॥ 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

Fax : (02462) 215572

Phone: (02462)215542

Academic-1 (BOS) Section

website: srtmun.ac.in

E-mail: bos@srtmun.ac.in

विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरण २०२० नुसार पदवी द्वितीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२५–२६ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक २७ मे २०२५ रोजी संपन्न झालेल्या मा. विद्यापरिषद बैठकीतील विषय क्रमांक १६/६१–२०२५ च्या ठरावानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील राष्ट्रीय शैक्षणिक धोरण–२०२० नुसारचे पदवी द्वितीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२५–२६ पासून लागू करण्यास मा. विद्यापरिषदेने मान्यता प्रदान केली आहे.

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.

त्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील बी. एस्सी द्वितीय वर्षाचे खालील विषयाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२५–२६ पासून लागू करण्यात येत आहेत.

01	B.Sc. II nd Year Chemistry (General)

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/विवत्रंविपदवी/२०२५–२६/
दिनांक २६.०६.२०२५

सहाय्यक कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत : माहितीस्तव तथा कार्यवाहीस्तव.

१) मा. कुलगुरू महोदयांचे कार्यलय, प्रस्तुत विद्यापीठ.
२) मा. प्र. कुलगुरू महोदयांचे कार्यलय, प्रस्तुत विद्यापीठ.
३) मा. आधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
४) मा. संचालक, परीक्षा व मुंल्यमापन मंडळ, प्रस्तुत विद्यापीठ.
५) मा. प्राचार्य, सर्व संबधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
६) सिस्टीम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. याना देवून कळविण्यात येते की, परिपत्रक अभ्यासक्रम संकेतस्थळावर प्रसिध्द करण्यात यावेत.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED - 431 606 (MS)

UNDER GRADUATE PROGRAMME OF SCIENCE & TECHNOLOGY

B.Sc. SECOND YEAR

SUBJECT–CHEMISTRY

With Effective from the Academic Year2025-2026

(As per NEP-2020)

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

Credit Framework for B.Sc.II Year

Multidisciplinary Degree Program with Multiple Entry and Exit

Subject: CHEMISTRY (Major) /CHEMISTRY (Minor)

Year & Level	Semester	Major *(From the same Faculty)*	Minor 1 *(From the same Faculty)*	(Minor 2) *(From the same Faculty)*	Generic Elective (GE) (select from Basket 3 of *Faculties other than Science and Technology*)	Vocational & Skill Enhancement Course	Ability Enhancement Course (AEC) (Basket 4) Value Education Courses (VEC) / Indian Knowledge System (IKS) (Basket 5) *(Common across all faculties)*	Field Work / Project/Internship/ OJT/ Apprenticeship / Case Study Or Co-curricular Courses (CCC) (Basket 6 for CCC) *(Common across all faculties)*	Credits	Total Credits
1	2	3	4	5	6	7	8	9	10	11
2 (5.0)	III	SCHECT1201 (2cr) SCHECT1202 (2cr) SCHECP1201 (2cr) SCHECP1202 (2cr) 8 Credits	SCHEMT1201 (2Cr) SCHEMP1201 (2Cr) 4 Credits		SCHEGE1201 (2cr)	SCHEVC1201 2 Credits	ACEENG1201 (2cr) ACEMIL1201 (2Cr) 4 Credits	CCCXXX1201(2Cr) *(NCC/NSS/SPT(sports)/ CLS(Cultural Studies)/HWS(Health Wellness)/ YGE(Yoga Education) / FIT(Fitness)* 2 Credits	22	88
	IV	SCHECT1251 (2cr) SCHECT1252 (2cr) SCHECP1251 (2cr) SCHECP1252 (2cr) 8 Credits	SCHEMT1251 (2Cr) SCHEMP1251 (2Cr) 4Credits		SCHEGE1251 (2cr)	SCHEVC1251 2 Credits	ACEENG1201 (2cr) ACEMIL1201 (2Cr) VECEVS1251 (2Cr) 6 Credits		22	
	Cum. Cr.	24	16	08	08	08	22	02	44	
***Exit option*: UG Diploma in Major CHEMISTRY and Minor CHEMISTRY on completion of 88 credits and** additional **4 credits NSQF / internship in CHEMISTRY**										

B. Sc. Second Year Semester III*(Level 5)*

Teaching Scheme

	Course Code	CourseName	Credits Assigned			Teaching Scheme (Hrs/week)	
			Theory	Practical	Total	Theory	Practical
Major	SCHECT1201	**Organic and Inorganic Chemistry**	02	--	**04**	02	--
	SCHECP1201	**Practical based on SCHECT 1201**	-	02			04
	SCHECT1202	**Physical and Inorganic Chemistry**	02	--	**04**	02	--
	SCHECP1202	**Practical based on SCHECT 1202**	-	02			04
Minor	SCHEMT1201	**Basic Chemistry**	02	--	**04**	02	--
	SCHEMP1201	**Practical based on SCHEMT 1201**	-	02			04
Generic Electives *(from other Faculty)*	SCHEGE1201	**Clinical Chemistry**	02	--	**02**	02	--
Vocational Course (related to Major)	SCHEVC1201	**Chemistry in Daily Life**	--	02	**02**	--	04
Ability Enhancement Course	AECENG1201	L1 – Compulsory English	02	--	**02**	02	--
Ability Enhancement Course	**ACEMIL1201**	**(MAR/HIN/URD /KAN/PAL)**	02	--	**02**	02	--
(NCC/NSS/SPT(sports)/ CLS(Cultural Studies)/HWS(Health Wellness)/ YGE(Yoga Education) / FIT(Fitness) **2 Credits**	**CCCXXX1201**	Select from **Basket 5**	02	--	**02**	02	--
Total Credits			**14**	**08**	**22**	**14**	**16**

B. Sc. Second Year Semester III*(Level 5)*

Examination Scheme

[20% Continuous Assessment (***CA***) and 80% End Semester Assessment (***ESA***)]

(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits assigned to individual paper)

Subject (1)	Course Code (2)	Course Name (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)	Total (7)	CA (8)	ESA (9)	
Major	SCHECT1201	**Organic and Inorganic Chemistry**	10	10	10	40	--	--	50
	SCHECP1201	**Practical based on SCHECT 1201**	--	--	--	--	20	30	50
	SCHECT1202	**Physical and Inorganic Chemistry**	10	10	10	40	--	--	50
	SCHECP1202	**Practical based on SCHECT 1202**	--	--	--	--	20	30	50
Minor	SCHEMT1201	**Basic Chemistry**	10	10	10	40	--	--	50
	SCHEMP1201	**Practical based on SCHEMT 1201**	--	--	--	--	20	30	50
Generic Electives	SCHEGE1201	**Clinical Chemistry**	10	10	10	40	--	--	50
Vocational Course	SCHEVC1201	**Chemistry in Daily Life-I**	--	--	--	--	20	30	50
Ability Enhancement Course	AECENG1201	L1 – Compulsory English	--	--	--	--	20	30	50
Ability Enhancement Course	ACEMIL1201	**(MAR/HIN/URD /KAN/PAL)**	--	--	--	--	20	30	50
(NCC/NSS/SPT(sports)/ CLS(Cultural Studies)/HWS(Health Wellness)/ YGE(Yoga Education) / FIT(Fitness) **2 Credits**	CCCXXX1201	Select from **Basket 5**	10	10	10	40	--	--	50

B. Sc. Second Year Semester IV *(Level 5)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	SCHECT1251	**Organic and Inorganic Chemistry**	02	--	**04**	02	--
	SCHECP1251	**Practical based on SCHECT 1201**	-	02			04
	SCHECT1252	**Physical and Inorganic Chemistry**	02	--	**04**	02	--
	SCHECP1252	**Practical based on SCHECT 1202**	-	02			04
Minor	SCHEMT1251	**Basic Chemistry-II**	02	--	**04**	02	--
	SCHEMP1251	**Practical based on SCHEMT 1251**	-	02			04
Generic Electives *(from other Faculty)*	SCHEGE1251	**Chemistry for Farming**	02	--	**02**	02	--
Vocational Course (related to Major)	SCHEVC1251	**Oil &Fat Technology**	--	02	**02**	--	04
Ability Enhancement Course	AECENG1251	L1 – Compulsory English	02	--	**02**	02	--
Ability Enhancement Course	**ACEMIL1251**	**(MAR/HIN/URD /KAN/PAL)**	02	--	**02**	02	--
(NCC/NSS/SPT(sports)/ CLS(Cultural Studies)/HWS(Health Wellness)/ YGE(Yoga Education) / FIT(Fitness) **2 Credits**	**CCCXXX1251**	Select from **Basket 5**	02	--	**02**	02	--
Total Credits			**14**	**08**	**22**	**14**	**16**

B. Sc. Second Year Semester IV*(Level 5)*

Examination Scheme

[20% Continuous Assessment (***CA***) and 80% End Semester Assessment (***ESA***)]

(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits assigned to individual paper)

Subject (1)	Course Code (2)	Course Name (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)	Total (7)	CA (8)	ESA (9)	
Major	SCHECT1251	**Organic and Inorganic Chemistry**	10	10	10	40	--	--	50
	SCHECP1251	**Practical based on SCHECT 1201**	--	--	--	--	20	30	50
	SCHECT1252	**Physical and Inorganic Chemistry**	10	10	10	40	--	--	50
	SCHECP1252	**Practical based on SCHECT 1202**	--	--	--	--	20	30	50
Minor	SCHEMT1251	**Basic Chemistry-II**	10	10	10	40	--	--	50
	SCHEMP1251	**Practical based on SCHEMT 1251**	--	--	--	--	20	30	50
Generic Electives	SCHEGE1251	**Chemistry for Farming**	10	10	10	40	--	--	50
Vocational Course (related to Major)	SCHEVC1251	**Oil& fat Technology**	--	--	--	--	20	30	50
Ability Enhancement Course	AECENG1201	L1 – Compulsory English	--	--	--	--	20	30	50
Ability Enhancement Course	**ACEMIL1201**	**(MAR/HIN/URD /KAN/PAL)**	--	--	--	--	20	30	50
(NCC/NSS/SPT(sports)/ CLS(Cultural Studies)/HWS(Health Wellness)/ YGE(Yoga Education) / FIT(Fitness) **2 Credits**	**CCCXXX1201**	Select from **Basket 5**	10	10	10	40	--	--	50

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

B.Sc. Second Year (Third Semester)

Subject**: Chemistry**

Organic and Inorganic Chemistry (Theory)

Course Code**: SCHECT 1201**

Credits: 02 **Periods:** 30

Course Objective:

1. To aware students with various name reactions and their mechanism on aldehydes and ketones.
2. To familiarize students with the synthesis and chemical transformations of aromatic carboxylic acids.
3. To inform students with the synthesis and chemical Inter conversions of aromatic carboxylic acids derivatives.
4. To develops the knowledge about organometallic compounds and their applications among students.
5. To prepare students for the application of theoretical knowledge about specific usage and application of different organometallic compounds.

