॥ सा 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

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

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

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Academic-1 (BOS) Section

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शैक्षणिक वर्ष २०२४–२५ पासून राष्ट्रीय शैक्षणिक धोरणानुसार लागू केलेल्या विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी प्रथम वर्षाच्या सुधारित (दुरूस्ती) अभ्यासक्रमा बाबत..

..

प रि प त्र क

संदर्भ:– १. जा.क्र.शै–१/एनईपी/विवत्रंविपदवी/२०२४–२५/१२३ दिनांक २०/०६/२०२४

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, संदर्भीय परिपत्रकान्वये दिनांक १५ मे २०२४ रोजी संपन्न झालेल्या मा. विद्यापरिषदेच्या बैठकीतील विषय क्र. १५/५९–२०२४ अन्वये मान्यता दिल्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरणानुसार पदवी प्रथम वर्षाचे अभ्यासक्रम शैक्षणिक वर्ष २०२४–२५ पासून लागू करण्यात आलेले आहेत. तथापी वरील संदर्भीय परिपत्रका अन्वये प्रकाशित केलेल्या अभ्यासक्रमामध्ये अभ्यासमंडळानी किरकोळ दुरूस्ती करून अभ्यासक्रम सादर केला असून मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा यांच्या मान्यतेने दुरूस्ती केलेले खालील अभ्यासक्रम लागू करण्यात येत आहेत.

01	B. Sc. I year Agrochemical and Fertilizer
02	B. Sc. I year Chemistry (General)
03	B. Sc. I year Biochemistry

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.

सहाय्यक.कुलसचिव
शैक्षणिक अभ्यासमंडळ विभाग

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.:शैक्षणिक–१/परिपत्रक/एनईपीयुजीदुरूस्ती/S&T/
२०२४–२५/284
दिनांक : ०८.१०.२०२४

प्रत माहिती व पुढील कार्यवाहीस्तव.

०१. मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
०२. मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
०३. मा. संचालक, सर्व संबधित संकुले, प्रस्तुत विद्यापीठ.
०४. मा. प्राचार्य, सर्व संबधित महाविद्यालये, प्रस्तुत विद्यापीठ.
०५.सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. यानां देवून कळविण्यात येते की, सदरील परिपत्रक विद्यापीठाच्या 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 changings 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.

Details of the Board of Studies Members in the subject Chemistry under the faculty of Science & Technology of S.R.T.M. University, Nanded

Sr. No.	Name of the Member	Designation	Address	Contact No.
1	Dr. D. R. Munde	Chairman	Science College Nanded	9421756689
2	Dr. B. S. Dawane	Member	School of chemical Sciences SRTMU Nanded	9423584000
3	Dr. Krishna Chaitanya	Member	School of Chemical Sciences SRTMU Nanded	7385721802
4	Dr. S. B. Sirsat	Member	Yeshwant Mahavidyalaya Nanded	9890374904
5	Dr. Jaman A. Angulwar	Member	Dayanand Science College Latur	9423246209
6	Dr. S. D. Dhage	Member	S.S.J.E.S. ACS College Gangakhed	9404864600
7	Dr. N. S. Kaminwar	Member	L.B.S. College Dharmabad	7588524845
8	Dr. A. S. Bondge	Member	Shivneri Mahavidyalaya Shirur Anantpal	9423577771
9	Dr. A. B. Chidrawar	Member	Degloor College Degloor	9423140093
10	Dr. Y. S. Nalwar	Member	Toshniwal ACS College Sengaon	9421292020
11	Dr. S. P. Hangirgekar	Member	Shivaji University Kolhapur	7276689374
12	Dr. S. V. Bhosle	Member	IICT Hydrabad	9490065673
13	Dr. B. C. Khade	Member	D.S.M. College Parbhani	9423443275
14	Dr. P. Bhaskar Reddy	Member	Bio Phore India Pharmaceuticals Hydrabad	9160744744
15	Miss. Goge Reshma Vikram	Member	Dyanand Science College Latur	
16	Miss. Tompe Pragati P.	Member	Yeshwant mahavidyalaya Nanded	

