE) 40 marks.
- Continuous Assessment (CA) 10 marks (Average of two test examinations conducted).
- At least fifteen practicals should be engaged in **Ist** semester: **05** practicals from Inorganic Chemistry, **10** from Organic Chemistry.
- At least fifteen practicals should be engaged in **IInd** semester: **05** practicals from Inorganic Chemistry, **10** from Physical Chemistry.

UG Chemistry (Semester-I)

Paper- (SCHECT 1101):

Organic Chemistry & Inorganic Chemistry
(Theory)

Credits: 02

Periods: 30

Module: 1. An introduction to Organic reactions:

07 P

- 1.1 Basic terms: Substrate and Reagents, types of reagents (Electrophilic and Nucleophilic). Notation of arrows: curved arrow, half headed arrow, double headed arrow, straight arrow.
- 1.2 Electronic displacement effects :- Inductive Effect , Resonance Effect And Hyperconjugation and their Applications in A) Acidic Strength B) Basic Strength
- 1.3 Bond fission: Homolytic and heterolytic fission.
- 1.4 Types of reactions and Reaction intermediates: Carbocation, Carbanion, Free radical, carbene, (Introduction, structure & Stability), nitrene & benzyne (only introduction).

Module: 2. Aromatic Hydrocarbons and Aromaticity

05P

- 2.1 Introduction, Nomenclature, kekule and resonance structure of benzene, stability, Orbital picture of benzene.
- 2.2 Aromaticity, antiaromaticity and homoaromaticity by Huckel's Rule for homocyclic and hetrocyclic compounds.
- 2.3 Electrophilic Substitution reaction of benzene (with mechanism): Nitration, Halogenation, Friedel Craft alkylation and acylation.
- 2.4 Orientation effect: Effect of activating and deactivating groups (-OH, NO₂, CH₃, Cl) on aromatic electrophilic (Nitration) substitution reaction (with mechanism).

Module: 3. Alcohols, Epoxides and Phenols:

08 P

- 3.1 Alcohols: Introduction, Nomenclature and Classification.
- 3.2 Dihydric alcohol (ethylene glycol): Preparation methods: i) Hydroxylation of alkene ii) 1,2-dihaloalkane. Chemical reactions: 1) Pb(OAc)₄, 2) P₂O₅/ZnCl₂.
- 3.3 Trihydric alcohol (Glycerol): Preparation methods from: 1) Oils and fats 2) Propene. Chemical reactions: action of 1) Nitric acid, 2) Acetylchloride on tryhydric alcohol.
- 3.4 Epoxides: Introduction and nomenclature. Preparation methods: a) Oxidation of ethene in presence of Ag catalyst, b) Epoxidation of ethene with peracetic acid.
- 3.5 Chemical reactions: a) Ring opening reactions of propylene oxide. a) Hydrolysis in acidic and basic medium. b) Action of Grignard reagent.
- 3.6 Phenols: Introduction, classification and acidic character of phenol (compare with ethanol).

Chemical reactions with mechanism: Reimer-Tiemann reaction, Acetylation, Fries rearrangement, Kolbe's carboxylation reaction.

Module: 4. Periodic Table And Periodicity:

10 P

- 4.1 Brief introduction to development of periodic table. Modern periodic law, long form of the periodic table, Sketch, Cause of periodicity. Division and general characteristics of s, p, d and f block elements.
- 4.2 Atomic and Ionic size: Definition and explanation of atomic radius, ionic radius, covalent radius, Vander Waals radius. Variation of atomic size along a period and in a group.
- 4.3 Ionization Energy (Ionization enthalpy): Definition and Explanation, Successive ionization energy, Factors affecting ionization energy. Variation of ionization energy along a period and in a group. Applications of ionization energy to chemical behavior of an element.
- 4.4 Electron Affinity (Electron gain enthalpy): Definition and Explanation, Successive electron affinity, Factors affecting electron affinity. Variation of electron affinity along a period and in a group. Applications of electron affinity to chemical behavior of an element.
- 4.5 Electronegativity: Definition and Explanation, Factors affecting electronegativity. Variation of electronegativity along a period and in a group. Pauling's approach of electronegativity. Calculations of electronegativity by Pauling's method (Numerical), Mulliken's approach. Applications of electronegativity to bond properties such as percent ionic character, bond length, bond angle.