Module I

Chemistry of Aromatic Carbonyl Compounds: 07 P

1.1 Introduction, Structure of carbonyl group. Reactions benzaldehyde and acetophenone with HCN, ethylalcohol, primary amine, phenylhydrazine, 2,4-Dinitrophenyl hydrazine

1.2 Condensation Reactions with mechanism: Benzoin condensation, Perkin condensation, Knoevenagel condensation, Wittig reaction, Mannich reaction.

1.3 Oxidation and Reduction Reactions with mechanism: Baeyer- Villiger oxidation, Meerwein-Pondorf-Verley reduction, Clemmensen reduction, Wolf-Kishner reduction.

Module II

Carboxylic acid and theirDerivatives. 07 P

2.1 Carboxylic Acids: Nomenclature, structure and bonding, Physical properties, acidity of carboxylic acid, effect of substituents on acid strength, preparation of carboxylic acid from G.R. and alkyl cyanide, Reactions of carboxylic acid- Reaction with metal, oxidation with hydrogen peroxide, Hell-Volhard-Zelinsky reaction, Huns diecker reaction, reduction of carboxylic acid using BH_3.

2.2 Unsaturated monocarboxylic acids (crotonic acid and cinnamic acid)- Methods of formation and chemical reactions: Crotonic acid from ethyl acetoacetate, croton aldehyde and acetaldehyde with diethyl malonate, Cinnamic acid from benzaldehyde (Claisen condensation and Reformatsky reaction) Dicarboxylic acids (Succinic acid, Phthalic acid): Methods of formation-Succinic acid from ethylene dibromide and maleic acid, effect of heat

and reaction with ammonia. Phthalic acid from o-Xylene and Naphthalene, Action of heat, reaction with PCl_5 and ethyl alcohol.

2.3 Carboxylic acid derivatives: Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides. Preparation of carboxylic acid derivatives, Interconversion of acid derivatives by nucleophilic substitution. Chemical reactions, Mechanism of esterification and hydrolysis (acidic and basic).

Module III

Organometallic Compounds: 06 P

3.1 Introduction, reactivity of organometallic compounds.

Organomagnesium Compounds: Preparation of Methyl Magnesium Bromide (CH3MgBr).Synthetic applications for preparation of: Ethanol, Ethanoic acid, Acetonitrile,Ethyl ethanoate.

3.2 Organolithium Compounds: Preparation of Methyl Lithium (CH_3Li) from Methyl Iodide. Synthetic applications for preparation of: Ethanol, 1-Propanol, 2-Propanol, 2-Methyl-2-Propanol.

3.3 Organozinc Compounds: Preparation of Diethyl Zinc [$(C_2H_5)_2Zn$] from ethyl iodide. Synthetic applications for preparation of: Ethane, 2-Butanol, Ethyl methyl ketone, Diethyl mercury.

3.4 Organocopper Compounds: Preparation of Lithium dimethyl cuprate. Synthetic applications for preparation of: Butane, Acetone, 2-Pentanone, 1-Butene, Toluene.

Module IV

A. Theory of Qualitative Analysis: 05 P

4.1 Introduction: Definition of qualitative analysis, macro, micro and semi micro qualitative analysis, radicals, acidic and basic radicals.

4.2 Role of sodium carbonate extract in qualitative analysis.

4.3 Interfering radicals, removal of interfering radicals such as oxalate, borate, fluoride and phosphate.

4.4 Use of solubility product, common ion effect and complex ion formation in the analysis of basic radicals:

i) Separation of IIA and IIB,

ii) Separation of II and IIIB,

iii) Separation of IIIA and IIIB

B. Acids and Bases: 05 P

4.5 Introduction, Arrhenius concept, Bronsted-Lowry concept, Lewis acids and bases concept, Solvent system concept, Cady-Elsey concept, Lux-Flood concept and Usanovich concept for acids and bases.

4.6 Definition of Hard and Soft acids and bases, borderline acids and bases with various examples. Pearson's principle (SHAB Principle).

4.7 Super acids and super bases.

4.8 Relative strength of acids and bases, trends in acid strength of hydro acids.

Course Outcomes:

1. Students are able to write and discuss the mechanism of reactions of carbonyl compounds.
2. Students are able to correlate between the reagent and reactions of carbonyl compounds.
3. Students can understand the importance and application of aromatic carbonyl compounds.
4. Students will learn the concept of reaction mechanism.
5. Students can identify and draw the structures carboxylic acids and their derivatives from their names or from structure name.
6. Students can explain and discuss synthesis of carboxylic acids and their derivatives.
7. Students can explain acidity of carboxylic acids and effect of substituents on its strength.
8. Students are able to explain and discuss Interconversions of acid derivatives.
9. Students can correlate between reagent and reactions of carboxylic acids and their derivatives.
10. Students can elucidate synthesis and synthetic applications of organometallic compounds.
11. Apply qualitative analysis techniques to identify basic and acidic radicals, accounting for interfering radicals and using solubility product and complex formation principles for group separation.
12. Compare various acid-base theories, including Arrhenius, Bronsted-Lowry, Lewis, solvent system, and Pearson's HSAB principle, to understand acid-base behavior in different systems.
13. Classify acids and bases based on strength and type, and explain advanced concepts like super acids and super bases with relevant chemical trends.

Reference books:

1. Organic chemistry by Morrison and Boyd, Print ice hall.
2. Organic chemistry by L.G. Wade. Print ice hall.
3. Organic chemistry Vol. I, II, III by S. M. Mukharji, S. P. Sing and R. P. Kapoor
4. Fundamental of organic chemistr y b y Solomon, John willey
5. A Text book of organic chemistry by Bahl and Bahl.
6. A Text book of organic chemistry by P. L. Soni.
7. A Text book of organic chemistry by Tewari Mehrotra.
8. Organic chemistry by I. L. Finar.
9. Organic Chemistry by Francis A. Carey, McGRAW-HILL, INC.
10. Modern Organic Chemistry by M. K. Jain and S. C. Sharma.

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

B.Sc. Second Year (Third Semester)

Subject**: Chemistry**

Physical and Inorganic Chemistry (Theory)

Course Code**: SCHECT 1202**

Credits: 02 **Periods:** 30

(Course Objective):

1. To introduce students to the fundamental concepts of quantum theory and its application in explaining atomic phenomena such as the photoelectric and Compton effects.
2. To enable students to understand and derive key principles such as the de-Broglie equation and Heisenberg's uncertainty principle, establishing the wave-particle duality of matter.
3. To develop students' ability to interpret and apply the Schrödinger wave equation and solve basic numerical problems related to quantum mechanical concepts.
4. To explain the foundational laws of thermodynamics, including the first and second laws, and their relevance to energy transformations.
5. To familiarize students with thermodynamic concepts such as entropy, Carnot's cycle, and the efficiency of reversible systems.
6. To provide students with the skills to analyze and calculate entropy changes during physical processes and solve numerical problems involving thermodynamic efficiency.
7. To introduce the basic concepts of catalysts and catalysis, including the types and characteristics of catalytic reactions.
8. To explore the roles of promoters, inhibitors, and mechanisms like autocatalysis and catalytic poisoning in chemical processes.
9. To impart an understanding of various forms of catalysis—homogeneous, heterogeneous, acid-base, and enzyme catalysis—with real-world examples.
10. To present multiple acid-base theories (Arrhenius, Bronsted-Lowry, Lewis, etc.) and develop an understanding of acid-base strength, including concepts like hard-soft acid base theory and super acids/bases.
11. To analyze and interpret the trends in acid and base strengths and familiarize students with modern classifications of acids and bases.
12. To equip students with the theoretical background and practical tools needed for qualitative analysis of radicals, including the identification and separation of interfering and basic radicals using solubility and complex ion principles.

Module-I **06P**

Atomic Structure and Wave Mechanics

1.1 Planck's quantum theory of radiation.

1.2 Photoelectric effect, explanation on the basis of quantum theory.

1.3 Compton Effect: Statement, explanation.

1.4 de-Broglie hypothesis; derivation of de-Broglie equation.

1.5 Heisenberg's uncertainty principle: Statement, explanation.

1.6 Schrodingerwave equation (time dependent): Physical significance of wave function (Ψ) and (Ψ^2).

1.7 Numericals.

Module-II **08P**

Thermodynamics

2.1 Introduction to First law of thermodynamics.

2.2 Carnot's cycle and its efficiency. Carnot theorem.

2.3 Need for second law of thermodynamics.

2.4 Entropy: Definition, Entropy as a state function. Unit of entropy.

2.5 Different statements of second law of thermodynamics.

2.6 Entropy change in Physical transformations: (i) Fusion of a solid. (ii)Vaporization of a liquid. (iii) Transition from one crystalline form to another.

2.7 Entropy changes for an ideal gas as a function of V and T and as a function of P and T.

2.8 Numerical on efficiency of Carnot cycle and entropy change in physical transformations.

Module-III

Catalysis: **06P**

3.1 Introduction to Catalyst and Catalysis.

3.2 Catalyst-Type of catalyst, positive and negative catalyst with examples.

3.3 Catalysis-Type of catalysis, homogenous and heterogeneous catalysis with examples

3.4 Characteristics of catalytic reactions.

3.5 Autocatalysis- explanation with examples.

3.6 Promoters- Definition, example, explanation of promotion action.

3.7 Catalytic poisoning- Definition, example, explanation of catalytic poisoning.

3.8 Acid-Base catalysis- General Acid-Base catalysis, examples.

3.9 Enzyme catalysis- Explanation, examples

Module-IV

A. Chemical Bonding I **05 P**

4.1 Chemical Bonding, Cause for chemical bonding, Types of chemical bonding.

4.2 Ionic Bonding: Definition and explanation, Factors affecting the formation of ionic bond, Energy charges in the formation of ionic bond, Lattice energy and Born-Haber cycle.

4.3 Covalent bonding: Definition and explanation, Sigma and pi-bond, Valence bond theory of covalent bonding and its limitations, Percentage ionic character in covalent bond from dipole moment and electronegativity difference (Numerical).