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 ofthe Course	Instruction Hrs. /Week	Total period	Internal CA	ESA	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	20	30	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	04	60	20	30	50	2
II		SCHECT 1151	Physical Chemistry + Inorganic Chemistry **(Theory)**	02	30	10	40	50	2
		SCHECP 1151	Physical Chemistry + Inorganic Chemistry **(Practical)**	04	60	20	30	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	04	60	20	30	50	2

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** fromOrganic Chemistry.
- At least fifteen practicals should be engaged in **IInd** semester: **05** practicals from Inorganic Chemistry, **10** from Physical Chemistry.

B. Sc. First Year Semester I *(Level 4.5)*

Teaching Scheme

	Course Code	CourseName	CreditsAssigned			TeachingScheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Optional 1	SCHECT1101	**Organic Chemistry & Inorganic Chemistry**	02	--	**02**	02	--
	SCHECP1101	**Practical Based on SCHECT 1101**	-	02	**02**	--	04
Generic Electives *(from other Faculty)*	SCHEGE1101	**Generic Elective (GE) Paper First Everyday Chemistry (Basket 3)**	02	--	**02**	02	--
Skill Based Course (related to Major)	SCHESC1101	**Fundamentals of Chemistry Laboratory OR Water Pollution**	--	02	**02**	--	04

B. Sc. First Year Semester I *(Level 4.5)*

Examination Scheme

Subject (1)	Course Code (2)	CourseName (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Average of T1 & T2 (6)	(7)	CA (8)	ESA (9)	
Optional 1	SCHECT1101	**Organic Chemistry & Inorganic Chemistry**	10	10	10	40	--	--	50
	SCHECP1101	**Practical Based on SCHECT 1101**	--	--	--	--	20	30	50
Generic Elective	SCHEGE1101	**Generic Elective (GE) Paper First Everyday Chemistry (Basket 3)**	10	10	10	40	--	--	50
Skill Based Course	SCHESC1101	**Fundamentals of Chemistry Laboratory OR Water Pollution**	--	--	--	--	20	30	50

B. Sc. First Year Semester II *(Level 4.5)*

Teaching Scheme

	Course Code	CourseName	CreditsAssigned			TeachingScheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Optional 1	SCHECT1151	**Physical Chemistry & Inorganic Chemistry**	02	--	**02**	02	--
	SCHECP1151	**Practical Based on SCHECT 1151**	-	02	**02**		04
Generic Electives *(from other Faculty)*	SCHEGE1151	**Soil and Fertilizer Chemistry (Basket 3)**	02	--	**02**	02	--
Skill Based Course (related to Major)	SCHESC1151	**Common Laboratory Techniques OR Soil Pollution**	--	02	**02**	--	04

B. Sc. First Year Semester I *(Level 4.5)*

Examination Scheme

Subject (1)	Course Code (2)	CourseName (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Average of T1 & T2 (6)	(7)	CA (8)	ESA (9)	
Optional 1	SCHECT1151	**Organic Chemistry & Inorganic Chemistry**	10	10	10	40	--	--	50
	SCHECP1151	**Practical Based on SCHECT 1151**	--	--	--	--	20	30	50
Generic Elective	SCHEGE1151	**Soil and Fertilizer Chemistry (Basket 3)**	10	10	10	40	--	--	50
Skill Based Course	SCHESC1151	**Common Laboratory Techniques OR Soil Pollution**	--	--	--	--	20	30	50

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, NO_2, CH_3, 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) $P_2O_5/ZnCl_2$.

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 5^{th} 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 Napthalene.

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 (First 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,Intrnational student edition .

3.Principles of inorganic chemistry Puri Sharma Kalia, Milestone publishers and distributors,

4.Principles of environmental chemistry second edition,James E.Girad 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.