Course Outcomes:

Students will gain an understanding of:

1. The basic things for chemical reactions i.e. Substrate and Reagents Types of reagents Electrophilic and Nucleophilic Homolytic and heterolytic fission. Electronic displacement effect.
2. Aromatic, antiaromatic and nonaromatic for organic compounds.
3. The different intermediates in chemical reactions and their uses in synthesis
4. Appreciate the concept of grouping elements in accordance to their properties led to the development of Periodic Table.
5. compare the reactivity of elements and correlate it with their occurrence in nature;
6. Understand the ideas related to periodic properties of elements such as atomic radii, ionization enthalpy, electron gain enthalpy, electronegativity.

References:

1. A New Pattern Text Book of Organic Chemistry for Competition: O.P.Tandon and A.K.Virmani (G.R.Bathla& Sons Publication) 2009 Edition
2. Chemistry for Degree Students: R.L.Madan (S.Chand Publication) 2010 Edition
3. A Textbook of Organic Chemistry: ArunBahl and B.S. Bahl (S.Chand Publication) 2011 Revised Colour Edition.
4. Organic chemistry: S M Mukherji and S P Singh, (New Age International Publication) vol. I, Second edition, 2010.
5. Principles of Organic Chemistry by R.O.C. Norman and J.M. Coxon.
6. Organic Chemistry by Robert Thornton Morrison and Robert Neilson Boyd
7. A Guide book to mechanism on Organic Chemistry: Peter Sykes.
8. Text Book of organic Chemistry: P. L. Soni.
9. Organic Chemistry : T. W. Graham Solomons, Sixth edition.
10. Modern Organic Chemistry: M. K. Jain and S. C. Sharma.
11. Principles of inorganic chemistry by Puri, Sharma and Kalia, Milestone Publishers and Distribution.
12. Inorganic Chemistry by Shriver and Atkins' Oxford University press 5th edition.
13. Advanced inorganic chemistry by Gurudeep Raj and ChatwalAnand.
14. Concise Inorganic Chemistry by J. D. Lee.
15. Basic Inorganic Chemistry by F. A. Cotton, G. Wilkinson and P. L. Gaus.
16. Inorganic Chemistry by A. G. Sharp.
17. Inorganic Chemistry by G. L. Miessler and D. A. Tarr.
18. Chemistry for degree students by Dr. R.L. Madan, (S. Chand)

Chemistry (Semester-I)
Paper- (SCHECP1101):
Organic Chemistry & Inorganic Chemistry
(Practicals)

Credits: 02

Periods: 60

1. I) Preparations (Any Four)
 - a) Phthalimide from phthalic anhydride and urea. b) Acetanilide from aniline.
 - c) Iodoform from acetone. d) Phenyl – azo – β – naphthol from aniline.
 - e) m-Dinitobenzene from nitrobenzene. f) Phthalic anhydride from phthalic acid.(Recrystallization and Melting point of product is compulsory)
2. A) Determination of Physical constant of Organic liquids (Any Two)

Aniline, Ethanol, Toluene, Benzene, ortho and meta toluidine, Chlorobenzene, Nitrobenzene.

B) Demonstration on purification by (Any Two)
 - a) Recrystallization of Phthalic acid/Benzoic acid from hot water.
 - b) Distillation of Ethyl alcohol. c) Sublimation of Naphthalene.
3. Identification of Two acidic and Two basic radicals by Semi-micro qualitative analysis technique.(Including interfering radicals). (Any Seven)
4. Spot- tests (of each radical) are compulsory.

Course Outcomes:

After successfully performing practicals, students will be able to:

1. Identify type of titration and estimation of ions.
2. Prepare required standard solution.
3. Determine hardness of any water sample.
4. Handle protocol for the synthesis of organic compound.
5. Select suitable purification method for synthesized organic compound.
6. Determine physical constant of solid/liquid.

Swami Ramanand Teerth Marathwada University, Nanded.
(Faculty of science and technology)
Four year multiple degree programme with multiple entry and exit.
2024-2025
B. Sc. First Year (Second Semester)
Chemistry
Generic Elective (GE) Paper First
(SCHEGE 1101)

Everyday Chemistry

Objective:

- to learn the chemistry behind the product which we use in our day to day life.
- to impart chemical literacy among the students.
- to generate curiosity among the readers to know more about chemicals.