4.4 Metallic bonding: Definition and explanation, free electron theory of metallic bonding.

4.5 Vander Waal's bonding: Definition and explanation, Types of Vander Waal's forces responsible for Vander Waal's bonding.

4.6 Hydrogen bonding: Definition and explanation, Types of hydrogen bonding and consequences of hydrogen bonding. Unique properties of water based on hydrogen bonding. Importance of hydrogen bonding in sustaining life.

B) Chemical Bonding –II **05 P**

4.7 Hybridization: Definition and explanation of dsp^2 hybridization $[Ni(CN)_4]^{-2}$, sp^3d hybridization (PCl_5), sp^3d^2 hybridization (SF_6), sp^3d^3 hybridization(IF_7).

4.8 VSEPR Theory: Postulates and explanation, Applications in explaining geometry and bond angle in molecules such as CH_4, NH_3, and H_2O. Limitations of VSEPR theory.

4.9 Molecular Orbital Theory: Basic principle of MOT, LCAO, Bonding and antibonding molecular orbital, Energy level diagram for molecular orbital. Rules for adding electrons in MO's, bond order, Molecular orbital diagram of homo nuclear diatomic molecules such as H_2, N_2, O_2, and Ne_2 and CO.

Outcomes:

After completion of these courses students should be able to,

1. Explain key concepts of quantum theory, including Planck's quantum theory, photoelectric effect, and the Compton effect, highlighting their significance in the development of modern physics.
2. Apply the de-Broglie hypothesis and Heisenberg's uncertainty principle to solve problems and understand the wave-particle duality of matter.
3. Interpret the Schrödinger wave equation and explain the physical significance of wave functions (Ψ and Ψ^2) in describing atomic behavior.
4. Understand and apply the laws of thermodynamics, including the first and second laws, and explain concepts like Carnot's cycle, entropy, and thermodynamic efficiency.
5. Analyze entropy changes in physical processes, such as phase transitions and behavior of ideal gases, using thermodynamic principles.
6. Solve numerical problems related to thermodynamic efficiency and entropy, enhancing problem-solving skills in thermal systems.
7. Differentiate various types of catalysis (homogeneous, heterogeneous, acid-base, enzyme) and explain the characteristics and mechanisms with relevant examples.
8. Describe the role of catalysts, promoters, and inhibitors, and analyze phenomena like autocatalysis and catalytic poisoning.
9. Evaluate the industrial and biological significance of catalytic processes, emphasizing the role of enzymes and acid-base catalysis in real-world systems.

10. Students will be able to understand the nature of Chemical bond, cause of chemical combination and different types of bonding.
11. Students will be able to understand the Concept of hybridization, VSEPR & Molecular Orbital theory.

Reference Books:

1. Principles of Physical Chemistry by Puri, Sharma and Pathania (Vishal Publication Jalandhar, Delhi),
2. Advanced Physical Chemistry by Gurdeep Raj (Goel publishing house, Meerut).
3. Essentials of Physical Chemistry by Arun Bhal, B. S. Bahl and G. D. Tuli. (S. Chand)
4. A Text Book Physical Chemistry by S. Glasstone, (Mac Millan.)
5. Elements of Physical Chemistry by P. W. Atkins. (Oxford University Press).
6. Physical Chemistry by R. A. Alberty (Wiley Eastern Ltd.).
7. Physical Chemistry by G. M. Barrow (Tata Mc-Graw Hill publishing Co., Ltd.)
8. Elements of Physical Chemistry by S. Glasstone & D. Lewis (D. van nostrand co. Inc.
9. Physical Chemistry by W. J. Moore (Orient Longman).
10. University General Chemistry by C. N. R. Rao (Mc-Millan).
11. Physical Chemistry through problems by S. K. Dogra, D. Dogra (Wiley Eastern Ltd)
12. Physical Chemistry by A. J. Mee. ELBS & Heinemann Educational Books Ltd.
13. Chemical Kinetics by K. J. Laidler (Tata Mc-Graw Hill Publishing Co. Ltd).
14. Text Book of Physical Chemistry by Soni-Dharmarha.
15. Advanced Physical Chemistry by D.N.Bajpai (S.Chand)
16. "Inorganic Chemistry" by J.D. Lee
17. "Inorganic Chemistry: Principles of Structure and Reactivity" by James E. Huheey, Ellen A. Keiter, Richard L. Keiter
18. "Modern Inorganic Chemistry" by R.D. Madan
19. "Vogel's Qualitative Inorganic Analysis" by G. Svehla & B. Sivasankar (revised edition)
20. "Analytical Chemistry" by Gary D. Christian

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

B.Sc. Second Year (ThirdSemester)

Subject**: Chemistry**

Organicand Inorganic Chemistry (Practicals)

Course Code**: SCHECP1201**

Credits: 02 **Periods:**60

Course Objective:

1. To train about the thin layer chromatography and distillation techniques.
2. To become skilled for qualitative analysis of organic compounds.
3. To know different tests and corresponding reagents for functional groups present in organic compounds.

(Organic)

1. **Only demonstration**
   i) Determination of Rf values of O, M and P-nitro aniline.
   ii) Separation of benzene and water by distillation method.
2. **Qualitative analysis: Identification of following organic compounds. (Two from each of the following)**

a) **Acids:** Benzoic acid, Phthalic acid, Salicylic acid, Cinnamic acid, o-chloro benzoic acid, m-nitro benzoic acid.

b) **Base:**Aniline, P-nitroaniline, m-nitroaniline, o-nitroaniline P-toludiene, p-chloro aniline.

c) **Phenols:** α-naphthol, β-naphthol, resorcinol.

d) **Neutral**: Naphthalene, Anthracene, Acetanilide, m-dinitrobenzene, Nitrobenzene, Chloro benzene, Toluene.

(Inorganic)

3. **Inorganic preparations**

a) Preparation of Ferrous Ammonium Sulphate (Mohr's Salt) $FeSO_4(NH_4)_2SO_4.6H_2O$

b) Preparation of microcosmic salt $Na(NH_4)HPO_4.4H_2O$

c) Preparation of Nickel Ammonium Sulphate $NiSO_4(NH_4)_2SO_4.6H_2O$

d) Preparation of Ferric Alum $Fe_2(SO_4)_3(NH_4)_2SO_4.24H_2O$

e) Preparation of Potash Alum $K_2SO_4Al_2(SO_4)_3.24H_2O$

Course Outcomes:

1. Students can determine Rf values of organic compounds.
2. Students learn about the fundamentals of organic qualitative analysis.
3. Students are able to identify the functional groups present in organic compounds using appropriate reagents.

Swami Ramanand Teerth Marathwada University, Nanded
Faculty of Science and Technology
B.Sc. Second Year (Third Semester)
Subject**: Chemistry**
Physical and Inorganic Chemistry (Practicals)
Course Code**: SCHECP1202**

Credits: 02 **Periods:**60

Note: At least 10 experiments should be taken.

(Physical Chemistry)

Instrumental

1. Determine the normality and strength of strong acid (HCl / H_2SO_4 / HNO_3) conductmetrically using standard solution of strong base (NaOH / KOH).
2. To determine the solubility of a sparingly soluble salts ($BaSO_4$ / $PbSO_4$ / AgCl) conductometrically at room temperature.
3. Determine the normality and strength of strong acid (HCl / H_2SO_4 / HNO_3) potentiometrically using standard solution of strong base (NaOH / KOH).
4. Verification of Lamberts-Beer's law using $KMnO_4$ / $NiSO_4$ / $K_2Cr_2O_7$ / $CuSO_4$ calorimetrically and determine concentration of unknown solution.

Non-Instrumental

5. To study the effect of addition of electrolyte (KCl / NaCl) on solubility of weak organic acid at room temperature.
6. Determine energy of activation of reaction between KI and $K_2S_2O_8$.
7. To study the effect of solute (NaCl / Succinic acid) on the CST of phenol- water system and hence, determine amount of solute in given sample of phenol – water composition.
8. To determine the composition of the given mixture consisting of two miscible liquids, A and B by viscosity measurement.
9. Determine partition coefficient of iodine between carbon tetrachloride and water.

(Inorganic)

Separation of binary mixtures and estimation of any one by volumetric method:

10. $Cu^{++} + Zn^{++}$
11. $Ba^{++} + Ca^{++}$
12. $Mn^{++} + Zn^{++}$
13. $Fe^{++} + Al^{+++}$
14. $Cu^{++} + Fe^{++}$

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

B.Sc. Second Year (Third Semester)

Subject**: Chemistry**

Physical and Inorganic Chemistry (Theory)

Course Code**: SCHEMT1201**

Credits: 02 **Periods:** 30

Course Objectives:

1. Grasp the basic concepts of catalysts and catalysis.
2. Distinguish between positive and negative catalysts, and understand their effects on reaction rates.
3. Distinguish between positive and negative catalysts, and understand their effects on reaction rates.
4. Study the general features of catalytic reactions such as selectivity, reusability, and action at lower activation energies.
5. Relate catalytic principles to industrial applications (e.g., Haber process, catalytic converters).

Module: I

Catalysis: **07P**

1.1 Introduction to Catalyst and Catalysis.
1.2 Catalyst-Type of catalyst, positive and negative catalyst with examples.
1.3 Catalysis-Type of catalysis, homogenous and heterogeneous catalysis with examples
1.4 Characteristics of catalytic reactions.
1.5 Autocatalysis- explanation with examples.
1.6 Promoters- Definition, example, explanation of promotion action.
1.7 Catalytic poisoning- Definition, example, explanation of catalytic poisoning.
1.8 Acid-Base catalysis- General Acid-Base catalysis, examples.
1.9 Enzyme catalysis- Explanation, examples

Module: II

Ionic Equilibrium **08P**

2.1Introduction.
2.2 Strong and weak Acids bases
2.3 Degree of dissociation and dissociation constant.
2.4 Ostwald's dilution law for weak acids and weak bases.
2.5 Ionic Product of water.
2.6 Definition of P^H and p^{OH}, relationship between P^H and p^{OH}.
2.7 Salt hydrolysis, buffer solutions.
2.8 Numericals on P^H and p^{OH}, for weak and strong acids and bases and P^H and p^{OH}, of mixtures

of acids and bases, buffer solutions.

