B. Sc Chemistry Programme

Under

Learning Outcomes based Curriculum Framework

(LOCF)

(For those students admitted during the Academic Year 2022-23 and after)

SYLLABUS

POST GRADUATE AND RESEARCH DEPARTMENT OF CHEMISTRY

(DST-FIST Sponsored Department)

NATIONAL COLLEGE (Autonomous)

(Nationally re-accredited at 'A^{+}' Level by NAAC with CGPA of 3.61 on 4.00 Scale)

College with Potential for Excellence by UGC,

DBT-STAR & DST-FIST Sponsored College

Tiruchirappalli-620 001

Post Graduate and Research Department of Chemistry

College

Vision: To offer quality higher education to the younger generation, especially from rural India, who are economically and socially backward, to liberate themselves from prejudice, oppression and ignorance and to gain knowledge for their bright future.

Mission:

- To ignite the young minds with lofty ideals and inspire them to achieve excellence in the chosen field.
- To facilitate individual growth of students, with accent on character building, through co- curricular and extra-curricular activities.
- To encourage the students to take up research and help them reach global standards.
- To provide a congenial atmosphere to study and to learn with infrastructural facilities of high standards.
- To instill in the minds of the students, a sense of Nationalism and to train them in social awareness.

Department

Vision:

The Chemistry Department is dedicated

- To develop a Centre of Excellence for teaching as well as research at par with national and international standards.
- To prepare the students of chemistry in such a way that they are self-reliant, highly informative and a better candidate in the demanding and ever changing world.
- To prepare the knowledgeable graduates for careers in academia, industry and government.
- To create a better everyday life for the students and we help the students to realize their full potential.

Mission:

- To develop wholesome and efficient student who will cause transformation in society through a study of chemistry.
- To extend the best student support services by making them comprehensive and by evolving a curriculum relevant to student community and society.
- To encourage students to face IIT-JAM, CSIR-NET, GATE, SET and other competitive examinations.

- To invite scientists from National/International laboratories for lectures of global standard.
- To provide high quality education through effective teaching – learning process for their pursuing high-quality teaching, learning, research, and service.
- To provide an educational environment where students can realize their full potential in chemistry and attain quality education to face the challenges of the future.
- To make the present day students who are the citizens of tomorrow more productive and successful by eliminating the barriers to opportunities.
- To make the students use the information gained in the classroom in their practical life, which is always challenging, by helping them to develop their skills.
- To shape the minds of the students so that they create a new future.
- To make the future teachers disseminate the educational content effectively and globally.
- To set the standards of excellence by helping them reach their full potential.

Goals:

1. To improve students basic knowledge of chemistry and to develop skills of scientific inquiry to design and carry out scientific investigations and evaluate scientific evidences to draw conclusions.
2. To make the students to think analytically, critically and creatively to solve problems, judge arguments, and make decisions in scientific and other contexts so that they can start a career in chemical industries.
3. To give training to develop inquiring minds and curiosity about science.

Programme Educational Objectives (PEOs)

1. Graduates will be able to accomplish professional standards in the global environment.
2. Graduates will be able to uphold integrity and human values.
3. Graduates will be able to appreciate and promote pluralism and multiculturalism in working environment.

National College (Autonomous), Tiruchirappalli

(UG Programme Outcomes)

Bachelor of Science (B.Sc.)

PO1: Students will exhibit the required **knowledge** appropriate to their respective field of study.

PO2: Students develop the ability to effectively **communicate** scientific information in written and oral formats.

PO3: Students will have a broad foundation in the core subjects of their choice with **critical thinking resulting in scientific reasoning, problem solving** and **analytical skills**.

PO4: Graduates will be able to apply the knowledge gained to analyze and provide **scientific reasoning to problems in real life**. They will understand their roles and responsibilities in the society, especially the primary role of protection of the people and the public interest. They will also acquire the ability to work **independently as well as in teams**.

PO5: Students are trained in breadth and depth of experimental techniques to select, apply and adopt appropriate methodology, resources, and modern technology and instrumentation, which will help them to pursue higher education or jobs after the programme. They will be proficient in applying the **basic moral and ethical principles** in all their pursuits like being **aware** of the environmental issues and ways to find their solutions.

PO6: Graduates will be able to build **understanding** between people and develop **positive attitude**, to be respectful and work towards equality, to identify and to address their own educational needs in a changing world in ways sufficient to maintain their **competence** and to allow them to contribute to the advancement of **knowledge**

B.Sc., Chemistry

Programme Specific Outcomes

PSO1: Acquired sound **knowledge** about the fundamentals and applications of chemical and scientific theories.

PSO2: Gained core knowledge in the key areas of Chemistry, developed written and oral communication skills in communicating chemistry-related topics.

PSO3: Developed analytical skills, interpret the data, problem solving skills and learned applications of numerical techniques through a variety of instruments and chemical principles.

PSO4: Graduates gathered **knowledge** of basic tools in chemistry and identified and defined the problem, analyzed them, generated creative solutions, abled to contribute effectively as **team members**.

PSO5: Graduates inculcated ethical, scientific and social responsibility in order to create sustainable chemical alternatives to the contemporary environmental challenges.

PSO6: Students took responsibility for their education, for their attainment of knowledge, and skills. They recognized gaps in their knowledge and then developed plans to narrow the gaps. Finally, they executed on those plans and acquired the missing knowledge.

GRADUATE ATTRIBUTES:

1. **Academic Excellence:** They will have a promising career in academics, research institutes both in India and abroad.
2. Students will be able to apply very well their knowledge in the design and manufacture of compounds and become entreprenuers.
3. **Communication skills:** Assignment writing develop all sorts of skills including critical thinking, creativity, and written communication.
4. Students will be able to communicate very well about their scientific findings both orally and written and in ICT formats.
5. **Critical Thinking:** They will be able to think rationally and draw logical conclusions.
6. **Problem Solving:** Students can become leaders of associations, which require finding solutions to problems faced by public.
7. **Analytical Reasoning:** The student will be able to discover trends in quantitative data, which they measure in the laboratory. Flaws and holes in the theory proposed ability to evaluate.
8. **Design and Development skills:** Able to design and develop new techniques in the field taken.
9. **Individual and teamwork:** Able to carry out individual and teamwork in qualitative and quantitative analytical field. This effect facilitate the teamwork efficiently.
10. **Technology, competency:** Able to increase the capacity to extrapolate from the technology gained in the thermodynamics and apply their competency to solve any non-familiar problem.
11. **Morals and Ethics:** Helps the students to acquire the ability to identify ethical issues and avoid unethical behavior in any trained practical field.
12. **Global citizenship:** Able to promote global citizenship by gaining and applying their skills in the fundamental and fast developing fields.
13. **Environmental and sustainability:** Able to provide environmental and sustainability from the exposure of teaching and evaluating methods
14. **Lifelong learning:** Ability to acquire knowledge and skills that are necessary for participating in learning activities throughout life.
15. Students will learn the application of modern tools and techniques in a multidisciplinary environment.
16. Volunteering demonstrates dedication, time management and civic-mindedness.
17. They can defend their ideas in dialogue with peers, respect others' views and perspectives.
18. Participating in individual and team sports builds leadership and team working skills.
19. Students will be to mix with a broad set of people, which will prove to be particularly useful whenever they are required to work within, and manage a fairly diverse team.
20. Submitting the assignment notebooks, practical notebooks, record notebooks in time illustrates the ability to prioritise tasks and manage their time effectively.

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1 - Remember; **K2** - Understanding; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

1. Theory Examination - Part I, II & III

CIA Test Question Pattern:

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2 Q1 to Q10	A (MCQ)	10 X 1 = 10	Objective Multiple Choice Questions (4 Questions from each unit)	50
K2, K3 Q11 to Q16	B (4 out of 6)	4 X 5 = 20	Descriptive Answers	
K2, K3 & K4 Q17 to Q19	C (2 out of 3)	2 X 10 = 20	Detailed Answers	

End Semester Examination Question Pattern:

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2 Q1 to Q20	A (MCQ)	20 X 1 = 20	Objective Multiple Choice Questions (4 Questions from each unit)	75
K2, K3 Q21 to Q25	B (Either/or type) ONE question from each unit	5 X 5 = 25	Descriptive Answers (Either/or type) (1 question from each unit	
K2, K3 & K4 Q26 to Q30	C (3 out of 5)	3 X 10 = 30	Detailed Answers (1 Question from each unit)	

NATIONAL COLLEGE (AUTONOMOUS), TRICHY-620 001
PG & RESEARCH DEPARTMENT OF CHEMISTRY
B.SC CHEMISTRY (Under CBCS and Outcome Based Education (OBE))
COURSE STRUCTURE (2022 BATCH)
(APPLICABLE TO THE CANDIDATES ADMITTED FROM THE ACADEMIC YEAR 2022-2023)

SEM	PART	COURSE	COURSE TITLE	Theory/ Practical	INS. HOURS /WEEK	CREDIT	EXAM HRS.	MARKS		TOTAL
								CIA	ESE	
I	I	LANGUAGE-I (U22T1/H1/S1)	TAMIL/HINDI/SANSKRIT	Theory	6	3	3	25	75	100
	II	ENGLISH-I (U22E1)	PROSE FOR COMMUNICATION	Theory	6	3	3	25	75	100
	III	CORE COURSE–I (U22CC-1)	GENERAL CHEMISTRY-I	Theory	5	5	3	25	75	100
		CORE COURSE-II (U22CC-2)	PRACTICAL (CC-1)*	Practical	3	-	-	-	-	-
		FIRST ALLIED COURSE-I (U22AMS1)	ALGEBRA, CALCULUS AND DIFFERENTIAL EQUATIONS	Theory	5	3	3	25	75	100
		FIRST ALLIED COURSE-II (U22AMS2)	VECTOR CALCULUS & ANALYTICAL GEOMENTRY OF THREE DIMENSIONS	Theory	3	-	-	-	-	-
	IV	ENVIRONMENTAL STUDIES (U22ES)	ENVIRONMENTAL STUDIES	Theory	2	2	3	25	75	100
		TOTAL			**30**	**16**				**500**
II	I	LANGUAGE COURSE-II (U22T2/H2/S2)	TAMIL/HINDI/SANSKRIT	Theory	6	3	3	25	75	100
	II	ENGLISH–II (U22E2)	ENGLISH THROUGH EXTENSIVE READING	Theory	6	3	3	25	75	100
	III	CORE COURSE-II (U22CC-2)	MAJOR PRACTICAL (CC-II)	Practical	3	5	3	25	75	100
	III	CORE COURSE-III (U22CC-3)	GENERAL CHEMISTRY-II	Theory	5	5	3	25	75	100
	III	FIRST ALLIED COURSE-II (U22AMS2)	VECTOR CALCULUS & ANALYTICAL GEOMETRY OF THREE DIMENSIONS	Theory	3	3	3	25	75	100
	III	FIRST ALLIED COURSE-III (U22AMS3)	TRIGONOMETRY, LAPLACE TRANSFORMS & FOURIER SERIES	Theory	5	3	3	25	75	100
	IV	SKILL BASED ELECTIVE COURSE-I (U22SBE1)	OFFICE AUTOMATION	Theory	2	2	3	25	75	100
		TOTAL			**30**	**24**				**700**
III	I	LANGUAGE-I (U22T3/H3/S3)	TAMIL/HINDI/SANSKRIT	Theory	6	3	3	25	75	100
	II	ENGLISH (U22E3)	READING POETRY AND DRAMA	Theory	6	3	3	25	75	100
	III	CORE COURSE–IV (U22CC4)	GENERAL CHEMISTRY-III	Theory	4	5	3	25	75	100
	III	CORE COURSE–V (U22CC5)	PRACTICAL–II SEMI MICRO ANALYSIS*	Practical	3	-	-	-	-	-
	III	SECOND ALLIED COURSE-I (U22APH1)	ALLIED PHYSICS-I	Theory	4	3	3	25	75	100
	III	SECOND ALLIED COURSE-II (U22APH2P)	PHYSICS ALLIED PRACTICAL*	Practical	3	-	-	-	-	-
	IV	SKILL BASED ELECTIVE–II (U22SBE2)	CHEMISTRY IN DAILY LIFE	Theory	2	2	3	25	75	100
	IV	SKILL BASED ELECTIVE–III U22SBE3	NANO AND CLINICAL CHEMISTRY	Theory	2	2	3	25	75	100
		TOTAL			**30**	**18**				**600**

*Practical Exam will be held in the corresponding even semester.