Outcomes: After studying this students will be able

- to understand the chemistry behind the product which we use in our day to day life.
- enlightened about the pros and cons of using processed food.
- to create curiosity among the readers about chemicals.

Everyday Chemistry

1. Soaps, Detergents and cosmetics.

20 P

Soaps: Introduction, fats and oils used in soaps, types of soaps, liquid soaps, synthesis of soaps, total fatty matter, cleaning action of soaps.

Detergents: Introduction, classification, synthesis, additive in detergents, enzymatic detergents, cleaning action of detergents.

Cosmetics: Introduction, toothpaste, shampoos, hair dyes, creams and lotions, lipstick, perfumes, shaving cream, after shave lotion, deodorants, bath oil, talcum powder.

Toxicity of cosmetics.

2. Food additives and flavouring agents.

20 P

Introduction, food colours, flavouring agents, emulsifying agents, preservative, leavening agents, test enhancers, antioxidants. Government regulations.

Soft drinks, its ingredients and health effects.

Food adulteration, food laws and standards.

Prevention of food adulteration (PFA) Act 1954

Essentials commodities act 1955

Food and safety and standards act 2006

3. Chemistry of plastics

10 P

Introduction,

Plastic in everyday life, plastic and polymers, classification of polymers, polymerization reaction.

Application of plastics: Polyethylene, low density polyethylene, high density polyethylene, polypropylene, polyvinyl chloride, polyethylene terephthalate and acrylonitrile-butadiene-styrene.

Environmental hazards and recycling of plastics.

4. Drugs chemistry.

10 P

Introduction

Classification of drugs.

Analgesics, antipyretics, antihistamines, antacids, tranquilizers, sedatives, antibiotics, antifertility drugs. (Name, structure, simple one preparation and uses are expected)

Reference books:

1. Advanced chemistry by Philip Matthews Cambridge low price editions.
2. Organic chemistry by Maitland Jones Jr., Steven A. Fleming fourth edition, International student edition .
3. Principles of inorganic chemistry Puri Sharma Kalia, Milestone publishers and distributors,
4. Principles of environmental chemistry second edition, James E. Girard by Jones and Bartlett student edition.
5. Chemistry in everyday life by G.D, Gem Matjew, Vishal publishing co.
6. Foye's Principles of medicinal chemistry by Thomas L. Lemke, David A. Williams, Victoria F. Rocho and S. William Zito, International edition.
7. Every day chemistry by Julia Sooy, illustrated by Bonnie Pang.

(SCHES1101)

UG Ist Year Semester I

Skill Enhancement Course

Fundamentals of Chemistry Laboratory

Course Objectives:

- **Enhance Safety and Organizational Skills:** Equip students with the knowledge and skills for ensuring laboratory safety, including understanding, safety provisions, and organizing practical work.
- **Develop Proficiency in Laboratory Apparatus Use:** Familiarize students with various laboratory apparatus, enabling correct identification, handling to ensure effective and safe use in experiments.
- **Solution Preparation Techniques:** Teach students the principles of solution preparation, including solution types, solubility, and concentration calculations, along with practical skills for accurately preparing solutions for reliable experiments.

Module: 1. Introduction of Chemistry Lab (05 Hours)

General introduction of chemistry laboratory, common instruction for safe working in chemical laboratories, Safety provisions, Organization of practical work, Cleaning of laboratories and preparation room.

Module: 2. Introduction of Lab Apparatus (05 Hours)

Glass apparatus - Beaker, Test tube, boiling tube, funnel, separating funnel, filtration flask, round bottom flask, flat bottom flask, condenser, watch glass, condenser, petridish, desiccator, etc.

Volumetric Apparatus - Measuring cylinder, burette, pipette, Volumetric flask, analytical balance, single-pan electronic balance/ electrical analytical balance etc.

Miscellaneous apparatus- Buchner funnel, burette stand, retort clamp, china dish, wire gauze, cork borers, filter pumps, crucible, pipe clay triangle, pestle and mortar, spirit lamp, spatulas, thermometer, pH paper etc. and laboratory centrifuge.

Apparatus for heating: Bunsen burner, water bath, oil bath, hot plate, sand bath, hot air oven, heating mantle etc.

Handling and storage of glass apparatus Kipp's apparatus

Module: 2. Solution Preparation (05 Hours)

Water as a solvent, types of solutions, components of a solution, solubility, concentration of solutions: percentage, molarity, normality, molality (in ppm) calculation of masses and volumes for preparation of solutions solids, liquids.