Module: III

Environmental pollution: **07P**

3.1 Introduction
3.2 Water pollution
3.3 Water Pollutants
3.4 Sources of water pollution
3.5 Water analysis: a) Color b) Chloride c) Acidity d) Alkalinity e) Hardness
3.6 Soil pollution, Analysis soil: a) Moisture b) P^H c) Total Nitrogen d) Lime

Module: IV

Statistical Treatment of Analytical Data: **08 P**

4.1 Precision and accuracy
4.2 Mean and median values, standard deviation, coefficient of variation.
4.3 Types of errors, determinate and indeterminate errors, confidence limits, significant figures.
4.4 Minimization of errors,
4.5 Statistical evaluation of data, t-test, f-test,
4.6 Correlation coefficient

Course Outcomes

1. Explain the basic concepts of catalysts and catalysis, including different types (positive, negative, homogeneous, and heterogeneous) with appropriate examples.
2. Describe the characteristics of catalytic reactions, autocatalysis, and enzyme catalysis, and distinguish between promoters and catalytic poisons with examples.
3. Classify acids and bases as strong or weak and explain their behavior in aqueous solutions using dissociation constants and degree of dissociation.
4. Apply Ostwald's dilution law and the concept of ionic product of water to determine the behavior of weak electrolytes in solution.
5. Calculate pH and pOH of strong and weak acids and bases, their mixtures, and buffer solutions; analyze the interrelationship between pH and pOH.
6. Identify various water pollutants, their sources, and effects; perform basic water quality analysis including chloride, acidity, alkalinity, and hardness.
7. Recognize types, causes, and impacts of soil pollution and carry out simple soil analyses including moisture content, pH, nitrogen, and lime estimation.
8. Differentiate between precision and accuracy in analytical data and calculate mean, median, standard deviation, and coefficient of variation.
9. Identify and categorize errors in analytical measurements, apply significant figures and confidence limits, and suggest ways to minimize errors.
10. Evaluate and interpret experimental data using statistical tools like t-test, f-test, and correlation coefficient to ensure reliability of analytical results.

Note: At least 10 experiments should be taken.

1. To find out the strength of the given hydrochloric acid solution by titrating it against NaOH by using p^H meter.
2. To find out the strength of HCl and CH_3COOH in a mixture of both by titrating it against NaOH by using p^H meter.
3. To find out the strength of acetic acid by titrating it against sodium hydroxide.
4. To find out the strength of sodium carbonate solution by titrating it against hydrochloric acid.
5. To determine moisture content of different soil samples.
6. To determine pH of different soil samples.
7. To determine lime requirement of different soil samples by buffer method.
8. To determine acidity of water sample by titrating it against standard base.
9. To determine alkalinity of water sample by titrating it against standard acid.
10. To determine chloride content of water sample by titrating it against by argentometric method.
11. To determine mean, median and standard deviation of the volumetric analysis results of group of students
12. To determine correlation coefficient of different titrant values.
13. To determine the equilibrium constant of the esterification reaction between acetic acid and ethanol.
14. To find the velocity constant of the hydrolysis of methyl acetate catalyzed by an acid.
15. To prepare standard solution of oxalic acid and estimate the amount of $KMnO_4$ by volumetric method.

Swami Ramanand Teerth Marathwada University, Nanded
Faculty of Science and Technology
B.Sc. Second Year (Third Semester)
Subject**: Chemistry**
Generic Elective (GE) – Paper III
Clinical Chemistry
Course Code**: SCHEGE 1201**

Credits: 02 **Periods:** 30

(Course Objective):

1. To introduce the fundamental concepts of clinical chemistry and its application in the healthcare field.
2. To provide a comprehensive understanding of the structure, function, and clinical significance of enzymes.
3. To study carbohydrate and lipid metabolism with a focus on their associated disorders.
4. To interpret biochemical test results and understand their relevance in diagnosing metabolic and cardiovascular diseases.
5. To equip students with the ability to link biochemical processes with clinical outcomes and laboratory diagnostics.

Course Modules:

Module-I: Introduction to Clinical Chemistry **08 P**

- Definition and scope of clinical chemistry
- Importance of clinical chemistry in healthcare
- Overview of biochemical processes in the human body

Module-II: Enzymes and Their Role in Clinical Chemistry **08 P**

- Structure and function of enzymes
- Enzyme kinetics and regulation
- Clinical significance of enzyme assays (e.g., ALT, AST, ALP)

Module-III: Carbohydrate Metabolism and Disorders **07 P**

- Blood glucose regulation
- Diabetes mellitus: types, diagnosis, and monitoring
- Hypoglycemia and hyperglycemia

Module-IV: Lipid Metabolism and Cardiovascular Health **07 P**

- Structure and function of lipids

- Cholesterol, lipoproteins, and atherosclerosis
- Lipid profile tests and their interpretation

(Course Outcomes):

Upon successful completion of the course, the student will be able to:

1. Explain the scope and importance of clinical chemistry in modern medical diagnostics.
2. Describe enzyme structure, kinetics, and their diagnostic relevance through clinical assays.
3. Analyze disorders related to carbohydrate metabolism such as diabetes and interpret related test results.
4. Understand lipid metabolism and its implications in cardiovascular health, including interpreting lipid profile tests.
5. Apply biochemical knowledge to assess and interpret laboratory results in a clinical context.

Reference books:

1. Textbook of Biochemistry with Clinical Correlations – Thomas M. Devlin
2. Clinical Chemistry: Principles, Techniques, and Correlations – Michael L. Bishop, Edward P. Fody, Larry E. Schoeff
3. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics – Carl A. Burtis, David E. Bruns
4. Harper's Illustrated Biochemistry – Victor W. Rodwell, David A. Bender, Kathleen M. Botham
5. Medical Biochemistry – John W. Baynes, Marek H. Dominiczak

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

B.Sc. Second Year (Third Semester)

Subject**: Chemistry**

Generic Elective (GE) – Paper III

चिकित्सा विषयक रसायनशास्त्र **(Clinical Chemistry)**

Course Code**: SCHEGE 1201**

Credits: 02 **Periods:** 30

(Course Objective):

1. क्लिनिकल केमिस्ट्रीच्या मूलभूत संकल्पना आणि आरोग्यसेवा क्षेत्रात त्याचा वापर यांचा परिचय करून देणे.
2. एन्झाइम्सची रचना, कार्य, आणि त्यांचे वैद्यकीय महत्त्व याचे सखोल ज्ञान प्रदान करणे.
3. कार्बोहायड्रेट आणि लिपिड चयापचय अभ्यासणे आणि त्यांच्याशी संबंधित आजारांवर लक्ष केंद्रित करणे.
4. जैव रासायनिक चाचण्यांचे निष्कर्ष समजून घेणे आणि चयापचय व हृदयरोग निदानात त्यांचे महत्त्व स्पष्ट करणे.
5. जैव रासायनिक प्रक्रिया आणि प्रयोगशाळेतील निदान यामधील संबंध समजून घेण्याची क्षमता विद्यार्थ्यांना विकसित करणे.

Course Modules:

Module-*I:* क्लिनिकल (चिकित्साविषयक) केमिस्ट्रीची ओळख ***(08 तास)***

• क्लिनिकल केमिस्ट्रीचा अर्थ व व्याप्ती

• आरोग्य सेवेत क्लिनिकल केमिस्ट्रीचे महत्व

• मानवी शरीरातील जैव रासायनिक प्रक्रियांचे संक्षिप्त स्वरूप

Module-*II:* क्लिनिकल केमिस्ट्रीतील एन्झाइम्स आणि त्यांची भूमिका ***(08 तास)***

• एन्झाइम्सची रचना व कार्य

• एन्झाइम गतीविज्ञान व त्याचे नियमन

• एन्झाइम चाचण्यांचे (चिकित्साविषयक) क्लिनिकल महत्त्व (उदा. ALT, AST, ALP)

Module-*III:* कार्बोहायड्रेट चयापचय आणि विकार ***(07 तास)***

- रक्तातील ग्लुकोजचे नियमन
- मधुमेह रोग: प्रकार, निदान आणि देखरेख
- अत्यल्प रक्तशर्करा (हायपोग्लायसेमिया) आणि अति रक्तशर्करा (हायपरग्लायसेमिया)

Module-IV: लिपिड चयापचय आणि हृदय व रक्तवाहिन्यांचे आरोग्य (07 तास)

- लिपिड्सची रचना व कार्य
- कोलेस्टेरॉल, लिपोप्रोटीन आणि ॲथेरोस्क्लेरोसिस (धमनी संकुचन रोग)
- लिपिड प्रोफाइल चाचण्या व त्यांचे विश्लेषण

(Course Outcomes):

या अभ्यासक्रमाचे यशस्वीपणे पूर्ण झाल्यावर विद्यार्थी सक्षम असतील:

1. आधुनिक वैद्यकीय निदानात क्लिनिकल केमिस्ट्रीचे कार्यक्षेत्र व महत्त्व स्पष्ट करणे.
2. एन्झाइम्सची रचना, गतीविज्ञान (kinetics) व त्यांचे निदानातील महत्त्व स्पष्ट करणे.
3. डायबेटीससारख्या कार्बोहायड्रेट चयापचयाशी संबंधित विकारांचे विश्लेषण करणे व संबंधित चाचण्यांचे अर्थ लावणे.
4. लिपिड चयापचय आणि हृदयरोगाशी त्याचे नाते समजावून घेणे आणि लिपिड प्रोफाइल चाचण्यांचे विश्लेषण करणे.
5. जैव रसायनशास्त्राचे ज्ञान वापरून प्रयोगशाळेतील चाचण्यांचे निष्कर्ष समजावून घेणे व त्यांचे विश्लेषण करणे.

Reference books:

1. Textbook of Biochemistry with Clinical Correlations – Thomas M. Devlin
2. Clinical Chemistry: Principles, Techniques, and Correlations – Michael L. Bishop, Edward P. Fody, Larry E. Schoeff
3. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics – Carl A. Burtis, David E. Bruns
4. Harper's Illustrated Biochemistry – Victor W. Rodwell, David A. Bender, Kathleen M. Botham.
5. Medical Biochemistry – John W. Baynes, Marek H. Dominiczak

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

B.Sc. Second Year (Third Semester)

Subject**: Chemistry**

Chemistry in daily life

Course Code**: SCHEVC 1201**

Credits: 02 **Periods:** 60 Hrs

Course Objective:

1. To know the chemistry of Milk.
2. Develop concepts of food science, covering nutritional value, processing, preservation, additives and adulteration analysis.
3. To discuss the classification and composition of different cosmetic products and its preparation.
4. To carry out the analysis and to improve the basic knowledge of constituents of perfumes its preparation

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Course Modules:

Module I

Chemistry of Dairy Products and Beverages **15**

1.1 Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk.