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(APPLICABLE TO THE CANDIDATES ADMITTED FROM THE ACADEMIC YEAR 2022-2023)

SEM	PART	COURSE	COURSE TITLE	Theory/ Practical	INS. HOURS /WEEK	CREDIT	EXAM HRS	MARKS		TOTAL
								CIA	ESE	
IV	I	LANGUAGE-I (U22T4/H4/S4)	TAMIL/HINDI/SANSKRIT	Theory	6	3	3	25	75	100
	II	ENGLISH–IV (U22E4)	ENGLISH FOR COMPETITIVE EXAMINATIONS	Theory	6	3	3	25	75	100
	III	CORE COURSE-V (U22CC5)	PRACTICAL–II SEMI MICRO ANALYSIS*	Practical	3	5	3	25	75	100
	III	CORE COURSE–VI (U22CC6)	GENERAL CHEMISTRY-IV	Theory	4	4	3	25	75	100
	III	SECOND ALLIED COURSE-II (U22APH2)	ALLIED PHYSICS PRACTICAL*	Practical	3	3	3	25	75	100
	III	SECOND ALLIED COURSE-III (U22APH3)	ALLIED PHYSICS -II	Theory	5	3	3	25	75	100
	IV	NON–MAJOR ELECTIVE–I (U22NMCH1)	AGRICULTURAL CHEMISTRY**	Theory	2	2	3	25	75	100
	IV	VALUE EDUCATION (U22VE)	VALUE EDUCATION	Theory	1	2	3	25	75	100
		TOTAL		Theory	**30**	**25**				**800**
V	III	CORE COURSE-VII (U22CC7)	INORGANIC CHEMISTRY-I	Theory	5	5	3	25	75	100
	III	CORE COURSE-VIII) (U22CC8)	ORGANIC CHEMISTRY-I	Theory	5	5	3	25	75	100
	III	CORE COURSE ELECTIVE-IX (U22CC9E)	ANALYTICAL CHEMISTRY	Theory	5	4	3	-	-	100
	III	CORE COURSE ELECTIVE-X (U22CC10E)	THERMODYNAMICS AND QUANTUM CHEMISTRY	Theory	5	4	3	-25	75	100
	III	CORE COURSE-XI (U22CC11P)	PRACTICAL–III PHYSICAL CHEMISTRY*	Practical	3	-	-	-	-	-
	III	CORE COURSE-XII (U22CC12P)	PRACTICAL–IV –GRAVIMETRY AND ORGANIC ANALYSIS*	Practical	3	-	-	-	-	-
	IV	NON–MAJOR ELECTIVE–II (U22NMCH2)	COSMETIC CHEMISTRY**	Theory	2	2	3	25	75	100
	IV	SOFT SKILLS (U22SS)	SOFT SKILLS	Theory	2	2	3	25	75	100
		TOTAL			**30**	**22**				**600**
VI	III	CORE COURSE-XI (U22CC11P)	PRACTICAL–III PHYSICAL CHEMISTRY	Practical	3	5	3	25	75	100
	III	CORE COURSE-XII (U22CC12P)	PRACTICAL–IV–GRAVIMETRY AND ORGANIC ANALYSIS	Practical	3	6	6	25	75	100
	III	CORE COURSE-XIII (U22CC13)	INORGANIC CHEMISTRY-II	Theory	6	6	3	25	75	100
	III	CORE COURSE-XIV (U22CC14)	ORGANIC CHEMISTRY-II	Theory	6	6	3	25	75	100
	III	CORE COURSE-XV (U22CC15)	PHYSICAL CHEMISTRY-II	Theory	6	6	3	25	75	100
	III	CORE COURSE ELECTIVE-XVI (U22CC16E)	FOOD CHEMISTRY	Theory	5	4	3	25	75	100
	V	GENDER STUDIES (U22GS)	GENDER STUDIES	Theory	1	1	3	25	75	100
	V	EXTENTION ACTIVITIES (EA)			-	1	-	-	-	
		TOTAL			**30**	**35**				**700**
		GRAND TOTAL			**180**	**140**				**3900**

*Practical Exam will be held in the corresponding even semester.

**This subjects meant for departments other than chemistry

NATIONAL COLLEGE (AUTONOMOUS), TRICHY-620 001
PG & RESEARCH DEPARTMENT OF CHEMISTRY
Programme: B.Sc. Chemistry, (CBCS and Outcome Based Education (OBE)
(APPLICABLE TO THE CANDIDATES ADMITTED FROM THE ACADEMIC YEAR 2022-2023)

SUBJECT CODE	TITLE OF THE PAPER		CORE
U22CH1	GENERAL CHEMISTRY-I		1
YEAR	SEMESTER	CREDITS	LECTURE HOURS
I	I	5	75

Course Objectives:

The students will be able

1. To understand the fundamentals of atoms and periodicity of elements.
2. To get a knowledge on some selected chemical bonds and to learn the various theories of bonding.
3. To learn the concepts of polar effects and reactive intermediates in organic reactions.
4. To learn about the behavior of ideal and real gases.
5. To understand the concepts of concentration of solutions and macromolecules.

UNIT I: Electronic Structure and Periodic Properties (15 Hours)

1.1 Electronic Structure: Quantum numbers - principal, azimuthal, magnetic and spin quantum numbers and their significance - principles governing the occupancy of electrons in various quantum levels - Pauli's exclusion principle - Aufbau principle - Hund's rule - (n+l) rule - stability of half-filled and fully-filled orbitals.

1.2 Periodic properties: Variation of atomic volume, atomic and ionic radii, ionization potential, electron affinity and electronegativity along periods and groups - factors affecting periodic properties Pauling's and Mulliken's scales of electronegativity and its applications.

UNIT II: Titrimetric Analysis (15 Hours)

2.1 Volumetric analysis: Definitions - standard solutions, equivalence point, end point, concentration units - molarity, molality, normality, mole fraction, primary and secondary standards.

2.2 Types of titrimetric reactions: - Acid-base, redox, precipitation and complexometric titrations - acid-base and redox indicators.

2.3 Oxidation-reduction: oxidation number and oxidation states - equivalent weights of oxidizing and reducing agents - balancing redox equations by oxidation number method and ion-electron method.

UNIT – III Nomenclature, bonding, polar effects and reactive intermediates (15 Hours)

3.1. Nomenclature of organic compounds: Catenation and classification of organic compounds. IUPAC naming of simple aliphatic compounds containing different functional groups and aliphatic mono & disubstituted monocyclic compounds.

3.2. Bonding: Types of bonds – homolytic and heterolytic fission of bonds, bond length, bond energy- orbital overlap – sigma and pi bonds – hybridization and geometry of molecules methane, ethane, ethylene, acetylene and benzene.

3.3. Polar effects and reactive intermediates: Inductive, electromeric, mesomeric, resonance, hyperconjugation and steric effects. Reactive intermediates - Stabilities of free radicals, carbocations and carbanions (primary, secondary, tertiary).

UNIT IV: Gaseous State: (15 Hours)

4.1 Kinetic Molecular Theory of Gases: The Gas constant 'R' in different units - Maxwell-Boltzmann distribution of molecular velocities- Root mean square, average and most probable velocities (no derivation).

4.2 Collision number and mean free path - Collision diameter. Deviation from ideal behavior - Van der Waal's equation for real gases.

4.3 Critical Phenomena - PV isotherms of real gases, critical temperature, and continuity of state - relation between critical constants and Vander Waal's constants - Determination of critical volume - the law of corresponding states - reduced equation of state.

UNIT V: Solutions and Macromolecules (15 Hours)

5.1 Solutions - Definition of ideal and non-ideal solutions - concentration units - weight percent and volume percent.

5.2. Macromolecules: Number average andweight average molecular weight of macromolecules - determination of molecular weight by osmometry (number average), ultra centrifuge (weight average), Viscometry and light scattering.

Course Learning Outcomes:

The students will be able to

1. Do practicals with the theoretical background of volumetric analysis and able to work in industries by learning the subjects under units I & II.
2. Predict the molecular geometry of chemical compounds.
3. Understand in detail the properties of real and ideal gases.
4. Prepare solutions in the laboratory by themselves by applying the knowledge about solutions.
5. Extend the idea obtained about macromolecules to proteins and the research involved in it.

Text Books:

1. P. L. Soni, Mohan Katyal, "*Text book of Inorganic Chemistry*", 20th Revised Ed., **(2007),** Sultan Chand & Sons, New Delhi. (**UNITS I & II**)
2. R. D. Madan, "*Modern Inorganic Chemistry*", 6th Ed., **(2008),** S. Chand and Company Ltd., New Delhi. (**UNITS I & II**)
3. J. D. Lee, "*A New Concise Inorganic Chemistry*", Oxford Publishers, 5th Ed., **2014**. (**UNITS I & II**)

4. A. Bahl, B. S. Bhal, A Textbook of Organic chemistry, S. Chand and Company Ltd., New Delhi, 22nd Ed., **2016**. (**UNIT III**)
5. P. L. Soni, "Text book of Organic Chemistry", S. Chand and Company Ltd., New Delhi, 28th Ed., **2004**. (**UNIT III**)
6. R. T. Morrison and R. N. Boyd., "*Organic Chemistry*", Prentice Hall of India Pvt. Ltd., New Delhi, 7th Ed., **2011**. (**UNIT III**)
7. B. R. Puri, L.R. Sharma and M. S. Pathania, "*Principles of Physical Chemistry*", Vishal Publishing Co., 47th Ed., **2016**. (**UNITS IV & V**)
8. P. L. Soni and O. P. Dharmaha, "*Text book of Physical chemistry*", S. Chand and Sons, New Delhi. (**UNITS IV & V**).

Reference Books:

1. Okhil K. Medhi, Ellen A. Keiter, James E. Huheey, Richard L. Keiter, Dorling Kindersley, "*Inorganic Chemistry: Principles of Structure and Reactivity*", India, 4th Ed., **2006**.
2. Carey, Francis A., Sundberg, Richard J., Springer, "*Advanced Organic Chemistry Part A: Structure and Mechanisms*", New York, 5th Ed., **2007**.
3. Peter Atkins, Julio de Paula, and James Keeler, "*Atkins' Physical Chemistry*", Oxford University Press, UK 11th Ed., **2017**.

SUBJECT CODE	TITLE OF THE PAPER		CORE
U22CH2P	PRACTICAL –I VOLUMETRIC ANALYSIS		2
YEAR	SEMESTER	CREDITS	LECTURE HOURS
I	I & II	5	75

Course Objectives:

1. To know the principles of the volumetry.
2. To have a knowledge on various types of titrations.
3. To know the Preparation of standard solutions.
4. To have Knowledge about normality, equivalent weight of compounds.

Experiments:

1. Estimation of HCl by NaOH using standard H_2SO_4 solution.
2. Estimation of HCl by NaOH using standard oxalic acid solution.
3. Estimation of Na_2CO_3 by HCl using standard Na_2CO_3 solution.
4. Estimation of oxalic acid by $KMnO_4$ using standard oxalic acid solution.
5. Estimation of $FeSO_4$ by $KMnO_4$ using standard Mohr's salt solution.
6. Estimation of KMnO4 by thio using standard $K_2Cr_2O_7$ solution.
7. Estimation of Ferric ion by $K_2Cr_2O_7$ using internal indicator method.
8. Estimation of Ferrous ion by $K_2Cr_2O_7$ using internal indicator method.
9. Estimation of Ferrous ion by $K_2Cr_2O_7$ using external indicator method.
10. Estimation of $CuSO_4$ by thio using standard $K_2Cr_2O_7$ solution.
11. Estimation of Ca (II) by EDTA solution.
12. Estimation of Total Hardness of Water
13. Estimation of As_2O_3 by I_2 solution using standard As_2O_3 solution (Demonstration only).
14. Estimation of ferrous and ferric in a mixture.
15. Estimation of Na_2CO_3 in washing soda.
16. Estimation of Na_2CO_3 and NaOH in a mixture of the two.
17. Estimation of Chloride ion in neutral medium (Mohr‘s method).
18. Estimation of Chloride ion in acid medium (Volhard‘s method).