SYLLABUS

SEMESTER -1 SCHESC1101

Unit	Topic/s
I **(Theory)**	**Fundamentals of Chemistry Laboratory** **(05 Hours)** General introduction of chemistry laboratory, common instruction for safe working in chemical laboratories, Lab design, Storage, ventilation, lighting, fume, cupboard, arrangement of store, Safety provisions, Organization of practical work, Maintenance of laboratory, equipment/ apparatus Cleaning of laboratories and preparation room. **Introduction of Lab Apparatus** **(05 Hours)** *Glass apparatus* - Beaker, Test tube, boiling tube, funnel, separating funnel, filtration flask, round CHEtom flask, flat CHEtom flask, condenser Liebig flask,watch glass etc. measuring conical or condenser, petridish, desiccator. *Volumetric Apparatus* - Measuring cylinder, burette, pipette, Volumetric flask, analytical balance, single-pan electronic balance/ electrical analytical balance etc. *Miscellaneous apparatus*- Buchner funnel, Bunsen burner, burette stand, retort clamp, china dish/evaporating basin, wire gauze, cork borers, filter pumps, crucible, mohr clip, pipe clay triangle, pestle and mortar, sprit lamp, spatulas, thermometer, pH meter/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* **Solution Preparation** **(05 Hours)** Water as a solvent, types of water, solutions, components of a solution, types of solution, solubility, concentration of solutions: percentage, molarity, normality, molality (in ppm) calculation of masses and volumes for preparation of solutions solids, liquids.
II **(Practical)**	***1.*** Handling of common laboratory equipment **(30 Hours)** *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 boiling point and melting point.
III **(Tutorials)**	*Activity 1:* Cleaning of laboratories and preparation room. **(15 Hours)** *Activity 2*: Classification of apparatus in store. *Activity 3*: Cleaning of glassware. *Activity 4:* Organization of practical work. *Activity 5:* A brief report on Safety provisions in laboratories.

OR

(SCHES1101)

UG Ist Year Semester I

Skill Enhancement Course

Water Pollution

PREREQUISITES

This course is intended for undergraduates students. It is a chemistry based course that the students to be comfortable with mathematical calculations and eligibility criteria for admission to this course is (10+2) science passing.

COURSE DESCRIPTION

This course provides an introduction to major aspects of water quality science and its control technology, including an overview of the main pollutants and their effects, typical wastewater characteristics (CHEh municipal and industrial wastewater) and how those characteristics may affect relevant unit operations (physical, chemical and biological). It also focuses on how to combine these operations to control water pollution and to meet effluent requirements. It will cover the analysis of different physical and chemical water parameters.

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 ofwater 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: 45 periods

a) P^H b) Dissolve Oxygen

c) Chemical Oxygen demand d) Bio-Chemical Oxygen demand

e) Hardness f) Chloride

g) Sulphate h) TDS

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. Introducation 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.

1.4. 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 (Tb) Inversion Temperature (Ti). Derivation of Vander-Waals equation, Units for Vander-Waals constants.

2.3 Critical phenomenon: Definitions of critical constants. Relation between critical constants (Tc, Vc, Pc) 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.

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 Gels: Classification of gels, preparation and properties gel.

3.6 Emulsions: Types of emulsions, preparation of emulsion, Emulsifier.

3.7 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 KNO3/NH4Cl.
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 muroexide 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.

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 Second

(SCHEGE 1151)

Soil and Fertilizer Chemistry

Objective:

• To understand the concept of soil and fertilizer.

• To increases the awareness about the soil and effect of excessive fertilizers.

• To emphasise 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 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 element's.

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.