1.2 Hands on exercise- Analysis of Milk and milk products- Acidity, total solids, fat, total nitrogen, lactose, phosphate activity, casein.

Module II

Food additives, adulterants, and contaminants **25**

2.1Food preservatives: Benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose, and sodium cyclamate.

2.2 Flavouring agents: Vanillin, Ethyl Propionate, allyl hexanoate and monosodium glutamate.

2.3 Artificial food colorants: Coal tar dyes and non-permitted colours and metallic salts.

2.4 Hands on exercise: Identification of adulterants in some common food items: Edible oil, Ghee, Milk, Coffee powder, Chili powder, Turmeric powder, Coriander powder, Asafoetida and Pulses.

Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, determination of methyl alcohol in alcoholic beverages.

Module III

Chemistry in Cosmetics **20**

3.1 Analysis of cosmetics: Major and minor constituents and their function, Composition of skin creams, body lotions, nail paints, lip balm.

3.2 Shampoos and conditioners: antidandruff, anti-lice, herbal and baby shampoos. Hazards of cosmetics.

3.3 Perfumes: Requirement of a good perfume, composition of marketed perfumes, classification of perfumery materials.

3.4 Hands-on Exercises: Preparation of Cold cream, Talcum Powder, Lip Balm, Nail Polish Remover, Shampoo and hair remover.

Course Outcomes:

1. Students will develop comprehensive product to meet new product criteria in desired timings.
2. Students will identify Food additives, adulterants, and contaminants in common food items.
3. Student will acquire skills in the preparation of Cosmeceuticals.
4. Students will be enlightened about the theoretical and applied knowledge of perfumes, such as classification, composition and testing.

Reference Books:'

1. B. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)
2. Ashtoush Kar. Medicinal Chemistry (Two Colour Edition), New Age International Pvt Ltd, 2022
3. Edward Cox Henry, The Chemical analysis of Foods, Hardcover, Hassell Street Press, 2021
4. Instrumental Methods of Analysis of Food Additives, H.Wincciam and Henry J Noebles; Interscience Publisher, New York, 1961.
5. Food Chemistry, Alex V Ramani, MJP Publisher, New Delhi, 2019,
6. Instrumental Methods of Analysis of Food Additives, H.Wincciam and Henry J Noebles; Interscience Publisher, New York, 1961.
7. The Chemical Analysis of Foods: Practical Treatise on the Examination of Food stuffs and the Detection of Adulterants; Fourth Edition; H. Edward, London, Churchill, 1950.
8. A handbook of lndustrial Organic Chemistry by Samuel P Sadtler, JB Lippincott Company.
9. Handbook Industrial Chemistry by Mohammad Farhat Ali Khan, First edition.
10. Industrial Chemistry, E. Stocchi: Vol -I, Ellis Horwood Ltd. UK.
11. Engineering Chemistry P.C. Jain, M. Jain: Dhanpat Rai & Sons, Delhi.
12. Industrial Chemistry, Sharma, B.K. & Gaur, Goel Publishing House, Meerut (1996).

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

B.Sc. Second Year (Fourth Semester)

Subject**: Chemistry**

Organic and Inorganic Chemistry (Theory)

Course Code**: SCHECT 1251**

Credits: 02 **Periods:** 30

Course Objective:

1. To aware students about nomenclature and classification of heterocyclic compounds.
2. To acquaint students about aromaticity, synthesis and reactions of heterocyclic compounds with one hetero atom.
3. To inform students about the importance of Nitrogen Containing Organic Compounds.
4. To enlighten students about preparation and chemical properties of aromatic nitro and amine compounds.
5. To inform students about the effect of substituents on the basicity of aniline.
6. To familiarize students with preparation methods and reactions of Diazomethane and Urea.
7. To enlighten students the synthesis and application of Reagents in Organic Synthesis.
8. To acquaint students about correlating reagent and reactions of nitrogen containing compounds and reagents used in organic synthesis.

Module-I

Chemistry of Heterocyclic Compounds with One Hetero Atom **07**

1.1 Classification and nomenclature, Molecular Orbital Structure, aromaticity in 5-numbered (Furan, Pyrrole and Thiophene) and 6-membered (Pyridine) ring containing one heteroatom.

1.2 Synthesis, reactions and mechanism of substitution reactions of: Furan- Preparation from Ammonium mucate and by Pall-Knorr synthesis. Pyrrole-Preparation from 1,4 dicarbonyl compound and by Fiest – Benary synthesis. Thiophene- Preparation from 1,4 dicarbonyl compound and Sodium succinate. Pyridine – Preparation from 1,5 dicarbonyl compound and by Hantzsch synthesis. Reactions - Nitration, Sulphonation, Acylation and Catalytical reduction, Ring expansion reaction of pyrrole.

Module-II

Nitrogen Containing Organic Compounds: **07**

2.1 Aromatic Nitro Compounds: Introduction, Preparation of a) Nitrobenzenefrom benzene and b) m-Dinitrobenzene from nitrobenzene, Chemical properties of Nitrobenzene:

a) Electrophilic substitution reactions-nitration and sulphonation b) Reductions: i) in acidic medium, ii) In neutral medium, iii) In alkaline medium.

2.2 Aromatic amines: Introduction, Classification, Preparation of aniline from a) Chlorobenzene, b) Phenol. Chemical properties: i) Diazotization reaction, ii) Action of

carbon disulphide, iii) Action of benzoyl chloride, iv) Carbylamine reaction. Effect of substituent (-NO_2 and -OCH_3) on the basicity of aniline.

2.3 Diazomethane: Introduction. Methods of Preparation from: i) N-nitroso-N-methylurethane, ii) Nitrous oxide and methyl lithium. Reactions of Diazomethane: i) Action of heat, ii) Reaction with mineral acid, iii) Reaction with phenol, iv) Reaction with ethanol and ethanamine, v) Ring expansion (cyclopentanone to cyclohexanone).

2.4 Urea: Synthesis of urea by a) Wohlers methods and b) From CO_2. Reactions: a) Action of heat, b) Action of nitrous acid, c) Hydrolysis, d) Action of thionyl chloride, e) Action of formaldehyde, f) Action of hydrazine, g) Action of acetyl chloride, h) Salt formation.

Module-III

Applications of Reagents in Organic Synthesis: 06

3.1 Osmium Tetraoxide[OsO_4]: Preparation, Reactions: a) formation of Cis-l,2-diol,

b) Acralaldehyde to glyceraldehyde, c) Cis- hydroxylation of maleic acid, d) 9, 10-dihydroxylation of phenanthrene.

3.2 Ozone [O_3]: Preparation. Reactions: a) Synthesis of aldehydes and ketones, b) Synthesis of dialdehydes and hydroxyl aldehydes, c) In degradation of alcohols.

3.3 Selenium Dioxide[SeO_2]: Preparation. Reactions: a) Oxidation of reactive methylene group into carbonyl group, b) In dehydrogenation reactions, c) allylic hydroxylation and oxidation.

3.4 Boron Trifluoride [BF_3]: Preparation. Applications in the formation of: a) acids, b) esters c) diketones d) Nitration e) Sulphonation.

Module-IV

S-Block elements: 05

4.1 Introduction, electronic configuration of IA and IIA group elements.

4.2 Variation in properties of s block elements with respect to atomic radius, ionization energy and alkali metal are good reducing agents.

4.3 Colours imparted to the flame by s block elements.

4.4 Diagonal relationship between lithium and magnesium.

4.5 Oxides of s block elements, carbonates and bicarbonates of alkali and alkaline earth metals.

4.6 Basic strength of hydroxide of alkali and alkaline earth metals.

4.7 Hydrides of IA and IIA group.

4.8 Complexes of alkali metals with salicylaldehyde, acetyl acetone, wrap around complexes with polydentate ligand such as crown ether and cryptate.

4.9 Complexes of alkaline earth metals such as beryllium oxalate ion, chlorophyll and complex of calcium with EDTA.

P-block elements: 05

4.10 Introduction, electronic configuration.

4.11 Variation in atomic radius, ionization energy, electron affinity, electronegativity, metallic character, melting point and boiling point, oxidizing and reducing properties.

4.12 Variation in basic and acidic character of hydroxides of P-block elements

4.13 Trends in acidic nature and basic nature of the oxides of p block elements in a group and period.

Course Outcomes:

1. Students can identify and draw the structures of heterocyclic compounds from their names or from structure to name.
2. Students are able to understand and write preparation methods and reactions with mechanism of heterocyclic compounds.
3. Students are able to understand the substitution reactions of heterocyclic compounds with their mechanism.
4. Students will learn the applications of Nitrogen containing organic compounds.
5. Students can explain / discuss synthesis of aromatic nitro and amine compounds.
6. Students can infer synthesis and reactions diazomethane and urea.
7. Students can coordinate between reagents and their uses in organic synthesis.
8. Students can understand the preparation and various applications of Reagents in organic synthesis.
9. Students will be able to understand the position of s blocks elements in periodic table and variation in properties.
10. Students will be able to understand the position of p blocks elements in periodic table and variation in properties.
11. "Inorganic Chemistry" by J.D. Lee
12. "Inorganic Chemistry: Principles of Structure and Reactivity" by James E. Huheey, Ellen A. Keiter, Richard L. Keiter
13. "Modern Inorganic Chemistry" by R.D. Madan

Reference Books:

1. Organic Chemistry by Morrison and Boyd, Print ice hall.
2. Organic Chemistry by L.G. Wade. Print ice hall.
3. Organic Chemistry Vol. I, II, III by S. M. Mukharji, S. P. Sing and R. P. Kapoor
4. Fundamental of organic chemistry by Solomon, John willey
5. A Text book of organic chemistry by Bahl and Bahl.
6. A Text book of organic chemistry by P. L. Soni.
7. Synthetic Organic Chemistry, by: G. R. Chatwal.
8. Organic Chemistry, Reactions, Rearrangements and Reagents, by: O. P. Agarwal
9. Reaction, Rearrangement and Reagents, by: S. N. Sanyal
10. Organic Chemistry 05th edition, by: A. K. Pine.
11. Organic Chemistry, by: SolomonsFryhle
12. A Text book of organic chemistry by Tewari Mehrotra.
13. Stereochemistr y by P. S. Kalsi. [07th edition]
14. Organic chemistry [volume-I] by I. L. Finar.
15. Organic Chemistry by Francis A. Carey, McGRAW-HILL, INC.
16. Heterocyclic Chemistry by Raj K. Bansal, New Age International
17. Heterocyclic Chemistry by J. A. Joule and K. Mills, Blackwell Science
18. Modern Organic Chemistry by M. K. Jain and S. C. Sharma.