Course Learning Outcomes:

After successful completion of the course, students will be able to

1. Prepare standard solutions.
2. Know knowledge about normality, equivalent weight of compounds.

Text Books:

1. Practical Chemistry by A.O. Thomas, Scientific Book Centre, Cannanore, **2003**.
2. Basic Principles of Practical Chemistry, V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Sultan Chand & Sons, New Delhi, 2nd Ed., **2004**.

Reference:

1. Vogel's textbook of quantitative chemical analysis Mendham, John. Denney, Ronald C. Barnes, John D. Thomas, M., 7th Ed., Prentice Hall, New York, 6th Ed., **2000**.

Scheme of Valuation

Maximum Marks : 75 Marks

Record	: 10 Marks
Procedure writing	: 10 Marks
Viva-voce	: 05 Marks
Practical	: 50 Marks
< 1%	: 50 Marks
1-2%	: 40 Marks
2-3%	: 30 Marks
3-4%	: 20 Marks
> 4%	: 10 Marks

SUBJECT CODE	TITLE OF THE PAPER		CORE
U22CH3	GENERAL CHEMISTRY-II		2
YEAR	SEMESTER	CREDITS	LECTURE HOURS
I	II	5	75

Course Objectives:

The students will be able:

1. To learn the practical application of volumetric analysis.
2. To know about the chemistry of metallurgy and s-block elements.
3. To understand the nomenclature of organic molecules.
4. To understand the chemistry of alkanes, alkenes, dienes and alkynes with their preparation, properties and uses.
5. Understand the structure of atom using the concepts of quantum mechanics.

UNIT I: Chemical Bonding (15 Hours)

1.1 Ionic bonding: Ionic bond - lattice energy and Born-Haber cycle (no derivation). Covalent bond - polarity of bonds - Fajan's rules - degree of covalent character in ionic bond.

1.2 VSEPR theory and bonding: Introduction to coordination bonds and metallic bonds. Hydrogen bonding - properties, types and consequences. Intermolecular forces - definition, types and examples.

UNIT II: Metallurgy and s-block Elements (15 Hours)

2.1 Metallurgy: -various steps in metallurgy - grinding, pulverizing - concentration (ore dressing)-hand picking, gravity separation, froth floatation, electromagnetic separation, chemical separation - calcinations and roasting - smelting, alumino thermic process- purification of metals- zone refining, vapour phase and electrolytic refining.

2.2 Position of hydrogen in the periodic table - atomic hydrogen – nascent hydrogen, occluded hydrogen, ortho-para hydrogen.

2.3 s-block elements: General characteristics of s-block elements and their compounds - oxides, hydroxides, halides, sulphates and hydrides - diagonal relationship of Li and Mg, Be and Al - extraction of Li and Be - anomalous behaviour of Li and Be - examples for aqua and cryptate complexes of alkali metals.

UNIT – III Alkanes, Cycloalkane and Conformational Analysis (15 Hours)

3.1 Alkanes: Preparation by Wurtz, Corey-House and Kolbe's synthesis – chlorination and pyrolysis (cracking). Petroleum: Thermal and catalytic process of cracking, synthetic petrol-Fischer Tropsch's Process, Bergius process, flash point, fire point, smoke point, knocking, octane number, cetane number, anti-knocking reagents and power alcohol.

3.2 Cycloalkanes: preparation using Wurtz reaction, Dieckmann's ring closure and reduction of aromatic hydrocarbons, substitution and ring opening reactions – Bayer strain theory.

3.3 Conformational Analysis: Ethane, *n*-butane, cyclohexane.

UNIT – IV Alkenes and Alkynes (15 Hours)

4.1. Alkenes – Preparation by Wittig reaction - properties of alkenes – electrophilic and free radical addition – addition reactions with hydrogen, halogens, hydrogen halides- Markownikoff's and anti- Markownikoff's rules.

4.2. Dienes: Conjugated – Non-conjugated and Cumulated dienes – relative stabilities of dienes and chemical reactivity, 1,2 and 1,4- additions , Diels-Alder reaction.

4.3. Alkynes – Acidity of alkynes - preparation from dihalides, Addition reactions of alkynes, oxidation by $KMnO_4$, ozonolysis.

UNIT V: Liquid Systems (15 HOURS)

5.1 Completely miscible liquid systems: Benzene and toluene. Raoult's law and Henry's law - deviation from Raoult's law and Henry's law. Duhem-Margules equation - theory of fractional distillation - azeotropes - HCl-water and ethanol- water systems -

5.2 Partially miscible liquid systems: phenol-water, triethanolamine -water and nicotine-water systems - lower and upper CSTs - effect of impurities on CST - completely immiscible liquids - principle and applications of steam distillation. Nernst distribution law derivation - applications –

5.3 Dilute solutions: colligative properties, relative lowering of vapour pressure, osmosis, law of osmotic pressure, elevation of boiling point and depression of freezing point.

Course Learning Outcomes:

1. The contents of unit I and II in this paper will impart knowledge to the students to analyze inorganic compounds in various fields and also gain information of the compounds of *p*-block elements.
2. Students learn the nomenclature of organic molecules
3. Students shall understand the chemistry of alkanes, alkenes, dienes and alkynes.
4. Students are expected to get a very good understanding of the basics of quantum chemistry.

Text Books:

1. P. L. Soni, Mohan Katyal, "*Text book of Inorganic Chemistry*", 20th Revised Ed., **(2007),** Sultan Chand & Sons, New Delhi. (**UNITS I & II**)
2. R. D. Madan, "*Modern Inorganic Chemistry*", 6th Ed., **(2008),** S. Chand and Company Ltd., New Delhi. (**UNITS I & II**)

3. J. D. Lee, "*A New Concise Inorganic Chemistry*", Oxford Publishers, 5th Ed., **2014**. (**UNITS I & II**)
4. A. Bahl, B. S. Bhal, A Textbook of Organic chemistry, S. Chand and Company Ltd., New Delhi, 22nd Ed., **2016**. (**UNITS III & IV**)
5. P. L. Soni, "Text book of Organic Chemistry", S. Chand and Company Ltd., New Delhi, 28th Ed., **2004**. (**UNITS III & IV**)
6. R. T. Morrison and R. N. Boyd., "*Organic Chemistry*", Prentice Hall of India Pvt. Ltd., New Delhi, 7th Ed., **2011**. (**UNITS III & IV**)
7. B. R. Puri, L.R. Sharma and M. S. Pathania, "*Principles of Physical Chemistry*", Vishal Publishing Co., 47th Ed., **2016**. (**UNIT V**)
8. P. L. Soni and O. P. Dharmaha, "*Text book of Physical chemistry*", S. Chand and Sons, New Delhi. (**UNIT V**).

Reference Books:

1. Okhil K. Medhi, Ellen A. Keiter, James E. Huheey, Richard L. Keiter, Dorling Kindersley, "*Inorganic Chemistry: Principles of Structure and Reactivity*", India, 4th Ed., **2006**.
2. Carey, Francis A., Sundberg, Richard J., Springer, "*Advanced Organic Chemistry Part A: Structure and Mechanisms*", New York, 5th Ed., **2007**.
3. Peter Atkins, Julio de Paula, and James Keeler, "*Atkins' Physical Chemistry*", Oxford University Press, UK 11th Ed., **2017**.

SUBJECT CODE	TITLE OF THE PAPER		CORE
U22CH4	GENERAL CHEMISTRY-III		4
YEAR	SEMESTER	CREDITS	LECTURE HOURS
II	III	5	60

Course Objectives:

1. To obtain the knowledge of the *p*-block elements and qualitative analysis.
2. To understand the chemistry of cycloalkanes with their preparation, properties and conformational analysis.
3. To understand the chemistry of hydroxyl compounds with their preparation and properties.
4. To study in detail about the laws of kinetics and to apply them in the laboratory.

UNIT I: Boron, Carbon and Nitrogen Family (12 Hours)

1.1 Boron Family: Comparative study of boron family elements - compounds of boron - diborane, borax, boron nitride, boron carbide and borazole - structure and uses.

1.2 Carbon family: Comparative study of carbon family elements and their compounds (hydrides, halides and oxides) - Fullerenes- intercalation compounds of Graphite with alkali metals - structure of graphite and diamond –

1.3 Nitrogen family: Comparative study of nitrogen family elements and their compounds (hydrides, halides, oxides and oxyacids) - chemistry of hydrazine, hydroxylamine, hydrazoic acids - oxoacids of phosphorus, microcosmic salts, Grahm's salt, paris green, scheele's green $CuHAsO_2$, tartaremetic and alloys of antimony and bismuth.

UNIT II: Oxygen, Copper and Zinc Family & Qualitative Analysis (12 Hours)

2.1 Oxygen family - Comparative study - preparation, properties, structural elucidation and uses of ozone, hydrogen peroxide, superoxides, peracids of sulphur and sodium thiosulphate.

2.2 Copper and Zinc family: Comparative study of copper group elements - photography - biologigal role of copper - fulminating silver and gold. Comparative study of zinc group elements - galvanization - evidence for the existence of Hg_2^{2+} ions - toxicity of cadmium and mercury.

2.3 Qualitative analysis: Principles of qualitative analysis - solubility product - common ion effect - complexation reactions including spot tests in qualitative analysis.

UNIT–III Ethers, Epoxides, Organometallic Compounds and Lipids (12 Hours)

3.1. Ethers: Simple and mixed ethers – isomerism – Williamson's synthesis, properties (formation of oxonium ion and hydrolysis). Anisole, thioether and mustard gas preparation, properties and uses.

3.2. Epoxides: Preparation – by oxidation of alkenes - properties - (reaction with - water, alcohol, and Grignard reagent).

3.3 Organometallic compounds: Grignard and Organo Lithium compound Preparation – properties – (Nucleophilic substitution and addition reaction with aldehydes, ketones, cyanides and alkylhalides).

3.4. Oils and fats: Definition, common fatty acids present in oils and fats, rancidity, hydrogenation of oils.

UNIT – IV Alcohols and Alkyl Halides (12 Hours)

4.1 Monohydric alcohols: Classification and nomenclature of monohydric alcohols - Preparation by reduction of aldehydes, ketones, carboxylic acids and hydrolysis of esters. Hydrogen bonding, Acidic nature. Reactions of alcohols - Etherification, Alkylation reaction of halogen acids, dehydrogenation, oxidation.

4.2 Dihydric & Trihydric alcohols: Dihydric alcohols: preparation, properties and uses of glycol. Glycerol-preparation, oxidative cleavage reactions of polyhydric alcohols with $Pb(OAc)_4$, HIO_4, OsO_4, uses of glycerol. Glyceryl trinitrate - Preparation, properties and uses.

4.3 Alkyl halides: Alkyl halide, vicinal dihalides and gem dihalides – Preparation, properties and uses.

UNIT V: Chemical Kinetics (12 Hours)

5.1 Order and Molecularity: Rates of reaction, rate laws, rate constants, order and molecularity of reactions. Rate equations for zero, first, second and third order reactions. Derivation of rate constants for first, second order reactions. Fractional order reactions - examples, half-life period, pseudo-first order reactions - examples.

5.2 Methods of determining the order of reactions: Integration, graphical, half-life and Ostwald's isolation methods.

5.3 Effect of temperature on reaction rates: Temperature dependence of reaction rates - Arrhenius parameters and calculations. Theories of reaction rates - simple collision theory] – Limitations - Steady state approximation - equilibrium approximation- Lindemann's hypothesis of unimolecular reactions.

Course Learning Outcomes:

1. The contents of unit I and II in this paper will impart knowledge to the students to analyze inorganic compounds in various fields and also gain information of the compounds of p-block elements.
2. Students shall understand the chemistry of cycloalkanes
3. Students know the chemical reactions involved in the preparation and properties of alcohols.
4. Students will be able to apply the laws of kinetics during research.