Practical (30 Hours)

1. Handling of common laboratory equipment
2. Cork boring experiment
3. Calibration of volumetric glassware
4. Weighing of chemicals using analytical balance
5. Preparation of solutions, indicators and reagents.
6. Preparation of buffer solutions and determination of their pH Values.
7. Preparation of some organic compound and determination of their boilingpoint and melting point.

Reference Books:

1. Vogels Qualitative Inorganic Analysis, A. I. Vogel, *Prentice Hall*,
2. Vogels textbook of chemical quantitative analysis, *Longman Scientific*
3. The golden book of chemistry experiments, R. Brent, *Golden press, NY*
4. Comprehensive Practical Organic Chemistry, V. K. Ahluwalia, & R. Aggarwal, *Universities Press*.
5. Lab Manual of Organic Chemistry, R. K. Bansal, *New Age Pub*.
6. Senior Practical Physical Chemistry, B. D. Khosla, *R. Chand & Co*
7. Chemistry Practical, O. P. Pandey, D.N. Bajpai, S. Giri, *S. Chand*
8. Advanced practical chemistry, J . Singh etal. *Pragati Prakashan*

9. Computer fundamental , B Ram, *New Age Pub.*

Outcomes:

- **Safety and Laboratory Management:** Students will understand and implement essential safety protocols and procedures for working in a chemistry laboratory, including proper lab design, storage, ventilation, and safety provisions, ensuring a safe and efficient working environment.
- **Familiarity with Laboratory Apparatus:** Students will identify, handle, and maintain various laboratory apparatus, including glassware, volumetric tools, and miscellaneous equipment, gaining proficiency in their proper use and storage.
- **Solution Preparation Skills:** Students will accurately prepare chemical solutions, understanding the concepts of solubility, concentration measurements (percentage, molarity, normality, molality), and the calculation of masses and volumes for preparing solutions, essential for conducting precise and reliable experiments.

OR

(SCHES1101)

UG Ist Year Semester I

Skill Enhancement Course

Water Pollution

OBJECTIVES

The main aim of the course is to provide students with a scientific and technical background in water quality monitoring, pollution control technologies and environmental management. This course focuses on unit operations for municipal and industrial wastewater treatment. Specific objectives are listed below.

1. Provide information on the basic concepts of water pollution and its effects on human and ecosystem health
2. Demonstrate how to interpret laboratory analysis to establish whether the water fulfills the quality requirements for different uses.
3. Show how to look at the major water pollutants, their sources, physical, chemical and biological transformations and impacts.
4. Assist with exploring how natural ecosystems respond to changes in water characteristics, including the self-purification capacity of oxygen-demanding materials and filtration of solid components.
5. Facilitate the learning of strategies to control common water pollutants in municipal and industrial wastewater.
6. Present detailed information about the design characteristics of unit operations for wastewater control, including pre-treatment, primary treatment and secondary treatment.
7. Help to provide an insight into the fundamentals of some of the most widely used advanced treatments

Module: 1. Pollution: 08 periods

Pollution: - Introduction, Definition, Sources & effect of water pollution. Control measures of water pollutions.

Module: 2. Analysis of water pollution:- Theory: 07 periods

Physical Parameters

- | | |
|---------------------------|---------------------------|
| a) Temperature | b)Electrical Conductance |
| c) Total Suspended Solids | d) Total dissolved Solids |
| e) Oil & Greases. | |

Module: 3. Chemical Parameters:-

Practicals:

- | | |
|---------------------------|-------------------------------|
| a) P ^H | b) Dissolve Oxygen |
| c) Chemical Oxygen demand | d) Bio-Chemical Oxygen demand |
| e) Hardness | f) Chloride |
| g) Sulphate | h) TDS |

30 periods

SKILLS/ COMPETENCIES / LEARNING OUTCOMES

Upon completion of this course, students should be able to:

1. List the main water pollutants and their effects on human health and the environment.
2. Discuss several types of water pollution problems and their chemical aspects affecting them.
3. Interpret the results of laboratory analysis for water characterization.