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

B.Sc. Second Year (Fourth Semester)

Subject**: Chemistry**

Physical and Inorganic Chemistry (Theory)

Course Code**: SCHECT 1252**

Credits: 02 **Periods:** 30

Course Objective:

1. To introduce the fundamental concepts of chemical kinetics**,** including rate of reaction, rate constant, order, and molecularity, with appropriate units and terminology.
2. To derive and analyze rate laws for first- and second-order reactions**,** and understand their characteristic behaviors through equations and graphical interpretation.
3. To develop the ability to determine the order of a reaction experimentally and solve numerical problems related to first and second-order rate constants.
4. To understand the basic concepts and units of conductance**,** specific resistance, equivalent conductance, molecular conductance, and their variation with dilution and temperature.
5. To study the classification of electrolytes as strong or weak and examine the Arrhenius theory of electrolytic dissociation along with its limitations.
6. To explain the Debye-Hückel theory and the Onsager equation**,** including their significance in understanding the behavior of strong electrolytes, and apply numerical methods for calculation.
7. To explain Kohlrausch's law and its practical applications**,** including determination of equivalent conductance, degree of dissociation, ionic mobility, and solubility of salts.
8. To introduce the concept of conductometric titrations**,** covering different acid-base and precipitation titrations, and understanding titration curves.
9. To apply Kohlrausch's law in solving numerical problems**,** enhancing analytical skills in electrochemical calculations.
10. To understand the structure, preparation, and applications of fullerenes**,** and explore different types of carbides with emphasis on CaC_2, TiC, and SiC.
11. To study the classification of silicates based on their structural units**,** and understand their properties and applications.
12. To explore the synthesis, types, and uses of zeolites**,** focusing on their industrial and environmental relevance.
13. To describe the structure and preparation of interhalogen compounds**,** including XY, XY_3, XY_5, and XY_7 types.

Module-I **07P**

Chemical Kinetics:

1.1 Introduction: Rate of reaction, Definition and units of rate constant.

1.2 Order and molecularity of reaction.

1.3 First order reaction: Rate expression and Characteristics.

1.4 Second order reaction: Rate expression and Characteristics (equal concentrations)

1.5 Methods of determination of order of a reaction.

1.6 Numerical on first order and second order rate constant.

Module-II

Electrochemistry-I: **07P**

2.1 Introduction, Conductance of electrolytes: Conductance, Specific resistance, Specific conductance, Equivalent conductance, Molecular conductance and their units.

2.2 Variation of specific and equivalent conductance with dilution, Equivalent conductance at infinite dilution. Effect of temperature on conductance.

2.3 Strong and weak electrolyte. Arrhenius theory of electrolytic dissociation and its limitations.

2.4 Debye-Huckel theory of strong electrolytes, Debye-Huckel Onsager's equation and its verification.

2.5 Numerical on Specific conductance, Equivalent conductance and cell constant.

Module-III

Electrochemistry-II: **06P**

3.1 Kohlrausch's law, Applications of Kohlrausch's law in

i) Determination of equivalent conductance at infinite dilution of weak electrolytes.

ii) Determination of degree of dissociation.

iii) Determination of solubility of sparingly soluble salts.

iv) Determination of absolute ionic mobility.

v) Determination of ionic product of water.

3.2 Conductometric titrations:

(i) Strong acid against strong base.

(ii) Strong acid against weak base

(iii) Weak acid against strong base.

(iv) Weak acid against weak base

(v) Precipitation titration

3.3 Numerical on applications of Kohlrausch's law.

Module-IV

A) Chemistry of Non-transition elements **05**

4.1 Fullerene: Preparation, properties, structure and applications.

4.2 Carbide: Definition, classification, preparation, properties and structure of ionic or salt like carbides (CaC_2), Metallic carbide (TiC) and covalent carbides (SiC).

4.3 Silicates: Definition, Basic Unit of silicate and classification on the basis of basic unit and their characteristics.

4.4 Zeolite: Definition, preparation, classification and applications.

B) Chemistry of Halogen compounds. **05**

4.5 Inter-halogen compounds: Definition, preparation and structure of XY, XY_3, XY_5, and XY_7.

4.6 Pseudo-halogen: Definition, preparation and properties.

4.7 Polyhalides: definition, preparation, properties & structure of ICl_2^-, & ICl_4^-

4.8 Oxyacids of halogens: Introduction, oxidation state, structure, strength and stability.

Outcomes:

After completion of these courses students should be able to,

1. Students will be able to define and distinguish between rate, rate constant, order, and molecularity of a reaction and explain their significance in chemical kinetics**.**
2. Students will be able to derive and interpret rate laws for first- and second-order reactions and analyze their characteristics using appropriate mathematical expressions.
3. Students will be able to determine the order of a chemical reaction using experimental data and perform numerical calculations involving rate constants**.**
4. Students will be able to describe various types of conductance (specific, equivalent, molecular) and their dependence on dilution and temperature.
5. Students will be able to differentiate between strong and weak electrolytes using Arrhenius and Debye-Huckel theories and explain their limitations and mathematical treatments.
6. Students will be able to solve numerical problems related to specific conductance, equivalent conductance, and cell constant using provided data and equations**.**
7. Students will be able to apply Kohlrausch's Law in determining important physical and chemical parameters such as dissociation degree, solubility, and ionic mobility**.**
8. Students will be able to explain and analyze various types of conductometric titrations**,** including acid-base and precipitation titrations with appropriate titration curves.
9. Students will be able to perform and interpret numerical problems based on Kohlrausch's Law and its applications in electrochemical systems**.**
10. Students will be able to describe the structure, properties, and applications of fullerenes, carbides, silicates, and zeolites.
11. Students will be able to classify different types of carbides and silicates based on their structural features and chemical behavior.
12. Students will be able to explain the industrial and environmental significance of zeolites and related compounds.

13. Students will be able to explain the preparation, properties, and structures of interhalogen compounds, pseudo-halogens, and polyhalides.
14. Students will be able to analyze the structures and oxidation states of oxyacids of halogens and correlate them with their strength and stability.
15. Students will be able to classify and compare various halogen-based compounds based on their bonding, reactivity, and molecular structure.

Reference Books:

1. Physical Chemistry by G. M. Barrow (Tata Mc-Graw Hill publishing Co., Ltd.)
2. Elements of Physical Chemistry by S. Glasstone& D. Lewis (D.van nostrand co. Inc.)
3. Physical Chemistry by W. J. Moore (Orient Longman).
4. University General Chemistry by C. N. R. Rao (Mc-Millan).
5. Elements of Physical Chemistry by P. W. Atkins. (Oxford University Press).
6. Physical Chemistry by R. A. Alberty (Wiley Eastern Ltd.).
7. Physical Chemistry through problems by S. K. Dogra, D. Dogra(Wiley Eastern Ltd)21
8. Principles of Physical Chemistry by Puri, Sharma and Pathania (VishalPublication)
9. Physical Chemistry by A. J. Mee. ELBS & Heinemann Educational Books Ltd.
10. Essentials of Physical Chemistry by ArunBhal, B. S. Bahl and G. D. Tuli. (S. Chand)
11. Chemical Kinetics by K. J. Laidler (Tata Mc-Graw Hill Publishing Co. Ltd).
12. Text Book of Physical Chemistry by Soni-Dharmarha.
13. A Text Book Physical Chemistry by S. Glasstone, (Mac Millan.)
14. Advanced Physical Chemistry by D.N.Bajpai. (S.Chand)
15. Advanced Physical Chemistry by Gurdeep Raj.(Goel publishing house, Meerut).
16. Inorganic Chemistry by J.D. Lee
17. Concise Inorganic Chemistry by J.D. Lee (5th Edition)
18. Inorganic Chemistry: Principles of Structure and Reactivity by James E. Huheey, Ellen A. Keiter, and Richard L. Keiter
19. Descriptive Inorganic Chemistry by Geoff Rayner-Canham and Tina Overton
20. Advanced Inorganic Chemistry by F.A. Cotton and G. Wilkinson
21. Inorganic Chemistry by Gary L. Miessler and Paul J. Fischer
22. A Textbook of Inorganic Chemistry by P.L. Soni and Mohan Katyal
23. Inorganic Chemistry by Shriver and Atkins

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

B.Sc. Second Year (Fourth Semester)

Subject**: Chemistry**

Organic and Inorganic Chemistry (Practicals)

Course Code**: SCHECP 1251**

Credits: 02 **Periods:** 60

Course Objective:

1. To get skill of estimation of organic compounds.
2. To do the quantitative analysis by estimations of organic molecules.
3. To get skill of preparation of organic compounds.

(Organic)

1. **Quantitative analysis: (estimation) any five**.
   a) Estimation of glycine by Sorenson's method.
   b) Estimation of phenol by bromination method.
   c) Estimation of glucose by iodination method.
   d) Estimation of unsaturation (cinnamic acid).
   e) Estimation of saponification value of an oil.
   f) Estimation of iodine value of an oil.
   g) Estimation of vitamin-C
   h) Estimation of formaldehyde.
2. **Organic Preparation: (Any five) [Weight of crude product, percentage yield, recrystallisation of crude product and its melting point expected]**
   a) **Acetylation:** Preparation of Aspirin from salicylic acid

   OR

   Preparation of β -naphtyl acetate from β -naphthol

   b) **Electrophilic substitution:** Preparation of p-nitroacetanilide from acetanilide (Nitration) Preparation of 2, 4, 6 – Tribromoaniline from aniline (Bromination)

   OR

   Preparation of p-bromo acetanilide from acetanilide (Bromination)

   c) **Diazotisation :** Preparation of Methylorange from sulphanilic acid (Coupling)

   OR

   Preparation of p-iodonitrobenzene from p-nitroaniline (Replacement)

   d**) Benzoylation :** Preparation of β -naphtyl benzoate from β -naphthol

   OR

   Preparation of Benzanilide from aniline

   e) **Osazone formation:** Preparation of Glucosazone from Glucose

   f) **Amide Formation:** Preparation of Benzamide from benzoic acid

   g) **Hydrolysis:** Preparation of p-nitroaniline from p-nitroacetanilide

h) **Polymerisation:** Preparation of phenol formaldehyde resin

(Inorganic)

3. Gravimetric estimation of Iron as Fe_2O_3.
4. Gravimetric estimation of Ba as $BaSO_4$
5. Gravimetric estimation of Nickel as $Ni(DMG)_2$.
6. Gravimetric estimation of Aluminium as $Al(Oxalate)_3$.
7. Gravimetric estimation of zinc as ZnO
8. Gravimetric estimation of Chloride as AgCl

Course Outcomes:

1. Students can be able to do estimation of organic compounds.
2. Students can synthesize some organic compounds.
3. Students get knowledge about separation of organic compounds from crude sample with percentage yield, recrystallization of organic compounds.