Text Books:

1. P. L. Soni, Mohan Katyal, "Text book of Inorganic Chemistry", 20th Revised Ed., (**2007**), Sultan Chand & Sons, New Delhi. (**UNIT I & II**)

2. R. D. Madan, "Modern Inorganic Chemistry", 2nd Ed., (**2008**), S. Chand and company Ltd., New Delhi. (**UNITS I & II**)
3. J. D. Lee, "*A New Concise Inorganic Chemistry*", Oxford Publishers, 5th Ed., **2014**. (**UNITS I & II**)
4. A. Bahl, B. S. Bhal, A Textbook of Organic chemistry, S. Chand and Company Ltd., New Delhi, 22nd Ed., **2016**. (**UNIT III & IV**)
5. P. L. Soni, "Text book of Organic Chemistry", S. Chand and Company Ltd., New Delhi, 28th Ed., **2004**. (**UNITS III & IV**)
6. R. T. Morrison and R. N. Boyd., "*Organic Chemistry*", Prentice Hall of India Pvt. Ltd., New Delhi, 7th Ed., **2011**. (**UNITS III & IV**)
7. B. R. Puri, L.R. Sharma and M. S. Pathania, "*Principles of Physical Chemistry*", Vishal Publishing Co., 47th Ed., **2016**. (**UNIT V**)
8. P. L. Soni and O. P. Dharmaha, "*Text book of Physical chemistry*", S. Chand and Sons, New Delhi. (**UNIT V**).

Reference Books:

1. Okhil K. Medhi, Ellen A. Keiter, James E. Huheey, Richard L. Keiter, Dorling Kindersley, "*Inorganic Chemistry: Principles of Structure and Reactivity*", India, 4th Ed., **2006**.
2. Carey, Francis A., Sundberg, Richard J., Springer, "*Advanced Organic Chemistry Part A: Structure and Mechanisms*", New York, 5th Ed., **2007**.
3. Peter Atkins, Julio de Paula, and James Keeler, "*Atkins' Physical Chemistry*", Oxford University Press, UK 11th Ed., **2017**.

SUBJECT CODE	TITLE OF THE PAPER		CORE
U22CH5P	PRACTICAL–II SEMI MICRO ANALYSIS		5
YEAR	SEMESTER	CREDITS	LECTURE HOURS
II	III & IV	5	75

Course Objectives:

1. To identify the anions and cations
2. To know the tests and spot tests for cations

Inorganic Qualitative Analysis

Analysis of a mixture containing two cations and two anions of which one will be an interfering ion. Semi micro methods using the conventional scheme with hydrogen sulphide may be adopted.

Cations to be studied: lead, copper, bismuth, cadmium, antimony, tin, iron, aluminium, zinc, manganese, cobalt, nickel, barium, calcium, strontium, magnesium and ammonium.

Anions to be studied: Carbonate, sulphide, sulphate, nitrate, bromide, fluoride, borate, oxalate, arsenite, arsenate and phosphate.

Course Outcomes:

1. Knowledge on conditions of precipitations
2. Knowing about solutions, identification of specific colors of ions
3. To know about interfering radicals

Text Books:

1. Practical Chemistry by A.O. Thomas, Scientific Book Centre, Cannanore, **2003**.
2. Basic Principles of Practical Chemistry, V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Sultan Chand & Sons, New Delhi, 2nd Ed., **2004**.

Reference:

1. Vogel's Qualitative Inorganic Analysis, G. Svehla, 7th Ed., Dorling Kindersley, India, 4th Ed., **2009**.

Scheme of Valuation

Maximum Marks: 75 Marks

Practical	: 60 marks
Record	: 10 marks
Viva-Voce	: 05 marks
Total	: 75 marks

4 radicals correct with suitable tests	:	60 marks
3 radicals correct with suitable tests	:	45 marks
2 radicals correct with suitable tests	:	30 marks
1 radical correct with suitable tests	:	15 marks

SUBJECT CODE	TITLE OF THE PAPER		CORE
U22CH6	GENERAL CHEMISTRY-IV		6
YEAR	SEMESTER	CREDITS	LECTURE HOURS
II	IV	4	60

Course Objectives:

1. To learn the chemistry of halogen and zero group elements.
2. To understand the chemistry of ethers, epoxides and organometallic compounds.
3. To understand the concepts in aromaticity and mechanism of electrophilic substitution reactions.
4. To acquire the knowledge about solid state and crystal structure.
5. To understand the behavior of the colloidal state and liquid crystals

UNIT I: Halogen Family and Zero Group Elements (12 Hours)

1.1 Halogen Family: Comparative study of halogens and their compounds - oxides and oxy acids of halogens (structure only) - estimation of available chlorine in bleaching powder - basic properties of halogens.

1.2 Interhalogen compounds Preparation, properties and uses - pseudo halogens - preparation, properties and uses of cyanogens and thiocyanogen - comparison with halogens.

1.2 Zero group elements: Position in the periodic table - isolation of noble gases from the atmosphere and uses - oxides and fluorides of xenon - structure and uses.

UNIT – II Aromaticity and Reagents (12 Hours)

2.1 Aromaticity: Structure of benzene – Kekule structure – Stability and application of Huckel's rule to benzene, naphthalene, anthracene, benzenoid and nonbenzenoid compounds.

2.2 Directive effects of substituents: Effects of substituent in benzene ring – Reactivity and orientation – Electrophilic substitution reactions – Mechanism of Nitration, Bromination, Sulphonation, Iodination, Riemer-Tiemann and Friedel Craft's alkylation and acylation.

2.3 Reagents: Synthetic applications of Lithium aluminium hydride, Sodium borohydride, Raney nickel, Wilkinson's catalyst, $KMnO_4$, chromyl chloride, HIO_4, $Pb(OAc)_4$ and SeO_2.

UNIT-III Substitution and Elimination Reactions (12 Hours)

3.1 Aliphatic nucleophilic substitution: Stereo chemical aspects and mechanism of S_N1, S_N2 and S_Ni reactions.

3.2 Elimination reaction: Hoffmann and Saytzeff's eliminations – Trans elimination: Mechanism of E_1, E_1CB and E_2 reactions. Elimination vs. Substitution.

3.3 Aromatic Nucleophilic substitution: Benzyne mechanism and intermediate complex formation mechanism.

UNIT IV: Solid State (12 Hours)

4.1 Properties of solids: Seven crystal systems - Bravais lattice, unit cell, law of rational indices, (Weiss indices) Miller indices. Symmetry elements in crystal systems (for cubic system only in detail).

4.2 X - ray diffraction by crystals: Derivation of Bragg's equation - Bragg method - powder method. Crystal structure of NaCl, KCl, ZnS and CsCl - radius ratio and packing in crystals.

UNIT V: Colloids and Liquid state (12 Hours)

5.1 Colloidal system: Classifications, preparation, properties, importance and applications of colloids - size of colloidal particles – peptization, stability of colloids, coagulation and Protection – Reverse Osmosis and desalination of sea water - Donnan membrane equilibrium electrophoresis and separation of proteins.

5.2 Gels and emulsions: Preparation, elastic and non-elastic gels – types of emulsion and emulsifiers.

5.3 Liquid state: liquid crystals – classification, structure, properties and applications.

Course Learning Outcomes:

1. The student will acquire the basic knowledge about the reactivity of halogens and inert group elements by learning the contents given in unit-I.
2. Students get to know the chemical reactions involved in the preparation and properties of ethers, epoxides and organometallic compounds.
3. Students understand the possible chemical modification of aromatic compounds.
4. Students understand the different kinds of electrophilic substitution reaction mechanisms.
5. Be able to do research in X-ray crystallography.

Text Books:

1. P. L. Soni, Mohan Katyal, "Text book of Inorganic Chemistry", 20th Revised Ed., (**2007**), Sultan Chand & Sons, New Delhi. (**UNIT I**)
2. R. D. Madan, "Modern Inorganic Chemistry", 2nd Ed., (**2008**), S. Chand and company Ltd., New Delhi. (**UNIT I**)
3. J. D. Lee, "*A New Concise Inorganic Chemistry*", Oxford Publishers, 5th Ed., **2014**. (**UNIT I**)
4. A. Bahl, B. S. Bhal, A Textbook of Organic chemistry, S. Chand and Company Ltd., New Delhi, 22nd Ed., **2016**. (**UNITS II & III**)
5. P. L. Soni, "Text book of Organic Chemistry", S. Chand and Company Ltd., New Delhi, 28th Ed., **2004**. (**UNITS II & III**)
6. R. T. Morrison and R. N. Boyd., "*Organic Chemistry*", Prentice Hall of India Pvt. Ltd., New Delhi, 7th Ed., **2011**. (**UNITS II and III**)
7. B. R. Puri, L.R. Sharma and M. S. Pathania, "*Principles of Physical Chemistry*", Vishal Publishing Co., 47th Ed., **2016**. (**UNITS IV & V**)

8. P. L. Soni and O. P. Dharmaha, "*Text book of Physical chemistry*", S. Chand and Sons, New Delhi. (**UNITS IV & V**)

Reference Books:

1. Okhil K. Medhi, Ellen A. Keiter, James E. Huheey, Richard L. Keiter, Dorling Kindersley, "*Inorganic Chemistry: Principles of Structure and Reactivity*", India, 4th Ed., **2006**.
2. Carey, Francis A., Sundberg, Richard J., Springer, "*Advanced Organic Chemistry Part A: Structure and Mechanisms*", New York, 5th Ed., **2007**.
3. Peter Atkins, Julio de Paula, and James Keeler, "*Atkins' Physical Chemistry*", Oxford University Press, UK 11th Ed., **2017**.

SUBJECT CODE	TITLE OF THE PAPER		CORE
U22CH7	INORGANIC CHEMISTRY-I		7
YEAR	SEMESTER	CREDITS	LECTURE HOURS
III	V	5	75

Course Objectives:

1. To learn the group study and the metallurgy of transition and inner transition elements.
2. To study the basic concepts of coordination compounds.
3. To explore the types of isomers, reaction mechanism and applications of coordination compounds.
4. To understand the chemistry of biological and metal carbonyl compounds.
5. To analyze the various concepts of acid-bases and non-aqueous solvents.

UNIT I: Transition and Inner Transition Elements (15 Hours)

1.1 The d-block elements: Group study of Titanium, Vanadium, Chromium, Manganese and Iron groups - Organometallic compounds of Ti, V and W.

1.2 Lanthanides and Actinides: General study involving electronic configuration, Oxidation state, magnetic properties and complexation behaviour - lanthanide and actinide contraction - comparative study of lanthanides and actinides. Chemistry of Thorium and Uranium.

UNIT II: Coordination Chemistry - I (15 Hours)

2.1 Coordination compounds: Ligands and their classification - coordination number - IUPAC Nomenclature of coordination compounds.

2.2 Theories of coordination compounds: Werner, Sidgwick, Valence bond, Crystal field, Molecular orbital theory - Effect of crystal field splitting - Jahn-Teller distortion. Stereochemistry of complexes.

UNIT III: Coordination Chemistry – II (15 Hours)

3.1 Isomerism in coordination compounds: Isomerism - stability of complexes - factors affecting stability. Unimolecular and bimolecular nucleophilic substitution reactions in octahedral and square planar complexes - trans effect.

3.2 Applications: Applications of coordination compounds - Chelates and their uses - Structure of EDTA and its complexes - complexometric titrations - principle and applications.

UNIT IV: Bioinorganic and Metal Carbonyl Compounds (15 Hours)

4.1 Bioinorganic Compounds: Biologically important coordination compounds - Chlorophyll, Hemoglobin and Vitamin B_{12} - structure and applications (elucidation not required). **4.2 Metal carbonyls:** Metal carbonyls - mono and polynuclear carbonyls of Ni, Fe, Cr, Co and Mn - Synthesis, reaction, structure and uses- carbonyl hydrides and carbonylate ions.

UNIT V: Acids and Bases (15 Hours)

5.1 Theories of acids and bases: Arrhenius concept - Lowry-Brønsted concept - LUX-Flood concept - The solvent system concept - The Lewis concept.

5.2 HSAB Principle: Hard and Soft acids and bases - Pearson's concept HSAB principle and its application - Solvolytic reactions - hydrolysis and alcoholysis.

5.3 Non-aqueous solvent: Types of solvents – characteristics of ionizing solvent -liq. ammonia and liq. HF as solvent.

Course Learning Outcomes:

1. Acquire an introductory understanding of transition and inner transition elements in chemistry.
2. Obtain a good understanding of coordination chemistry.
3. Recognize the isomerism, reaction mechanisms, and applications of coordination compounds.
4. Learn more about the coordination chemistry of biological and metal carbonyl compounds.
5. Study the fundamental ideas of acid-base chemistry.