4. Develop a broad overview understanding of the strategies, regulations and policies to manage water pollution.
5. Describe unit operations used for wastewater treatment.
6. Select methods to control and prevent water pollution to meet effluent requirements within realistic constraints, such as economic, environmental and social aspects, health and safety.
7. Design and optimize various unit operations and unit processes used in water treatment and configure processes in a treatment plant. This includes obtaining and applying appropriate design values and making appropriate assumptions when needed

Reference books

1. Environmental Pollution -A.K. De
2. Environmental Pollution - Khitoliya R.K.
3. Water Pollution -Salpekar Aradhana
4. Introduction to Waste Water Treatment Process -Jindal M.
5. Water Pollution -Sharma B.K.
6. Environmental Chemistry -Sharma B.K
7. Environmental Chemistry -Bhagi Ajaykumar
8. Environmental Chemistry-Kaver H.
9. Environmental Chemistry-Banerji S.K.
10. Water Pollution - Kudesia V.P.

UG Chemistry (Semester-II)

Paper- (SCHECT1151)

Physical Chemistry & Inorganic Chemistry
(Theory)

Credits: 02

Periods: 30

Module: 1. Atomic structure

06 P

- 1.1. Introduction, Rutherford's alpha particle scattering experiment, Rutherford's atomic model and its drawbacks.
- 1.2. Bohr's theory of hydrogen atom: Bohr's atomic model-Postulates, Derivation for radius of an orbit and energy of an electron. Energy difference in terms of wave number and Rydberg constant. Bohr's explanation of hydrogen spectrum. Merits and demerits of Bohr's theory.
- 1.3. Quantum numbers, Electronic configuration of elements: Aufbau principle, Pauli's Exclusion principle, Hund's rule of maximum multiplicity. Numericals on radius and energy.

Module: 2. Gaseous State

07 P

- 2.1 Kinetic theory of gases: Postulates of kinetic molecular theory of gases. Ideal and non-ideal gases.
- 2.2 Deviation of gases from Ideal behavior and Compressibility factor (Z), Boyle's Temperature (T_b) Inversion Temperature (T_i). Derivation of Vander-Waals equation, Units for Vander-Waals constants.
- 2.3 Critical phenomenon: Definitions of critical constants. Relation between critical constants (T_c, V_c, P_c) and Vander-Waals constants (a, b). Units of critical constants.
- 2.4 Molecular velocities-Root mean square, average and most probable velocities, Relation between molecular velocities, Numericals on Root mean square velocity and critical constants.

Module: 3. Adsorption and Colloids

07 P

- 3.1 Introduction, Definition of Adsorbate, Adsorbent, Adsorption, factors affecting adsorption. Difference between adsorption and absorption. Types of adsorption: Physical adsorption and chemical adsorption.
- 3.2 Introduction, Definition of Dispersed phase (dp) and Dispersion medium (dm) Classification of colloidal systems.
- 3.3 Sols: Types of sols, Properties of sols- Colour, Optical (Tyndall effect), Kinetic (Brownian movement) and electrical properties (electrophoresis and electro osmosis).
- 3.4 Coagulation of colloidal solution, Hardy-Schulze rule's. Protective action of sol and Gold Number.
- 3.5 Emulsions: Types of emulsions, preparation of emulsion, Emulsifier.
- 3.6 Applications of colloids.

Module: 4. A. Oxidation and reduction:**05P**

- 4.1 Definition of oxidation, Reduction, Oxidizing agent and reducing agents according to classical concept, electronic concept, oxidation number concept.
- 4.2 Rules for assigning oxidation number.
- 4.3 Balancing of redox reaction by 1) Ion-electron method and 2) Oxidation number method.

B. Noble Gas Chemistry:**05P**

- 4.4 Introduction and Position in the Periodic table.
- 4.5 Electronic configuration.
- 4.6 Compounds of noble gases, under excited condition, through coordination, by physical trapping (Clathrates).
- 4.7 Fluorides of xenon: Preparation, properties and structure of XeF_2 , XeF_4 , XeF_6 .
- 4.8 Uses of Noble gases.

Course Outcomes:

After studying mentioned topics students will able to know:

1. Intermolecular forces of interactions.
2. Distinguish between true solution, colloidal solution and suspension solution.
3. Applications of adsorption and colloids.
4. Define the acidic and basic radicals.
5. Uses of noble gases in diversified fields.
6. Explain the role of common ion effect, solubility product and complex formation during the separation metal ions.
7. Define the terms oxidation, reduction, oxidising agent and reducing agent.
8. Use the concept of oxidation number to identify oxidant and reductant in a reaction.
9. Balance chemical equations using (i) ion electron method (ii) oxidation number method.