Swami Ramanand Teerth Marathwada University, Nanded
Faculty of Science and Technology
B.Sc. Second Year (Fourth Semester)
Subject**: Chemistry**
Physical and Inorganic Chemistry (Practicals)
Course Code**: SCHECP1252**

Credits: 02 **Periods:** 60

Note: At least 10 experiments should be taken.

Part I (Physical Chemistry):
Instrumental

1. Determine the normality and strength of weak acid (CH_3COOH / HCOOH) conductmetrically using standard solution of strong base (NaOH / KOH).
2. Determine redox potential of Fe^{3+}/ Fe^{2+} / or Sn^{4+}/Sn^{3+} or Ce^{4+} / Ce^{3+} system by titrating it with standard $K_2Cr_2O_7$ / $KMnO_4$ potentiometrically
3. Determine the concentration of Cu^{++} ion in given solution, titrating with EDTA by colorimetric measurements.
4. To determine pKa value of the given organic acid by pH measurements.

Non-Instrumental

5. Determine interfacial tension between two immiscible liquids, benzene and water by Stalagmometer.
6. Determine the solubility of benzoic acid in water at different temperatures and hence its heat of solution.
7. To find out the enthalpy of neutralization of weak acid/weak base against strong base/strong acid and determine the enthalpy of ionization of weak acid/ weak base.
8. To study the kinetics of dissolution of magnesium metal in dil. HCl.
9. To study the kinetics of decomposition of sodium thiosulphate by a mineral acid

(Inorganic)

10. To determine amount of acetic acid in commercial vinegar solution using standard NaOH solution.
11. To determine percentage of available chlorine in bleaching powder.
12. To determine percentage of ammonia in ammonium salts (NH_4Cl).
13. To determine equivalent weight of acid (Oxalic/Citric acid) using standard NaOH solution.
14. To determine percentage purity of Boric acid.
15. Estimation of ascorbic acid using 2, 6-dichloronidophenol dye.

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

B.Sc. Second Year (Fourth Semester)

Subject**: Chemistry**

Organic & Inorganic

Chemistry Minor (Theory)

Course Code**: SCHEMT1251**

Credits: 02 **Periods:** 30

Course Objectives:

1. Understand the chemical nature of biomolecules.
2. Classify and describe major biomolecules.
3. Comprehend enzyme structure and function.
4. Understand the Role of Chemistry in Drug Design and Action.
5. Study the Classification of Drugs and Their Uses.
6. Explore Drug-Body Interactions.
7. Learn about Common Pharmaceuticals and Their Chemistry.
8. Develop Awareness of Medicinal Chemistry and Toxicology.

Module-I

BIOMOLECULES: 07 P

1.1 General introduction and importance of biomolecules'

1.2 Carbohydrates– classification: aldoses and ketoses: monosaccharide's (glucose and fructose) and constituent monosaccharides of oligosaccharides (sucrose, lactose, and maltose)'

1.3 Proteins Elementary Idea of. Amino acids, peptide bond, polypeptides. Proteins: primary. Secondary, tertiary, and quatemary structure (qualitative Idea only), denaturation of proteins' enzymes.

1.4 Vitamins - Classification and functions'

1.5 Nucleic Acids - Chemical constitution of DNA and RNA', Biological functions of nucleic acids', Hormones (General introduction).

Module-II

Chemistry in the Medicine: 08 P

2.1 Introduction to Medicines, Definition of a Medicinal drug, Requirements of an ideal drug.

2.2 Nomenclature of drugs: Generic name, Brand name, Systematic name.

2.3 Difference between prescription and over the counter medicines, Identification of expiry and manufacturing date.

2.4 Storing medicines and its importance & disposal of medicines. Simple Concept of antacids, antihistamines, antiseptic ointment, topical ointment, antifungal, anti-sickness, antipyretics, antihypertensive, antidiabetics Concept of sedation, hypnotics and anesthesia

Module-III

Acids and Bases: 07 P

3.1 Introduction, Arrhenius concept, Bronsted-Lowry concept, Lewis acids and bases concept, Solvent system concept, Cady-Elsey concept, Lux-Flood concept and Usanovich concept for acids and bases.

3.2 Definition of Hard and Soft acids and bases, borderline acids and bases with various examples. Pearson's principle (SHAB Principle).

3.3 Super acids and super bases.

3.4 Relative strength of acids and bases, trends in acid strength of hydro acids.

Module-IV

Non Aqueous Solvents **08P**

4.1 Introduction

4.2 Physical properties Solvents: a) Melting point and boiling point b) Enthalpy of fusion and vaporization c) Dielectric constant

4.3 Types of solvent: a) Ionizing and non-ionizing solvents, b) Protic and aprotic solvents

4.4 Auto ionization of ammonia as a solvent

4.5 Types of reaction in liquid ammonia and Sulphur dioxide.
a) Acid base b) Precipitation c) Redox d) Complex Formation e) Solvolysis

4.6 Advantages and Disadvantages of Ammonia as Solvent

Course Outcomes

Upon successful completion of this course, the student will be able to:

1. Explain the importance and classification of biomolecules, including carbohydrates (monosaccharides, oligosaccharides) and their biological significance.

2. Describe the structure and classification of proteins, peptide bonds, and the hierarchy of protein structure; understand protein denaturation and enzyme function.

3. Classify vitamins and explain their biological functions; understand the chemical composition and role of nucleic acids (DNA & RNA) and hormones.

4. Define medicinal drugs, list ideal drug characteristics, and differentiate between generic, brand, and systematic names of drugs.

5. Distinguish between prescription and over-the-counter (OTC) drugs and interpret medicine labels to identify manufacturing and expiry dates.

6. Understand proper storage, handling, and disposal of medicines; identify the role and function of commonly used drugs like antacids, antihistamines, antidiabetics, etc.

7. Compare and contrast various acid-base theories including Arrhenius, Bronsted-Lowry, Lewis, Lux-Flood, and Usanovich concepts.

8. Explain the concept of hard and soft acids and bases using Pearson's SHAB principle, and analyze the trends in acid and base strength.

9. Identify the physical properties and classifications of non-aqueous solvents, including ionizing vs non-ionizing and protic vs aprotic solvents.

10. Describe the autoionization of ammonia and interpret various types of reactions (acid-base, redox, solvolysis, etc.) in non-aqueous solvents like ammonia and sulfur dioxide.

Reference Books

1. Lehninger Principles of Biochemistry – David L. Nelson, Michael M. Cox.
2. Textbook of Organic Chemistry – Morrison and Boyd.
3. Essentials of Physical Chemistry – Bahl and Tuli.
4. Medicinal Chemistry – Ashutosh Kar.
5. Biochemistry – U. Satyanarayana.
6. General Chemistry – R.C. Mukherjee.
7. Pharmaceutical Chemistry – V.K. Ahluwalia, Madhu Chopra

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

B.Sc. Second Year (Fourth Semester)

Subject**: Chemistry**

Chemistry Minor (Practical)

Course Code**: SCHEMP1251**

Credits: 02 **Periods:** 60

Note: At least 10 experiments should be taken.

1. Quantitative analysis: (estimation) any five.

a) Estimation of glycine by Sorenson's method.

b) Estimation of glucose by iodination method.

c) Estimation of saponification value of an oil.

d) Estimation of vitamin-C

2. Synthesis of Drugs:

a) Synthesis of Aspirin (Acetylsalicylic Acid

b) Synthesis of Paracetamol (Acetaminophen)

c) Synthesis of Benzimidazole

d) Synthesis of Schiff's Base

3. Inorganic Section:

a) To determine amount of acetic acid in commercial vinegar solution using standard NaOH solution.

b) To determine percentage of available chlorine in bleaching powder.

c) To determine percentage of ammonia in ammonium salts (NH_4Cl).

d) To determine equivalent weight of acid (Oxalic/Citric acid) using standard NaOH solution.

e) To determine percentage purity of Boric acid.

f) Estimation of ascorbic acid using 2, 6-dichloronidophenol dye.

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

B.Sc. Second Year (Fourth Semester)

Subject**: Chemistry**

Generic Elective (GE) – Paper IV

Chemistry For Farming

Course Code**: SCHEGE 1251**

Credits: 02 **Periods:** 30

(Course Objective):

1. To impart the experiential learning through promoting skills, knowledge in the field of plant protection, production, reduction in toxicity, environmental safety and sustainability of agro ecosystem
2. To provide relevant education to the students in soil science, its formation and soil fertility
3. To impart the profound theoretical and practical knowledge of the specific science discipline along with the fundamental core concepts
4. To utilize the skills and knowledge gained through the subject to deal with real life situations and problems related to society, environment, research and development.
5. To create skilled human resources useful for agriculture as well as various industries like fertilizer, micronutrient, agrochemicals, pesticide, etc.

Course Modules:

Module-I: Fertilizers: 08 P

- Types**:** Nitrogenous (urea, ammonium nitrate), phosphate (superphosphate), potassic (potassium sulfate).
- Micronutrients**:** Importance and application in crop growth.
- Organic Manures**:** Definition, types (farmyard manure, compost), and role in improving soil health.
- Biofertilizers**:** Rhizobium, blue-green algae – their characteristics and applications.
- Manufacturing**:** Overview of industrial processes used to produce various fertilizers.
- Application**:** Methods of fertilizer application and their effects on plant development.
- Environmental Impact**:** Issues related to water pollution and soil contamination.

Module-II: Pesticides 08 P

- Types**:** Insecticides, herbicides, fungicides.
- Formulations**:** Insecticide formulations in the form (Wettable powders, dusts, emulsifiable concentrates, etc.)
- Application**:** Application techniques and their effectiveness in pest control.
- Residues**:** Study of pesticide residues in soil, water, and crops.

- Pest Management**:** Introduction to Integrated Pest Management (IPM) strategies.
- Environmental Impact: Effects on soil, water, and non-target organisms.
- Safety Measures: Safe handling, usage, and storage of pesticides.

Module-III: Plant Nutrition: **07 P**

- Essential Nutrients: Functions and deficiency symptoms of macro- and micronutrients.
- Nutrient Forms: Chemical forms absorbed by crops.
- Nutrient Uptake: Mechanisms of nutrient absorption.
- Sources: Various sources of plant nutrients, both natural and synthetic.