Text Books:

1. J. D. Lee, "*A New Concise Inorganic Chemistry*", Oxford Publishers, 5th Ed., **2014**. (**ALL UNITS**)
2. P. L. Soni, Mohan Katyal, "Text book of Inorganic Chemistry", 20th Revised Ed., (**2007**), Sultan Chand & Sons, New Delhi. (**ALL UNITS**)
3. R. D. Madan, "Modern Inorganic Chemistry", 2nd Ed., (**2008**), S. Chand and company Ltd., New Delhi. (**ALL UNITS**)
4. R. Gopalan, P. S. Subramanian and K. Rangarajan, Elements Analytical chemistry, Sultan Chand & Sons, New Delhi, **1995**. (**ALL UNITS**)
5. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, 31st edition, **2011-12**. (**ALL UNITS**)
6. F. Albert Cotton, Geoffrey Wilkinson and Paul L. Gaus, "*Basic Inorganic Chemistry*", 3rd Ed., Wiley India Pvt. Ltd. **2007**. (**ALL UNITS**)

Reference Books:

1. Okhil K. Medhi, Ellen A. Keiter, James E. Huheey, Richard L. Keiter, Dorling Kindersley, "*Inorganic Chemistry: Principles of Structure and Reactivity*", India, 4th Ed., **2006**.
2. F. Albert Cotton, Geoffrey Wilkinson, Manfred Bochmann and Carlos Murilla, "*Advanced Inorganic Chemistry*", 6th Ed., Wiley India Pvt. Ltd. **2007**.

SUBJECT CODE	TITLE OF THE PAPER		CORE
U22CH8	ORGANIC CHEMISTRY-I		8
YEAR	SEMESTER	CREDITS	LECTURE HOURS
III	V	5	75

Course Objectives:

1. To enable the students to understand and appreciate the concepts of stereochemistry.
2. To study about the reactions of heterocyclic compounds.
3. To learn and understand the chemistry of carbonyl compounds.
4. To know the chemistry of carboxylic acids.
5. To enable the students to think and appreciate in a scientific a scientific manner through a comprehensive study of vitamins and terpenoid. An understanding of the methods of isolation, purification and structural elucidation of natural products.

UNIT-I Stereochemistry – I (15 Hours)

1.1 Stereoisomerism: Definition – Classification into Structural and Stereo isomerisms.

1.2 Optical isomerism: Optical activity – Definition - Optical and specific rotations – conditions for optical activity– Asymmetric centre – Chirality – Achiral molecule – (+) and (-) and D and L notations – Elements of symmetry. Optical activity of lactic acid, tartaric acid, biphenyls, allenes and spiranes. Racemization – Resolution methods (Mechanical separation, seeding, biochemical and conversion into diastereo isomers) – Asymmetric synthesis (partial and absolute asymmetric synthesis) – Walden inversion

1.3 Cahn – Ingold – Prelog rules: R,S notations for optical isomers with one asymmetric carbon– Erythro and Threo representations.

UNIT-II Stereochemistry – II and Heterocyclic Compounds (15 Hours)

2.1 Geometrical isomerism: Cis-trans, syn-anti and E-Z notations, Geometrical isomerisms in Maleic, Fumaric acids and in unsymmetrical Ketoximes – Methods of distinguishing geometrical isomers (Dipolemoment, dehydration, cyclization, melting points) – Methods of determining the configuration of geometrical isomers.

2.2 Heterocyclic Compounds: Aromatic characteristics and basicity of five membered heterocyclic compounds - preparation, properties and uses of furan, pyrrole and thiophene.

2.3 Six membered heterocyclic systems: Structure, synthesis and reactions of pyridine and piperidine.

2.4 Fused rings: Synthesis of Quinoline, isoquinoline and indole by Skraup, Bischler Napieralski and Fischer Indole synthesis respectively and their reactions.

Unit–III Carbonyl Compounds–Aldehydes, Ketones and Photochemistry (15 Hours)

3.1 Carbonyl Compounds: Structure – preparation, properties - Nucleophilic addition-Acid & base catalysed reactions – acidity of α-hydrogens. Addition reactions – sodium bisulphate, hydrogen cyanide. Reduction reaction–reduction to alcohol and alkane using Grignard reagent and $LiAlH_4$ –$NaBH_4$

3.2 Name Reactions in carbonyl compounds: Naming reactions involving carbonyl compounds - Aldol, Perkin, Knoevengal, Benzoin, Cannizaro, Crossed Cannizaro, Mannich, Michael addition, Claisen, Wolf Kishner reactions and MPV reactions with mechanisms. Oxidation reaction – Oxidation of aldehydes and ketones - Oppenauer oxidation - Haloform, Reformatsky and Wittig Reaction.

3.3 Photochemistry: Basics of photochemistry- Photochemistry of Carbonyl compounds - Norrish I and II types.

Unit–IV Carboxylic Acids and Tautomerism (15 Hours)

4.1 Monocarboxylic acids: Methods of preparation - Acidity of carboxylic acid – Acidity constant – chemical properties of mono carboxylic acids – formation of acid halides - formation of amides - formation of esters.

4.2 Dicarboxylic acids: Preparation and properties of oxalic, malonic, succinic, glutaric and adipic acids.

4.3 Malonic and acetoacetic esters: Characteristics of reactive methylene group – synthetic uses of malonic and acetoacetic esters.

4.4 Tautomerism: Definition - keto-enol-identification, - amido-imido and nitro - acinitro tautomerism (Only interconversion).

Unit –V Alkaloids, Terpenoids, and Steroids (15 hours)

5.1 Alkaloids: Introduction to alkaloids – classification – occurrence and isolation – structural elucidation of coniine and nicotine only. Structures of alkaloids: quinine, morphine, atropine, piperine and papaverine (structural elucidation not necessary). Importance of alkaloids.

5.2 Terpenoids: Classification and definition of terpenoids – isoprene rule – structure and uses of some essential oils – structural elucidation of geraniol only.

5.3 Steroids: Structure and functions of steroids – androgen, esterogen and cholesterol.

Course Learning Outcomes:

1. Students shall become aware of the fundamental aspects of stereochemistry and its influence on chemical properties.
2. To know the chemistry of heterocyclic compounds.
3. A comprehensive knowledge and understanding on the carbonyl compounds, and acid derivatives
4. Students learn the chemistry of vitamins and terpenoids

Text Books:

1. D. Nasipuri, "*Stereochemistry of Organic Compounds-Principles and Applications*", 2nd Ed., New Age International (**2005**). (**UNITS I & II**)
2. P. S. Kalsi, "*Stereochemistry*", Wiley Eastern Ltd, **1990**. (**UNITS I & II**)
3. E. L. Eliel and S. H. Wilen, "*Stereochemistry of Organic Compounds*", John Wiley, **2008**. (**UNITS I & II**)
4. A. Bahl, B. S. Bhal, A Textbook of Organic chemistry, S. Chand and Company Ltd., New Delhi, 22nd Ed., **2016**. (**ALL UNITS**)
5. R.T. Morrison and R.N. Boyd, "*Organic Chemistry*", New York, Allyn & Bacon Ltd., 7th Ed., **2011**. (**ALL UNITS**)
6. K. S. Tewari and N. K. Vishnoi, "A Text book of Organic Chemistry", Vikas Publishing House Pvt. Ltd., 3rd Ed., **2006**. (**ALL UNITS**)
7. P. L. Soni, "Text book of Organic Chemistry", S. Chand and Company Ltd., New Delhi, 28th Ed., **2004**. (**ALL UNITS**)
8. M. K. Jain and S. C. Sharma, "Modern Organic Chemistry", Vishal Publications, New Delhi, 14th Ed., **2014**. (**ALL UNITS**)
9. I. L. Finar, Organic Chemistry, Vol 1 and 2 (6th edition) England, Addison Wesley Longman Ltd. (**2002**). (**ALL UNITS**)
10. K. Srivastava, "Organic Chemistry", 1st Ed., (**2002**)–New Age International Publishers, New Delhi. (**ALL UNITS**)
11. V. K. Ahluwalia "Text book of organic chemistry" Vol.-I & Vol.-II (**2010**) Ane's Student edition, New Delhi. (**ALL UNITS**)
12. O. P. Agarwal, "*Chemistry of Organic Natural Products*", Volume I & II, Goel Publishers, **2014**. (**UNIT V**)

Reference Books:

1. Advanced Organic Chemistry Part A: Structure and Mechanisms Carey, Francis A., Sundberg, Richard J., Springer, New York, 5th Ed., **2007**.
2. Stereochemistry of Organic Compounds, E.L. Eliel, Samuel H. Wilen, Wiley – India **2008**.
3. Organic Chemistry, Paula Yurkanis Bruice, Dorling Kindersley, India, 5th Ed., **2009**.

SUBJECT CODE	TITLE OF THE PAPER		ELECTIVE
U22CH9E	ANALYTICAL CHEMISTRY		1
YEAR	SEMESTER	CREDITS	LECTURE HOURS
III	V	4	75

Course Objectives:

1. To acquire the knowledge of the analytical chemistry.
2. To understand the various quantitative methods of analysis and Gravimetric analysis.
3. To study the thermal and spectral techniques.
4. To learn the instrumentation of infrared spectrophotometer.
5. To analyse the methods of purification of organic compounds.

UNIT I: Introduction to Analytical Chemistry (15 Hours)

1.1 General Introduction: Types of analytical methods - Importance of analytical methods in qualitative and quantitative analysis - chemical and instrumental methods. Advantages and limitations of chemical and instrumental methods.

1.2 Laboratory hygiene and safety: Storage and handling of corrosive, flammable, explosive, toxic, carcinogenic and poisonous chemicals. Simple first aid procedures for accidents involving acids, alkalies, bromine, burns and cut by glass. Threshold vapour concentration - safe limits - Waste disposal and fume disposal.

1.3 Evaluation and treatment of analytical data: Idea of significant figures - its importance. Accuracy - methods of expressing accuracy - error analysis - types of errors-minimizing errors. Precision - methods of expressing precision - mean, median, mean deviation, standard deviation and confidence limit. Method of least squares - problems involving straight line graphs.

UNIT II: Quantitative Analysis (15 Hours)

2.1 Estimations of commercial samples: Determination of percentage purity of samples - Pyrolusite, Iron ore, washing soda and Bleaching powder.

2.2 Gravimetric analysis: Principle - theories of precipitation - solubility product and precipitation - conditions of precipitations - types of precipitants - specific and selective precipitants - organic and inorganic precipitants - types of precipitation - purity of precipitates - co precipitation - post precipitation - precipitation from homogeneous solution - use of sequestering agent.

UNIT III: Thermo and Electroanalytical Techniques (15 Hours)

3.1 Thermo analytical methods: Principle of thermogravimetry, differential thermal analysis - Instrumentation for TGA and DTA - Characteristics of TGA and DTA curves - factors affecting TGA and DTA curves - applications - TGA of calcium oxalate monohydrate and Copper sulphate pentahydrate - DTA of calcium acetate monohydrate. **3.2 Electro analytical techniques**: Electrogravimetry - theory of electrogravimetric analysis - determination of copper (by constant current procedure) - electrolytic separation of metals: Principle - separation of copper and nickel.

UNIT IV: Spectro Analytical Techniques (15 Hours)

4.1 Visible Spectrophotometry and Colorimetry: Colorimetry and spectrophotometry - Beer-Lambert's law - principle of colorimetric analysis - visual colorimetry - standard series method - balancing method - estimation of Ni^{2+} and Fe^{3+} colorimetrically - photoelectric photometer method.

4.2 Infrared absorption spectroscopy: Infrared spectroscopy (instrumentation only) - block diagram - source - monochromator - cell - detectors and recorders - sampling techniques - NMR spectroscopy (instrumentation only) – block diagram.

UNIT V: Chromatographic Techniques (15 Hours)

5.1 Theoretical Principles: Chromatography - introduction - theory - classification of chromatographic methods - development of chromatograms.

5.2 Column chromatography: Principle, types of adsorbents, preparation of the column, elution, recovery of substances and applications.

5.3 Thin layer chromatography: Principle, choice of adsorbent and solvent, preparation of chromatoplates, R_f-values, factors affecting the R_f -values, Significance of R_f values. **5.4 Paper chromatography**: Principle, solvents used - development of chromatogram, ascending, descending and radial paper chromatography.