Reference book

1. Principles of inorganic chemistry by Puri, Sharma and Kalia, Milestone Publishers and Distribution.
2. Inorganic Chemistry by Shriver and Atkins' Oxford university press 5th edition.
3. Inorganic chemistry by Gary L. Miessler and Donald Tarr Pearson publication third edition.
4. Inorganic Chemistry by Shriver and Atkins' Oxford University press 5th edition.
5. Mathematical preparation for physical Chemistry .By F. Daniel, Mc. Graw Hill publication.
6. University General Chemistry. By C.N. R. Rao Mc. Millan Publication.

7. Principles of Physical Chemistry. By Maron and Pruton 4th Ed. Oxford and IBH publication.
8. Physical Chemistry. By G.M. Barrow. 5th Edn
9. Essentials of Physical Chemistry .By B. S. Bahl, G. D. Tuli, ArunBahl (S. Chand and Co Ltd.) (25 edition)
10. Elements of Physical Chemistry.By S. Glasstone and D. Lewis (The Macmillan Press Ltd.)
11. Physical Chemistry. By Robert A. Alberty(John Willey and Sons)
12. Principles of Physical Chemistry. By Puri– Sharma.
13. The Elements of Physical Chemistry .By P. W. Atkins
14. Advanced Physical Chemistry.By Harish Gurudeep.

UG Chemistry (Semester-II)
Paper- (SCHECP1151)
Physical Chemistry & Inorganic Chemistry
(Practicals)

Credits: 02

Periods: 60

Laboratory Work (Practicals):

1. Determination of the viscosity of liquid by Ostwald's viscometer.
2. To determine the surface tension of a given liquid by stalagmometer method.
3. Determine the equivalent weight of magnesium by hydrogen displacement method using Eudiometer.
4. To study kinetics of hydrolysis of ester in presence of mineral acid like HCl.
5. To study kinetics of cooling of hot water.
6. To study distribution of benzoic acid between benzene and water.
7. To study critical solution temperature (CST) of phenol water system.
8. Determination of Heat of solution of $\text{KNO}_3/\text{NH}_4\text{Cl}$.
9. Determination of Heat of reaction of displacement of copper by zinc.
10. Preparation of Arsenic sulphide (As_2S_3) sol.
11. Determine volumetrically the amounts of sodium carbonate and sodium hydroxide present together in the given solution provided 0.1 N HCl solution.
12. Determine the percentage of CaCO_3 in the chalk sample, provided 1 N HCl and 0.1N NaOH.
13. Estimate the strength of the given sample of KMnO_4 Solution in g/lit. Prepare a standard solution of N/10 Mohr's salt or N/10 Sodium Oxalate solution.
14. Estimate volumetrically the strength of Ferrous and ferric ion in the given solution provided N/10 KMnO_4 Solution.
15. Determination of Nickel using murexide as an indicator (Direct method).
16. Prepare standard solution of Zn ion standardize the give EDTA solution and estimate the amount of unknown Zn ion concentration.
17. To determine the total, permanent and temporary hardness of water by complexometric method using EDTA.

Course Outcomes:

After Performing experiments students will able to know:

1. Properties of water i.e. surface tension, viscosity, density etc.
2. To prepare solutions of desired concentrations.
3. Nature of aqueous solution of substance i.e. acidic, basic or natural.
4. The quantity of solute in solution using different titrimetric techniques.
5. The ideas to identify acidic or basic radicals qualitatively.

B. Sc. First Year (First Semester)
Chemistry
Generic Elective (GE) Paper Second
(SCHEGE 1151)
Soil and Fertilizer Chemistry

Objective:

- To understand the concept of soil and fertilizer.
- To increase the awareness about the soil and effect of excessive fertilizers.
- To emphasize the importance of agriculture on global economy.
- To understand the seriousness of agro problems.

Outcome:

After completion of syllabus students will be able to understand following outcomes.

- To define the concept of soil and fertilizer.
- To be aware about the soil and effect of excessive fertilizers.
- To understand the importance of agriculture on global economy.
- To explain the seriousness of agro problems.

Soil and fertilizers chemistry.

1. Fundamentals of Soil:

10 P

Introduction, soil classification, chemical composition of soil, composition of Earth's crust, soil minerals: primary, secondary minerals, elemental composition of soils.