SEMESTER -2

SCHESC1151

Unit	Topic/s
I **(Theory)**	**Common Laboratory Techniques** **(05 Hrs.)** *Refluxing:* Apparatus with interchangeable ground glass joints (Quick fit), *Filtration*: Techniques and filter media, filter paper, simple filtration, *Recrystallization*: Choice of solvent and precautions with flammable solvents, *Distillation*: recovery of solvents through partial distillation, distillation under reduced pressure, and *Determination of Boiling Point* **Chemistry Laboratory Safety** **(03 Hours)** *Fire Hazards:* Causes of fires, classification of fires, fire prevention protocols and measures, fire alarms, fire escapes, fire Extinguishers and their uses. *Chemical Hazards*: Classification and handling of hazardous chemicals, storage of chemicals, transfer from large containers *Gas Hazards:* usage of LPG and CNG safer in the laboratory, detection and handling of Gas Leakage, health hazards of gases **Use of Computer in Laboratory** **(03 Hours)** Hardware in computer, CPU, I/O devices, data input, data processing, data output, application MS office software and Internet. **Stock and Inventory Control** **(02 Hours)** Arranging stock, locating and referencing, shelf arrangement of stock, order books, inventory. **Files and Records** **(02 Hours)** *Filing Systems*- Classification of files, filing methods, filing system for equipments and chemicals, filing of printed and written material, preparation of lab manuals. *Records system* : Stock records, recording stock (used and misused), record of use of listed poisons, record of use of alcohol, record of breakages, information about equipment serial numbers, record maintenance, miscellaneous records.
II **(Practical)**	**1.** Preparation of hydrogen sulphide (H_2S) gas using Kipp's apparatus. **(30 Hours)** 2. Simple acid-base titration. 3. Preparation of distilled/deionized water. 4. Purification of organic compounds by recrystallization. 5. Preparation of inorganic double salts. 6. Experiments based on chromatography
III **(Tutorials)**	*Activity 1*: Classification of chemicals in laboratory/store. **(15 Hours)** *Activity 2*: Classification hazardous chemicals based on the information given on the labels. *Activity 3*: Preparation of comparative chart. *Activity 4*: To learn the use of a carbon dioxide fire extinguisher. *Activity 5*: Preparation of stock register on MS-Excel.

Bibliography:

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.*

OR

(SCHES 1151)

UG Ist Year Semester II

Skill Enhancement Course

Soil Pollution

OBJECTIVES 60 Period

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 acidicity 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, Mothods to prevent soil pollution.

Module: 4 Laboratory Work **45 P**

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

Learning 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 environemntal engineerer in soil environment toward the society.
7. Conceive ideas of soil environment improvement in soil degradation and pollution.

Text book

1. Ibrahim A. Mirsal, Soil Pollution Origin, Monitoring & Remediation, Springer-Verlag Berlin Heidelberg, 2008.

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, 1999Vietnam environmental protect law, HCM Tonghop Publisher, 2015.

Guidelines for Course Assessment:

A. Continuous Assessment (CA) (20% of the Maximum Marks):

This will form 20% of the Maximum Marks and will be carried out throughout the semester. It may be done by conducting **Two Tests** (Test I on 40% curriculum) and **Test II** (remaining 40% syllabus). Average of the marks scored by a student in these two tests of the theory paper will make his **CA** score (col. 6).

B. End Semester Assessment (80% of the Maximum Marks):

(For illustration we have considered a paper of 04 credits, 100 marks and need to be modified depending upon credits of an individual paper)

1. **ESA Question paper will consists of 6 questions, each of 10 marks.**
2. **Students are required to solve a total of 4 Questions.**
3. **Question No.1 will be compulsory and shall be based on entire syllabus.**
4. Students need to solve **ANY THREE** of the remaining Five Questions (Q.2 to Q.6) and shall be based on entire syllabus.

Note: **Number of lectures required to cover syllabus of a course depends on the number of credits assigned to a particular course. One credit of theory corresponds to 15 Hours lecturing and for practical course one credit corresponds to 30 Hours. For example, for a course of two credits 30 lectures of one hour duration are assigned, while that for a three credit course 45 lectures.**