5.5 Gas chromatography and HPLC: Gas chromatography and HPLC - principles, instrumentations and applications.

Course Learning Outcomes:

1. Gain of insight into analytical methods, safety measures and data analysis
2. Understanding quantitative estimations of minerals and gravimetric analysis
3. Knowledge of thermo analytical techniques
4. Importance of colorimetric estimations
5. functioning of various chromatographic systems

Text Book:

1. A. Douglas, Skoog, D. M. West and F. J. Holler, Fundamentals of Analytical Chemistry, 7th Ed., Harcourt College Publishers. (**All Units**)
2. J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas, Vogel's Text book of Quantitative Chemical analysis 6th Ed., Pearson education. (**All Units**)
3. B. K. Sharma, Instrumental Methods of Chemical Analysis, Goel Publishing House, Merrut, 5th Ed., **1993**. (**All Units**)
4. R. Gopalan, P. S. Subramaniam and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand and Sons. (**All Units**)
5. S. Usharani, Analytical Chemistry, Macmillian. (**All Units**)

Reference Books:

1. Vogel's textbook of quantitative chemical analysis Mendham, John. Denney, Ronald C. Barnes, John D.Thomas, M., 7th Ed., Prentice Hall, New York, 6th Ed., **2000**.
2. Instrumental Methods of Analysis, H.W. Willard, L.I. Merrit, J.A. Dean and P.A. Settle, CBS Publishers, 7th Ed., **1996**.

SUBJECT CODE	TITLE OF THE PAPER		ELECTIVE
U22CH10E	Thermodynamics and Quantum Chemistry		2
YEAR	SEMESTER	CREDITS	LECTURE HOURS
III	V	4	75

Course Objectives:

1. To learn about the basic terms used in understanding thermodynamics and also to learn the first law of thermodynamics.
2. To learn about the energy changes taking place in a chemical reaction and how it is stored in atoms and molecules.
3. To learn the concept of entropy, free energy and also the second law of thermodynamics.
4. To learn the concept of chemical potential and also the third law of thermodynamics.
5. To get a deep insight into the world of microscopic particles.

UNIT I: Thermodynamics – I (15 Hours)

1.1 Basic Terms: Thermodynamic processes - reversible and irreversible, isothermal and adiabaticprocesses - state and path functions - exact and inexact differentials. Work of expansion at constant pressure and free expansion. First law of thermodynamics - statement - definition of internal energy (E), enthalpy (H) and heat capacity.

1.2 Heat capacity: Relation between C_p and C_v. calculation of w, q, dE and dH for expansion of ideal and real gases under isothermal and adiabatic conditions of reversible and irreversible processes. Definition of Joule-Thomson coefficient - calculation of ($\mu J,T$) for ideal and real gases - Inversion temperature.

1.3 Thermochemistry: Thermochemistry - relation between enthalpy of reaction at constant volume (q_v) and at constant pressure (q_p) - temperature dependence of heat of reaction – Kirchoff's law and it's applications.

UNIT II: Thermodynamics – II (15 Hours)

2.1 Limitations of first law and Need for second law of thermodynamics: Second law of thermodynamics - need for the law - different statements of thelaw - Carnot's cycle and efficiency of heat engine - Carnot's theorem - thermodynamic scale of temperature.

2.2 Entropy and entropy changes in processes: Concept of entropy - definition and physical significance of entropy - entropy as a function of P, V and T – entropy changes during phase changes - entropy of mixing - entropy criterion forspontaneous and equilibrium processes in isolated system –

2.3 Free energy: Gibb's free energy (G) and Helmholtz free energy (A) –

variation of A and G with P, V and T - Gibb's - Helmholtz equation and its applications - thermodynamic equation of state - Maxwell's relations only - ΔA and ΔG as criteria for spontaneity and equilibrium - advantages of ΔG over entropy change.

UNIT III: Thermodynamics – III (15 Hours)

3.1 Thermodynamic treatment of chemical equilibrium: Equilibrium constant and free energy change - thermodynamic derivation of law of mass action - equilibrium constants in terms of pressure and concentration - NH_3, PCl_5, - thermodynamic interpretation of Le Chatelier's principle (Concentration, temperature, pressure and addition of inert gases.)

3.2 Partial molar free energy and chemical potential: Partial molar quantities - chemical potential - Gibb's Duhem equation. van't Hoff's reaction isotherm - van't Hoff's isochore - Clapeyron equation and Clausius- Clapeyron equation – applications.

3.3 Third law of thermodynamics: Third law of thermodynamics - Nernst heat theorem statement of III law and concept of residual entropy.

UNIT IV: Quantum Chemistry (15 Hours)

4.1 Introduction and Principle of Quantum Theory: Black body radiation and quantum theory- inadequacy of old quantum theory - atomic spectra - Bohr's model of atoms - Bohr's theory of Hydrogen atom andspectral lines. Limitations of Bohr's model. Sommerfeld's extension - photoelectric effect and Compton effect. de-Broglie's equation and verification. Heisenberg'suncertainty principle.

4.2 Schrodinger wave equation: Eigen values and eigen functions - significance of ψ and ψ2 - Radial probability distribution – orbital energies in multi electron atoms – Filling of orbitals.

UNIT V: Thermodynamics of Phase Changes (15 Hours)

5.1 Phase Equilbria and Phase Rule: Definition of terms in the phase rule - derivation and application to one component systems -Water, carbondioxide and sulphur.

5.2 Two component systems: Type A: Simple eutectic system - solid liquid equilibria, simple eutectic (lead-silver, Bi-Cd), desilverisation of lead compound Type B: formation with congruent melting point (Mg-Zn) and incongruent melting point (Na-K) - solid solutions - fractional crystallization – freezing mixtures - $FeCl_3$ - H_2O systems, $CuSO_4$-H_2O system.

Course Learning Outcomes:

1. Students are able to apply the knowledge gained about thermodynamics to everyday appliances like refrigerator, air conditioner etc.
2. Students gain an insight into the energy changes taking place in spontaneous and non-spontaneous processes.
3. Students understand about the physical significance of entropy and the applications of Clausius Clapeyron equation.

4. Students understand Nernst heat theorem, the concept of absolute entropies of elements and compounds and the experimental verification of the third law of thermodynamics.

5. Students will be able to apply their mathematical knowledge to study about microscopic particles.

Text books:

1. B. S. Bahl, G. D. Tuli and Arun Bahl, "*Essentials of Physical Chemistry*", S. Chand & Company Ltd, New Delhi, 12th Ed., **2011**. (**ALL UNITS**)
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "*Principles of Physical Chemi*stry", Vishal Publishing Co., 47th Ed., **2016**. (**ALL UNITS**)
3. P.L. Soni, "*Text book of Physical Chemistry*", S. Chand & sons, New Delhi. (**ALL UNITS**)
4. A.S. Nagi and S.C. Anand, "*A Text Book of Physical Chemistry*", Wiley Eastern Ltd, New Delhi, 7th Ed., **2000**. (**ALL UNITS**)

Reference Books:

1. Peter Atkins, Julio de Paula, and James Keeler, "*Atkins' Physical Chemistry*", Oxford University Press, UK 11th Ed., **2017**.

SUBJECT CODE	TITLE OF THE PAPER		CORE
U22CH11P	PRACTICAL–III PHYSICAL CHEMISTRY PRACTICAL		11
YEAR	SEMESTER	CREDITS	LECTURE HOURS
III	V & VI	5	90

Course Objectives:

1. To improve the knowledge of the rate of chemical reactions.
2. To acquire the knowledge of electro chemical aspects like conductometric and potentiometric titrations
3. To create knowledge about colligative properties and binary mixtures of the system
4. To correlate the theoretical principles with practical experiments of physical chemistry.

List of Experiments:

1. Determination of Critical Solution Temperature of phenol-water system.
2. Effect of impurity on Critical Solution Temperature of phenol-water system.
3. Determination of Transition Temperature
4. Rast Method - Determination of K_f.
5. Rast Method - Determination of molecular weight.
6. Phase Diagram - Two-component system-Simple eutectic system
7. Kinetics - Determination of rate constant of acid catalysed hydrolysis of an ester.
8. Conductometry - Acid-Base Titration, precipitation titration
9. Potentiometry - Redox Titration
10. Conductometry - Determination of cell constant and equivalent conductance of a strong electrolyte.

Demonstration Experiments:

11. Determination of optical rotation using polarimeter.
12. Determination of acid strengths using polarimeter.
13. Edible oil extraction using Soxhlet apparatus.
14. UV – Visible Spectral Studies
    Recording UV-visible spectrum of coordination complexes and interpretation of the spectra.

Course Learning Outcomes

The students are able to

1. By carrying out both electrical and non-electrical physical practicals.
2. Find out CST of phenol-water system, Transition temperature of any hydrated salt and molecular weight of any substance.
3. Measure eutectic temperature and follow kinetics of reaction.

4. Perform conductometric and potentiometric titrations for calculating concentration and the amount present in the given solution.
5. Determine cell constant and equivalent conductance.

Text Books:

1. Practical Chemistry by A.O. Thomas, Scientific Book Centre, Cannanore, **2003**.
2. Basic Principles of Practical Chemistry, V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Sultan Chand & Sons, New Delhi, 2nd Ed., **2004**.

Reference Books:

1. Experimental Physical Chemistry: A Laboratory Textbook, Arthur M. Halpern, Prentice Hall, **1997**.

Scheme of Valuation

Maximum Marks: 75 Marks

Record	: 10 Marks
Procedure Writing	: 10 Marks
Practical	: 50 Marks
Viva-voce	: 05 Marks

SUBJECT CODE	TITLE OF THE PAPER		CORE
U22CH12P	PRACTICAL–IV GRAVIMETRY AND ORGANIC ANALYSIS PRACTICAL		12
YEAR	SEMESTER	CREDITS	LECTURE HOURS
III	V & VI	6	90

Course Objectives:

1. To have a knowledge about analyzing organic compounds
2. To Know some important organic reactions
3. To know about estimation of compounds

Gravimetric Analysis:

1. Estimation of Lead as lead chromate.
2. Estimation of Barium as barium chromate.
3. Estimation of Nickel as Nickel - DMG complex.
4. Estimation Calcium as calcium oxalate monohydrate
5. Estimation of Barium as barium sulphate.

Organic Qualitative Analysis:

Analysis of Simple Organic compounds

(a) characterization of functional groups

(b) confirmation by preparation of solid dervatives / characteristic colour reactions.

Note: Mono-functional compounds are given for analysis. In case of bi-functional compounds, students are required to report any one of the functional groups.

Organic Preparation:

Preparation of Organic Compounds involving the following chemical conversions

1. Oxidation
2. Reduction
3. Hydrolysis
4. Nitration
5. Bromination,
6. Diazotization
7. Osazone formation
8. Microwave assisted organic preparation (Preparation of aspirin from salicylic acid).
9. Synthesis of Nano particles using green synthesis.

Determination of Physical Constants (Demonstration only):

1. Determination of boiling /melting points by semi micro method.

Course Learning Outcomes:

1. Knowledge on the technique of organic qualitative analysis
2. Knowledge about the method of organic compound preparation
3. Learning physical constant of solid and liquid organic compounds

4. Understand by the principles of gravimetric estimation and develop practical skill in it.

Text Books:

1. Practical Chemistry by A.O. Thomas, Scientific Book Centre, Cannanore, **2003**.
2. Basic Principles of Practical Chemistry, V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Sultan Chand & Sons, New Delhi, 2nd Ed., **2004**.

Reference Books:

1. Experimental Physical Chemistry: A Laboratory Textbook, Arthur M. Halpern, Prentice Hall, **1997**.

Scheme of Valuation Maximum Marks: 75 Marks

Record	: 5 + 5 = 10 Marks
Viva-Voce	: 05 Marks
Gravimetric	: 30 Marks
Organic Preparation	: 10 Marks
Organic Analysis	: 20 Marks

Split up mark for Organic Analysis as follows:

Aromatic/Aliphatic	: 03 Marks
Saturated/Unsaturated	: 03 Marks
Special Element	: 06 Marks
Functional Group	: 05 Marks
Derivative	: 03 Marks

SUBJECT CODE	TITLE OF THE PAPER		CORE
U22CH13	INORGANIC CHEMISTRY-II		13
YEAR	SEMESTER	CREDITS	LECTURE HOURS
III	VI	6	90

Course Objectives:

1. To study the chemistry of ionic and organometallic compounds
2. To learn the structural studies of polymeric inorganic compounds
3. To get the knowledge of theoretical concepts and applications of metallic state
4. To understand the basics of nuclear chemistry.
5. To apply the knowledge in the advanced field of industrial chemistry and nuclear chemistry.