Essential nutrients: introduction, essential, functions and deficiency symptoms of nutrients, beneficial elements.

2. Soil analysis and management.

20 P

Soil acidity, sources of hydrogen and hydroxyl ions, nature of acidity, soil reaction correlation, acid forming factors, determination of soil pH, genesis, occurrence and characteristics of acid soils, naturally occurring liming materials, management of acid soils.

Soil salinity and alkalinity, introduction, common sources of salts, origin of salt affected soils, characterization, classification, effect of salts on plant growth, management of soil salinity and alkalinity problem.

Analysis of soil: Introduction, extraction techniques, soil analysis.

3. Fertilizers at a glance.

10 P

Introduction, manures in ancient India, fertilizers in Indian agriculture, history of fertilizer production. Classification of fertilizers, nitrogenous fertilizers, phosphatic fertilizers, potash fertilizers, secondary

nutrients, mixed fertilizers, characteristics of fertilizers.

4. Soil fertility managements and sustainable farming.

20 P

Introduction, soil fertility constraints, management of soil fertility, optimum fertilizer rates, balanced use of fertilizer nutrients.

Efficient use of fertilizer, nutrient needs of cropping systems, integrated nutrient management.

Soil pollution and its control.

Reference books:

1. Fundamentals of soil science, Indian society of soil science.
2. Soil and fertilizers at a glance by L.L.Somani, P.C.Kanthaliya, agrotech publishing academy Udaipur.
3. Principles of environmental chemistry second edition by James E.Girad Jones and Bartlett student edition.
4. Principles of inorganic chemistry by Puri, Sharma and Kalia, Milestone Publishers and Distributors Delhi.

(SCHES 1151)

UG 1st Year Semester II Skill Enhancement Course

Common Laboratory Techniques

Objectives:

1. **Master Fundamental Laboratory Techniques:** Equip students with the skills to perform essential laboratory techniques such as refluxing, filtration, recrystallization, and distillation, including understanding the use of appropriate apparatus and safety precautions.
2. **Implement Safety Protocols in the Laboratory:** Educate students on the identification and prevention of fire, chemical, and gas hazards, including proper storage, handling, and emergency response measures to ensure a safe laboratory environment.
3. **Integrate Computer Applications in Laboratory Work:** Teach students to utilize computer hardware and software, including data input, processing, and output, with a focus on applications such as MS Office and Internet resources to enhance laboratory efficiency and data management.
4. **Develop Practical Laboratory Skills:** Provide hands-on experience in preparing hydrogen sulfide gas, performing acid-base titrations, preparing distilled water, purifying organic compounds, and preparing inorganic double salts, with additional experiments based on chromatography techniques.

Module 1

(05 Hrs.)

1. Refluxing: Apparatus with interchangeable ground glass joints (Quick fit),
2. Filtration: Techniques and filter media, filter paper, simple filtration,
3. Recrystallization: Choice of solvent and precautions with flammable solvents,
4. Distillation: recovery of solvents through partial distillation, distillation under reduced pressure, and
5. Determination of Boiling Point

Module 2 Chemistry Laboratory Safety

(05 Hours)

1. Fire Hazards: Causes of fires, classification of fires, fire prevention protocols and measures, fire alarms, fire escapes, fire Extinguishers and their uses.
2. Chemical Hazards: Classification and handling of hazardous chemicals, storage of chemicals, transfer from large containers
3. Gas Hazards: safer usage of LPG in the laboratory, detection and handling of Gas Leakage, health hazards of gases.

Module 3 Use of Computer in Laboratory

(05 Hours)

Hardware in computer, CPU, I/O devices, data input, data processing, data output, application MS office software and Internet.

Module 4 Practical

1. Preparation of hydrogen sulphide (H₂S) gas using Kipp's apparatus.
2. Simple acid-base titration.
3. Preparation of distilled/deionized water.
4. Purification of organic compounds by recrystallization.
5. Preparation of inorganic double salts.

(30 Hours)

Reference Books:

10. Vogels Qualitative Inorganic Analysis, A. I. Vogel, *Prentice Hall*,
11. Vogels textbook of chemical quantitative analysis, *Longman Scientific*
12. The golden book of chemistry experiments, R. Brent, *Golden press, NY*
13. Comprehensive Practical Organic Chemistry, V. K. Ahluwalia, & R. Aggarwal, *Universities Press*.
14. Lab Manual of Organic Chemistry, R. K. Bansal, *New Age Pub*.
15. Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co
16. Chemistry Practical, O. P. Pandey, D.N. Bajpai, S. Giri, S. Chand
17. Advanced practical chemistry, J . Singh etal. *Pragati Prakashan*
18. Computer fundamental , B Ram, *New Age Pub*.