Module-IV: Soil Science **07 P**

- Soil Micronutrients: Role in plant development.
- Soil Types: Characteristics of acidic and alkaline soils.
- Soil Reclamation: Techniques for improving degraded soils.
- Contaminant Absorption: Behavior of toxic metals and chemicals in soil.
- Modern Impact: Influence of contemporary agro-technologies and pesticide use on soil quality.

Course Outcomes:

1. The students will get knowledge of the chemistry of pesticides and Fertilizers.
2. Students will be aware about the soil fertility and soil productivity.
3. Students will learn about methods and time of fertilizer application

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Reference books:

1. Manures and Fertilizers By. K.S. Yawalkar J.P. Agarwal, S. Bokde
2. Soil Fertility and Fertilizers by S.L Tisdale , Nelson W.L.
3. Commercial Fertilizers By Collings.
4. Hand Book of Fertilizer Technology by Fertilizer Association of India

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

B.Sc. Second Year (Fourth Semester)

Subject**: Chemistry**

Generic Elective (GE) – Paper IV

Chemistry For Farming

Course Code**: SCHEGE 1251**

Credits: 02 **Periods:** 30

पाठ्यक्रम उद्दिष्टे (Course Objectives):

1. वनस्पती संरक्षण, उत्पादन, विषारीपणात घट, पर्यावरणीय सुरक्षा आणि कृषी परिसंस्थेच्या शाश्वततेसंबंधी कौशल्ये व ज्ञान विकसित करून प्रायोगिक शिक्षण देणे.
2. मृदा विज्ञान, मृदेची निर्मिती व सुपीकतेविषयी विद्यार्थ्यांना सुसंगत शिक्षण प्रदान करणे.
3. संशोधनीय शाखेच्या मूलभूत संकल्पनांसह सैद्धांतिक व प्रायोगिक ज्ञान देणे.
4. विषयातून प्राप्त कौशल्ये व ज्ञान समाज, पर्यावरण, संशोधन व विकासाशी संबंधित वास्तव समस्यांवर उपाययोजना करण्यासाठी वापरणे.
5. कृषी क्षेत्रात तसेच खते, सूक्ष्मपोषक, कृषीरसायने, कीटकनाशके इत्यादी विविध उद्योगांसाठी उपयुक्त कौशल्यसंपन्न मानव संसाधन तयार करणे.

पाठ्यक्रम विभाग (Course Modules):

Module-I: खते (Fertilizers): **(08 तास)**

- प्रकार: नत्रयुक्त (युरिया, अमोनियम नायट्रेट), स्फटिकयुक्त (सुपरस्फटिक), पोटॅशयुक्त (पोटॅशियम सल्फेट).
- सूक्ष्मपोषक: पीक वाढीतील महत्त्व आणि उपयोग.
- सेंद्रिय खते: व्याख्या, प्रकार (शेणखत, कंपोस्ट) व मृदा आरोग्यातील भूमिका.
- जैवखते: रायझोबियम, निळ्या-हिरव्या शैवळांचे प्रकार व उपयोग.
- निर्मिती प्रक्रिया: विविध खतांच्या निर्मितीचे प्रक्रिया.
- वापर: खत वापरण्याच्या पद्धती आणि त्यांचे वनस्पतींच्या विकासावर होणारे परिणाम.
- पर्यावरणीय प्रभाव: पाण्याचे प्रदूषण व मृदेचे दूषित होण्याची शक्यता.

Module-II: कीटकनाशके (Pesticides): **(08 तास)**

- प्रकार: कीटकनाशके, तणनाशके, बुरशीनाशके.
- सूत्रीकरण: वेगवेगळ्या स्वरूपातील कीटकनाशक फॉर्म्युलेशन्स (ओले पावडर, धूळ, इमल्सिफायबल कॉन्सन्ट्रेट्स, इ.)

- संविधान: वेगवेगळ्या स्वरूपातील कीटकनाशक फॉर्म्युलेशन्स (जसे की वेटेबल पावडर, धूळ स्वरूपातील, व इमल्सिफायबल कॉन्सन्ट्रेट्स).
- वापर: कीटक नियंत्रणात वापरण्याच्या पद्धती आणि त्यांची प्रभावीता.
- अवशेष: मृदा, पाणी व पिकांमधील कीटकनाशक अवशेष समजून घेणे.
- कीटक नियंत्रण: एकात्मिक कीड व्यवस्थापन (IPM) धोरणे.
- पर्यावरणीय परिणाम: पाणी व मृदा प्रदूषणाची शक्यता व इतर सजीवांवर परिणाम.
- सुरक्षा: कीटकनाशकांचा सुरक्षित वापर व साठवणूक.

Module-III: वनस्पती पोषण (Plant Nutrition): **(07 तास)**

- महत्त्वाचे पोषकतत्त्वे, त्यांचे कार्य व कमतरतेची लक्षणे.
- वनस्पतींना पोषकतत्त्वे कोणत्या स्वरूपात मिळतात.
- वनस्पती पोषकतत्त्वांचे स्रोत.
- स्रोत: वनस्पती पोषक तत्वांचे विविध स्रोत, नैसर्गिक आणि कृत्रिम दोन्ही.

Module-IV: मृदा विज्ञान (Soil Science): **(07 तास)**

- मातीतील सूक्ष्म अन्नद्रव्ये: वनस्पतींच्या विकासात भूमिका.
- मातीचे प्रकार: आम्लयुक्त आणि क्षारीय मातीची वैशिष्ट्ये.
- माती पुनर्प्राप्ती: खराब झालेल्या मातीत सुधारणा करण्यासाठी तंत्रे.
- दूषित पदार्थांचे शोषण: मातीमध्ये विषारी धातू आणि रसायनांचे वर्तन.
- आधुनिक प्रभाव: मातीच्या गुणवत्तेवर समकालीन कृषी-तंत्रज्ञान आणि कीटकनाशकांच्या वापराचा प्रभाव.

पाठ्यक्रमाचे परिणाम (Course Outcomes):

1. विद्यार्थ्यांना कीटकनाशके व खतांच्या रसायनशास्त्राचे ज्ञान प्राप्त होईल.
2. विद्यार्थ्यांना मृदासुपीकता व मृदाक्षमता याविषयी जागरूकता निर्माण होईल.
3. विद्यार्थी खतांचे अर्ज करण्याच्या योग्य पद्धती व योग्य वेळ यासंबंधी माहिती शिकतील.

Reference books:

1. Manures and Fertilizers By. K.S. Yawalkar J.P. Agarwal, S. Bokde
2. Soil Fertility and Fertilizers by S.L Tisdale , Nelson W.L.
3. Commercial Fertilizers By Collings.
4. Hand Book of Fertilizer Technology by Fertilizer Association of India

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

B.Sc. Second Year (Fourth Semester)

Subject: Chemistry

Oil & Fat Technology

Course Code: SCHEVC-1251

Credits: 02 **(Theory 1 + Practical 1)** **Periods:** 60 Hrs

Course objectives:

1. The objective of the course is to provide the students a thorough knowledge about extraction of oil by different process.
2. The course also comprehensively covers the topics such as Physical, Chemical properties of oils and fats.
3. To understand the characteristics of different oil.
4. To provide experimental skills.

Course Modules:

Module I

Basics of Oils and Fats **10hrs**

1.1 History – common fatty acids present in oils and fats – classification of oils and fats

1.2 Omega fatty acids, Trans fats – role of oils and fats in plants, animals and human beings

1.3 Physical properties of oils and fats – oiliness and viscosity – surface tension – density – refractive index - specific heat and heat of fusion

1.4 smoke fire and flash point – solubility and miscibility – determination of refractive index, specific gravity, and viscosity.

Module II

Characteristics of Oils and Fats **10hrs**

2.1 Structure and composition of oils and fats –triglyceride composition of natural fat – hydrolysis – saponification – rancidity and its types – hydrogenation – halogenations – chemical oxidation – epoxidation and polymerization.

2.2 Characteristics of soya bean oil –linseed oil- gingili oil – sunflower oil and cotton seed oil.

2.3 Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).

Module III

Practical Content: **40hrs**

Determination of physical properties of different oilseeds

1. Determination of moisture and oil contents of oilseeds
2. Determination of specific gravity, colour, viscosity, etc. of oils
3. Determination of acid value of oil.
4. Determination of Iodine values of oils and fats

5. Determination of saponification value of oil and fats
6. Determination of rancidity of oils and fats
7. Determination of peroxide value of oil
8. Determine the RM value (Reichert-Meissl value) in oils and fats
9. Determination of Acetyl Value of oil

Visit to commercial solvent extraction Unit *(ghani*, rotary, hydraulic press and screw expellers etc.)

Course outcomes:

This course deals with the History, sources, composition and properties of plant and animal origin oils and fats. Upon completion of this course, Students should be able to:

1. Understand the importance of oils and their effects on human health.
2. Discuss on physical properties of oils.
3. Learn the different extraction process of oils.
4. Understand the Biological aspects of oils.
5. Learn the experimental skill of oil technology.

Recommended Books:

1. Standard Methods for the Analysis of Oils, Fats and Derivatives 1St Supplement to the 7 th Revised and Enlarged Edition Prepared for publication by A. Dieffen bacher ,W.D. Pocklington
2. A. Bahl and B.S. Bahl, Advanced Organic Chemistry, 1st Multi colour Edition, S. Chand &Company, New Delhi, 2010
3. K.S. Tewari, N.K. Vishnoi and S.N. Mehrotra, A Textbook of Organic Chemistry, 2nd Edition, Vikas Publishing House (Pvt.) Ltd., New Delhi, 2004.
4. The Chemistry of Oils and Fats: Sources, Composition, Properties and Uses, Frank D. Gunstone, Blackwell Publishing Ltd, UK (2004)
5. Bailey's Industrial Oil and Fat Products, Sixth Edition Vol. 1:EdibleOil and Fat Products: Chemistry, Properties, and Health Effects, Ed. Fereidoon Shahidi, JohnWiley & Sons, Inc., Wiley Interscience Publication (2005).
6. Industrial chemistry, B. K. Sharma.
7. The chemistry of oils and fats, Frank D Gunstone, Blackwell Publishers, 2004.
8. Bailey's Industrial oil and fat products, Vol.2, Daniel Swern, Wiley Interscience Publications.
9. Oil seed crops, E. A. Weiss, Longmann Groups Ltd.