UNIT I: Ionic and Organometallic Compounds (**18 Hours**)

1.1 Ionic Compounds: Structure of crystal lattice – examples - NaCl, CsCl, Zinc blende, Wurtzite and fluorite. Layer structure compounds - examples CdI_2 and NiAs.

1.2 Organometallic Compounds: Organometallic compounds of alkenes, alkynes and cyclopentadiene. Organometallics in agriculture and industry.

UNIT II: Polymeric Inorganic Compounds (**18 Hours**)

2.1 Clathrates, Borates, Silicones and Phosphorus Compounds: Clathrates - examples and structures - Borates. Silicones - composition, raw materials, manufacture, structure, properties and uses. Boron - Phosphorus compounds - coordination polymers and phosphonitrilic polymers.

2.2 Silicates Minerals: Silicates - classification into discrete anions - one, two, and three dimentional structures with typical example - composition, properties and uses of beryl, asbestos, talc, mica, zeolites and ultramarines.

UNIT III: Metallic State (**18 Hours**)

3.1 Theories of metallic bonding: Electron gas, Pauling and Band theories. Structure of alloys substitutional and interstitial solid solutions - Hume- Rothey ratios - crystal defects in stoichiometric and non-stoichiometric compounds.

3.2 Semi-conductors: Extrinsic and intrinsic - n- type and p-type - composition, structure and uses in electronic industry. Superconductivity - principle.

UNIT IV: Nuclear Chemistry (**18 Hours**)

4.1 Structure of the atom: Introduction - composition of nucleus and nuclear forces. Nuclear stability n/p ratio – mass defect, binding energy, packing fraction and magic numbers - nuclear shell and liquid drop models.

4.2 Nuclear isomers: Isotopes - detection and separation - isotopic constitution of elements - Whole number rule - Isobars, Isotones and nuclear isomers. Nuclear fission and fusion - nuclear reactor. Recent discovery challenges.

UNIT V: Radioactivity and Nuclear Transformations (**18 Hours**)

5.1 Radioactivity: - discovery, detection and measurement (Wilson Cloud Chamber) – radioactive emission – disintegration theory – modes of decay – rate of disintegration - half-life- average life - radioactive series.

5.2 Nuclear transformations: Projectiles – particle acceleratos - cyclotron- nuclear reactions – Q values of nuclear reactions- applications of radioisotopes - carbon dating - radioactive waste disposal. Biological effects of radiation.

Course Learning Outcomes:

1. Gain the fundamental knowledge of ionic and organometallic compounds.
2. Obtain a comprehensive understanding of the structural studies of polymeric compounds.
3. Enhance understanding on theoretical concepts and applications of metallic state.
4. Expand awareness on basic concepts of nuclear chemistry.
5. Enlighten the fundamental concepts involved in radioactivity and nuclear transformations.

Text Books:

1. J. D. Lee, "*A New Concise Inorganic Chemistry*", Oxford Publishers, 5th Ed., **2014**. (**ALL UNITS**)
2. P. L. Soni, Mohan Katyal, "Text book of Inorganic Chemistry", 20th Revised Ed., (**2007**), Sultan Chand & Sons, New Delhi. (**ALL UNITS**)
3. R. D. Madan, "Modern Inorganic Chemistry", 2nd Ed., (**2008**), S. Chand and company Ltd., New Delhi. (**ALL UNITS**)
4. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, 31st edition, **2011-12**. (**ALL UNITS**)
5. F. Albert Cotton, Geoffrey Wilkinson and Paul L. Gaus, "*Basic Inorganic Chemistry*", 3rd Ed., Wiley India Pvt. Ltd. **2007**. (**ALL UNITS**)

Reference Books:

1. Okhil K. Medhi, Ellen A. Keiter, James E. Huheey, Richard L. Keiter, Dorling Kindersley, "*Inorganic Chemistry: Principles of Structure and Reactivity*", India, 4th Ed., **2006**.
2. F. Albert Cotton, Geoffrey Wilkinson, Manfred Bochmann and Carlos Murilla, "*Advanced Inorganic Chemistry*", 6th Ed., Wiley India Pvt. Ltd. **2007**.

SUBJECT CODE	TITLE OF THE PAPER		CORE
U22CH14	ORGANIC CHEMISTRY-II		14
YEAR	SEMESTER	CREDITS	LECTURE HOURS
III	VI	6	90

Course Objectives:

1. To learn the chemistry of nitrogen containing compounds.
2. To impart the knowledge on chemistry of amino acids, proteins, nucleic acids and carbohydrates.
3. To learn the chemistry of phenols and its derivatives.
4. To study about various organic compounds of industrial importance (dyes and polymers).
5. To learn the various types of rearrangements and their mechanisms.
6. To learn the characteristics and reactions of alkaloids.

UNIT-I Chemistry of Nitrogen Compounds (18 Hours)

1.1 Nitrogen compounds: Nitro alkanes - synthetic uses and reactions of nitroalkanes - alkyl nitrites – differences between nitroalkanes and alkyl nitrites

1.2 Aromatic nitro compounds: Properties of aromatic nitro, di and trinitro compounds - preparation and reduction of nitro benzene under different conditions. Chemistry of Picric acid and TNT.

1.3 Amino compounds: Classification of Aliphatic and aromatic amines – Reactions of Aromatic and Aliphatic amines - effect of substitutents on basicity and comparison of aliphatic and aromatic amines - mechanism of carbylamine reaction and diazotization – preparation and synthetic importance of benzene diazonium salt. Hinsberg test.

Unit – II Amino acids, Proteins and Nucleic acids (18 hours)

2.1 Amino acids: Classification – preparation of amino acids – reactions of amino acids – Zwitter ion, isoelectric point. Synthesis of dipeptides: protection, activation and deprotection – Merrifield solid phase synthesis.

2.2 Proteins: Classification of proteins – terminal residue analysis: N–terminal (Edman Pehr method) – C–terminal analysis (enzymatic and chemical) – Sanger method of identification of amino acid sequence in a polypeptide – primary, secondary and tertiary structures of proteins.

2.3 Nucleic acids: Nucleotides, nucleosides, heterocyclic bases and sugars. DNA and RNA, biological functions.

Unit– III Carbohydrates (18 Hours)

3.1 Monosaccharides: Classification of carbohydrates – Monosaccharides – preparation, properties and uses of glucose and fructose - structural elucidation of glucose – epimerization - interconversion of glucose and fructose, chain lengthening,

chain shortening of aldoses, mutarotation and α, β – glycoside linkages, cyclic structure, pyranose and furanose forms of D – Glucose. Tests for Carbohydrates.

3.2 Disaccharides: Structure, Properties and general reactions- Maltose, Lactose & Sucrose. Sucrose – Manufacture, properties and structural elucidation.

3.3 Polysaccharides: Structure and Properties of starch and cellulose **(Structural Elucidation not required).**

UNIT IV: Phenols and Dyes (18 Hours)

4.1 Phenols: Preparation, properties, Acidic character of phenols, and reactions of Phenol - Coupling reaction - electrophilic substitution reactions - Reimer-Tiemann reaction, Houben-Hoesch acylation, Gattermann's reaction, Kolbe's reaction. Cresols, Nitro and aminophenols, di and trihydric phenols, α- and β-naphthols preparation and properties.

4.2 Dyes: Theory of color and constitution. Classification according to structure and application. Preparation and uses of the following dyes. (i) Azodyes (ii) nitro/nitroso dye (iii) diphenyl methane dyes (iv) Triphenyl methane dyes (v) Phthalein/xanthane dye (vi) vat dye and (vii) anthraquinone dye

UNIT V: Molecular Rearrangement and Vitamins (18 Hours)

5.1 Molecular Rearrangement: Classification - anionotropic, cationotropic, intermolecular and intramolecular rearrangement.

5.2 Name Reactions in Molecular Rearrangement: Pinacol–pinacolone rearrangement (Mechanism, Evidence for carbocation intermediate Formation, Migratory aptitude). Beckmann, Benzidine, Hoffmann, Curtius, Fries, Benzilic acid rearrangements (Mechanism only), Claisen rearrangement (sigmatropic rearrangement), Cope rearrangement.

5.3 Vitamins: Types - sources - deficiency disorders. Structure of vitamin A, B_6, B_{12} and C. Structural elucidation of riboflavins and ascorbic acid.

Course Learning Outcomes:

1. A comprehensive knowledge and understanding on the nitro compounds, amines compounds and its derivatives.
2. Students learn the chemistry of amino acids, proteins, nucleic acids and sugars.
3. Students understand the preparation, properties and application of phenol derivatives, various dyes and polymers and to know their uses in everyday life.
4. Students get to know the classifications, mechanisms and applications of various molecular rearrangements.

Text Books:

1. A. Bahl, B. S. Bhal, A Textbook of Organic chemistry, S. Chand and Company Ltd., New Delhi, 22nd Ed., **2016**. (**ALL UNITS**)
2. R.T. Morrison and R.N. Boyd, "*Organic Chemistry*", New York, Allyn & Bacon Ltd., 7th Ed., **2011**. (**ALL UNITS**)

3. K. S. Tewari and N. K. Vishnoi, "A Text book of Organic Chemistry", Vikas Publishing House Pvt. Ltd., 3rd Ed., **2006**. (**ALL UNITS**)
4. P. L. Soni, "Text book of Organic Chemistry", S. Chand and Company Ltd., New Delhi, 28th Ed., **2004**. (**ALL UNITS**)
5. M. K. Jain and S. C. Sharma, "Modern Organic Chemistry", Vishal Publications, New Delhi, 14th Ed., **2014**. (**ALL UNITS**)
6. I. L. Finar, Organic Chemistry, Vol 1 and 2 (6th edition) England, Addison Wesley Longman Ltd. (**2002**). (**ALL UNITS**)
7. K. Srivastava, "Organic Chemistry", 1st Ed., (**2002**)–New Age International Publishers, New Delhi. (**ALL UNITS**)
8. V. K. Ahluwalia "Text book of organic chemistry" Vol.-I & Vol.-II (**2010**) Ane's Student edition, New Delhi. (**ALL UNITS**)

Reference Books:

1. Advanced Organic Chemistry Part A: Structure and Mechanisms Carey, Francis A., Sundberg, Richard J., Springer, New York, 5th Ed., **2007**.
2. Stereochemistry of Organic Compounds, E.L. Eliel, Samuel H. Wilen, Wiley – India, **2008**.
3. Organic Chemistry, Paula Yurkanis Bruice, Dorling Kindersley, India, 5th Ed., **2009**.

SUBJECT CODE	TITLE OF THE PAPER		CORE
U22CH15	PHYSICAL CHEMISTRY-II		15
YEAR	SEMESTER	CREDITS	LECTURE HOURS
III	VI	6	90

Course Objectives:

1. To learn in detail about the different terms used in electrolytic conductance, Ostwald's dilution law, and the Debye-Huckel theory of strong electrolytes.
2. To learn in detail about the applications of electrical conductance.
3. To understand the different types of electrodes used in electrochemical cells, the meaning and interpretation of electromotive force .
4. To study the reactions which are caused by the absorption of light radiations.
5. To learn in detail about the nature of electromagnetic light and its interaction with matter.

UNIT I: Electrical Conductance (18 Hours)

1.1 Introduction to Electrical Conductance: Electrical transport and conductance in metal and in electrolytic solution - specific conductance and equivalent conductance - measurement of equivalent conductance. Arrhenius theory of electrolytic dissociation and its limitation - Arrhenius theory of strong and weak electrolytes. Ostwald's dilution law –applications and limitation - variation of equivalent conductance with concentration. Transport number and Hittorf's rule - determination by Hittorf's method and moving boundary method Kohlrausch's law and its applications. The elementary treatment of the Debye-Huckel - Onsager equation for strongelectrolytes.