Outcomes:

1. **Proficiency in Essential Laboratory Techniques:** Students will demonstrate proficiency in refluxing, filtration, recrystallization, distillation, and boiling point determination, including the use of appropriate apparatus and adherence to safety precautions.
2. **Enhanced Laboratory Safety Practices:** Students will identify and mitigate fire, chemical, and gas hazards in the laboratory by applying safety protocols, proper handling and storage of hazardous materials, and appropriate emergency response measures.
3. **Effective Use of Computer Technology in Laboratories:** Students will effectively use computer hardware and software for laboratory applications, including data input, processing, and output, and utilize MS Office and Internet resources to support laboratory activities and data management.
4. **Hands-On Laboratory Experience:** Students will gain practical experience in preparing hydrogen sulfide gas, performing acid-base titrations, preparing distilled/deionized water, purifying organic compounds, preparing inorganic double salts, and conducting chromatography experiments, enhancing their laboratory skills and techniques.

OR

(SCHES 1151)

**UG Ist Year Semester II
Skill Enhancement Course**

Soil Pollution

30 periods

OBJECTIVES

1. Knowledge of soil environment, soil degradation and pollution affecting the society; preventing and improving method.
2. Evaluating the causes of soil pollution and proposing appropriate improving methods.
3. Conceiving ideas of soil environment improvement, proposing, designing soil sedimentation methods.

Module: 1. General geology and soil formation

05P

Definition of soil environment, Soil formation process, Physical and chemical of soil environment
Summary of teaching methodology, Soil structure, texture and energy, Composition of gas and water phases in soil, metabolism in soil environment, Gas phase, Water in soil, Colloid, Soil solution, Biological composition in soil.

Module: 2. Soil degradation and prevention and conservation methods

05P

Soil degradation Soil acidity Soil salinity Soil desertification Soil erosion, Prevention and conservation methods

Module: 3. Soil pollution and prevention methods

05P

Soil pollution Soil pollution by agricultural waste Soil pollution by industrial waste Soil pollution by oil and effects of oil pollution Soil pollution due to natural and biological factors, Self cleaning ability of soil environment, Land use planning methods to prevent soil pollution, Methods to prevent soil pollution.

Module: 4 Laboratory Work (Any eight practicals)

30P

1. Determination of pH of different types of soil samples
2. Determination of electrical conductivity of different types of soil samples.
3. Determination of total alkalinity of soil.
4. Determination of total organic matter in the given soil Sample.
5. Determination of available nitrogen of the soil sample
6. Determination of total Phosphorous of the soil sample
7. Determination of Ca (II) and Mg(II) ions from soil sample.
8. Determination of Fe (II) and Fe (III) ions from soil sample.

9. Determination of K from soil sample by flame photometry
10. Determination of Na from soil sample by flame photometry
11. Determination of available sulphur in soils

Outcomes

1. Apply knowledge of soil structure and soil formation to address soil environment issues.
2. Apply physical and chemical parameters of soil environment in the process of soil degradation and pollution assessment.
3. Evaluate the soil degradation, advantages and disadvantages of preventing and improving methods for soil pollution.
4. Assess the causes and sources of pollution to treat soil contamination.
5. Read English documents for describing soil degradation and pollution phenomena.
6. Practise the role and responsibility of an environmental engineer in soil environment toward the society.
7. Conceive ideas of soil environment improvement in soil degradation and pollution.

References :

1. R. E. White, Principles and Practice of Soil Science, The soil as a natural resource. 4th Ed., Blackwell Publishing, 2006.
2. Le Van Khoa, Nguyen Xuân Cu, Le Duc, Tran Khac Hiep, Tran Cam Van, Dat va Moi Truong, NXB Giao Duc – 2003.
3. Ku. Jeff, Practical Design Calculations for Groundwater and Soil Remediation, CRC Press LLC, 1999 Vietnam environmental protect law, HCM Tonghop Publisher, 2015.
4. Ibrahim A. Mirsal, Soil Pollution Origin, Monitoring & Remediation, Springer-Verlag Berlin Heidelberg, 2008.