1.2 Application of Electrical Conductance: Application of conductance measurements - determination of theconcentrations of strong electrolytes and acids. Determination of K_a of acids – Buffer solutions – Henderson Hasselbach equation - determination of solubility product of a sparingly soluble salt - common ioneffect - conductometric titrations.

UNIT II: Electrochemical Cells (18 Hours)

2.1 Electromotive force: Electrolytic and galvanic cells - reversible and irreversible cells - conventional representation of electrochemical cells - electromotive force of a cell and its measurement - calculation of thermodynamic quantities of cell reactions ($\Delta G, \Delta H$, ΔS and K) - application of Gibbs-Helmholtz equation - concentration andEMF - Nernst equation.

2.2 Types of reversible electrodes: Gas/metal ion - metal/metal ion; metal/insoluble salt/anion and redox electrodes – electrode reactions derivation of cell - EMF and single electrode potential – standard hydrogen electrode - reference electrodes - standard electrode potentials - sign convention -

electrochemical series and its significance - concentration cell with and without transport - liquid junction potential - application of EMF of concentration cells - valency of ion- solubility product and activity co-efficient.

2.3 Potentiometric titrations: Determination of pH using hydrogen and quinhydroneelectrodes - determination of pKa of acids by potentiometric method.

UNIT III: Photochemistry (18 Hours)

3.1 Light absorption and its consequences: Light absorption **-** Jablonski diagram - radiative and non-radiative transitions- - Fluorescence, phosphorescence and chemiluminescence - laws of photochemistry - Lambert-Beer, Grothus - Draper and Stark-Einstein's law of photochemical equivalence. quantum efficiency - photochemical reactions rate law.

3.2 kinetics and energy transfer in Photochemical reactions: kinetics of H_2-Cl_2 and H_2-Br_2 reactions-comparison of their quantum yields.- comparison between thermal and photochemical chain reactions - photosensitization and quenching.

UNIT IV: Spectroscopy – I (18 Hours)

4.1 Electromagnetic radiations: Electromagnetic spectrum - the regions of various types of spectra. Microwavespectroscopy: Rotational spectra of diatomic molecules - treatment as rigidrotator - condition for a molecule to be active in microwave region - rotational constants - and selection rules for rotational transition. Frequency of spectrallines, calculation of inter - nuclear distance in diatomic molecules.

4.2 Infrared spectroscopy: Vibrations of diatomic molecules - harmonic and an harmonic oscillators - zero point energy - dissociation energy and force constant - condition for molecule to be active in the IR region - selection rules for vibrational transition - fundamental bands - overtones and hot bands - diatomic vibrating rotator - determination of force constant

4.3 UV visible spectroscopy and AAS: conditions - theory of electronic spectroscopy - types of electronic transitions - Franck-Condon principle – pre-dissociation – applications - Atomic absorption spectroscopy (AAS) - principle and application.

UNIT V: Spectroscopy – II (18 Hours)

5.1 Raman spectroscopy: Rayleigh scattering and Raman scattering - Stokes and antistokes lines in Raman spectra - Raman frequency - quantum theory of Raman effect – P,Q,R branches condition for a molecule to be Raman active - comparison of Raman and IR spectra - structural determination from Raman and IR spectroscopy - rule of mutual exclusion.

5.2 NMR spectroscopy: Nuclear spin and conditions for a molecule to give rise to NMR spectrum - theory of NMR spectra - number of NMR signals - equivalent and non-equivalent protons - position of NMR signals - shielding, deshielding, chemical shift, ∂ scale - peak area and number of protons - splitting of NMR signals - spin-spin

coupling- NMR spectra of of simple compounds like acetone, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, toluene, isomers of dimethylcyclopropane (1,1-dimethylcyclopropane, cis-1,2- dimethylcyclopropane and trans-1,2-dimethylcyclopropane), 1,1- dichloroethane, 1,1,2-trichloroethane, 1,1,2,2-tetrachloroethane, 1-bromo-2- chloroethane, 2-methylpropene and 1-chloro-2,2-dimethylpropane.

Course Learning Outcomes:

The students will be able to apply the knowledge gained to research and /or in industries.

1. Students learn the basics of electrolytic conductance and also its applications.
2. Student understand the Nernst equation, electrochemical series and the applications.
3. Students will be able to understand the Jablonski diagram, Beer-Lambert's law, the laws of photochemistry and the kinetics involved in photochemical reactions.
4. Students learn the difference between atomic and molecular spectra, the various types of spectra, the applications of infra red and ultraviolet and visible spectra.
5. Student lean the basics and the applications of Raman and nuclear magnetic resonance spectroscopes.

Text books:

1. B. S. Bahl, G. D. Tuli and Arun Bahl, "*Essentials of Physical Chemistry*", S. Chand & Company Ltd, New Delhi, 12th Ed., **2011**. (**ALL UNITS**)
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "*Principles of Physical Chemis*try", Vishal Publishing Co., 47th Ed., **2016**. (**ALL UNITS**)
3. P.L. Soni, "*Text book of Physical Chemistry*", S. Chand & sons, New Delhi. (**ALL UNITS**)
4. A.S. Nagi and S.C. Anand, "*A Text Book of Physical Chemistry*", Wiley Eastern Ltd, New Delhi, 7th Ed., **2000**. (**ALL UNITS**)

5. Reference Books:

6. Atkins' Physical Chemistry, Peter Atkins, Julio de Paula, and James Keeler, Oxford University Press, UK 11th Ed., **2017**.

SUBJECT CODE	TITLE OF THE PAPER		ELECTIVE
U22CH16E	FOOD CHEMISTRY		3
YEAR	SEMESTER	CREDITS	LECTURE HOURS
III	VI	4	75

Course Objectives:

1. To learn the importance of food nutrition and balanced diet.
2. To know about adulteration and food poison and health problem associated with it
3. To learn about food additives and chemical composition
4. To know the specific quality attributes and the basic concepts of food system, drug licence WHO standard and ISI specifications.

UNIT I: Nutrition and Balanced Diet (15 Hours)

1.1 Nutrition: Nutrition and balanced diet - calorific value of food stuff - energy requirements of individuals. Diseases associated with protein malnutrition, vitamin deficiency. Nutritional importance of carbohydrates, fibers and lipids. Advantages and disadvantages and the effect of various methods of cooking on nutrients-minimising nutrients losses. Over nutrition-obesity, coronary heart disease, diabetes - prevention of anemia.

UNIT II: Food Adulteration and Food Poison (15 Hours)

2.1 Food adulteration - Types of food adulterants - intentional, incidental, common adulterants and their detection by simple analytical techniques in different food - milk and milk products, (butter, ghee), vegetable oils, wheat, rice, dhal, spices, pulses. Estimation of iodine value in oil, isolation of casein from milk and estimation of available carbondioxide in baking powder.

2.2 Food poison - food poison - Natural poisons (alkaloids - nurotoxing) -Chemical poisons - first aid for poison consumed victims.

UNIT III: Food Additives (15 Hours)

Food additives difference between additives and adulterants, artificial sweeteners - low calorie non nutritive sweeteners, saccharin - cyclomate and asparatate, food flavours, synthetic and natural, esters aldehydes and heterocyclic compound. Food colors - restricted use of spurious colors - emulsifying agents - leavening agents, baking powder, yeast - taste makers - MSG, vinegar, antioxidants

UNIT IV: Beverages (15 Hours)

Beverages - types fruit and vegetable juices, fermented and non-fermented, synthetic and non-synthetic - carbonated and non- carbonated beverages-non-distilled and distilled beverages Carbonating process and packaging of carbonating beverages - Additives for beverages-quality control and standards for beverages, chemical, microbial and sensory evaluation, product shelf life

UNIT V: Food Preservation and Quality Control (15 Hours)

5.1 Food preservation – Methods – preservation by low temperature, high temperature - preservatives.

5.2 Quality control: Pesticide residues, environmental contamination, FPO, FDA, Drug license, WHO standards, ISI specifications packing and label requirements, essential commodities Act, commune protection Act, AGMARK - FSSAI, basic concepts. Importance of food labels in processed foods and nutritional labelling.

Course Outcomes:

The student gained knowledge about Nutrition calorific value of food stuff, balanced diet food additives alcohol addiction social problem. Preservation techniques and quality control.

Text Books:

1. Thangamma Jacob, Text Books of Applied chemistry for home science and Allied Science, Macmillan, 1st Ed., **1990**.
2. M. Swaminathan, Text Book on Food chemistry, Printing and Publishing Co., Ltd., Bangalore, **1993**.
3. M. Swaminathan, Essentials of food and Nutrition, Ganesh and company, Volume I and II, 2nd Ed.,
4. An operational Text Book, Guide to Food Laws and Regulations, P. A. Curtis, Wiely Blackwell publishers, 2nd Ed., **2013**.
5. Jayashree Ghose, "Fundamental Concepts of Applied Chemistry", S. Chand and Company (P) Ltd, New Delhi, 1st Ed, **2006**
6. Food & Beverage Laws - Food Safety and Hygiene. J. Negi. ABD Publishers: Distribution, **2016**.
7. Toxicology, A. Sood, Sarup & Sons, New Delhi, **1999**.
8. Alex Ramani, V., Food Chemistry, MJP Publishers, Triplicane, Chennai, **2009**.
9. Sivasankar, B., Food Processing and Preservation, PHI Learning Private Limited, Delhi, **2013**.

Reference Books:

1. Aquatic pollution and toxicology, R.K. Trivedy, ABD Publishers & Distributions, Oxford Book Co. Jaipur 1st Ed., **2001**.
2. Toxicology and Environmental Health, S.B. Vohora, V.R. Agrawal, Asia tech Publishers Inc. India, **2000**.
3. The Food Safety and Standards Act, 2006 along with Rules & Regulations, Commercial Law Publishers (India) Pvt. Ltd. **2011**.
4. Introduction to food toxicology, T. Shibamoto, L. Bjeldanes, Elsevier, UK. 2nd Ed., **2009**.

SUBJECT CODE	TITLE OF THE PAPER		SKILLED BASED ELECTIVE
U22SBE1	OFFICE AUTOMATION		1
YEAR	SEMESTER	CREDITS	LECTURE HOURS
I	II	2	30

UNIT I: MS- Word

MS- Word- Introduction to Computers - Hardware - Software, Operating System: Windows XP -MS-Paint, Notepad, WordPad, Introduction to MS-Word, Creating, Editing and Formatting Document - Working with Drawing objects - Text Manipulation

UNIT II: MS- Word

Working with Tables – Columns – Labels - Plotting, editing and Filling drawing objects- Bookmark – Header & Footer - Checking and Correcting a document – Creating Labels – Envelops – Mail Merge – Formatted output and Report generation Printing Documents, Working with Internet.

UNIT III: MS – Excel

Ms – Excel - Ms – Excel: Introduction – Data Entry – Cell Formatting - Plotting Graphs – Workbook Features – Library Functions.

UNIT IV: MS – Excel

Conditional Functions and Data Sorting – Limit the data on a worksheet - Data Validation – Data consolidation - Chart creation - Checking and Correcting Data - Tracking and Managing Changes- Advanced Features

UNIT V: MS – PowerPoint

MS – PowerPoint- Introduction - Creating, Editing and Formatting Presentation – Applying Transition and Animation Effects - Applying Design Templates - Viewing and Setting up a Slide Show - Navigating among Different Views - Ms Outlook: Introduction to Folder List – Address Book.

TEXTBOOKS

1. Jill Murphy, Microsoft Office Word- Comprehensive Course, Labyrinth Publications, **2003**.
2. Deborah Hinkle, Microsoft Office 2003 PowerPoint: A Professional Approach, McGraw-Hill/Irwin, New Delhi. **2004** 1st Ed.
3. Nellai Kannan, C., MS-Office, Nels Publications, Tamil Nadu, **2002**. 67.
4. Sanjay Saxena "MS-Office 2000" S Chand 2000, 1st Ed.

SUBJECT CODE	TITLE OF THE PAPER		SKILLED BASED ELECTIVE
U22SBECH2	CHEMISTRY IN DAILY LIFE		2
YEAR	SEMESTER	CREDITS	LECTURE HOURS
II	III	2	30

Course Objectives:

At the end of the course, students will be able

1. To know about basic ingredients in essential oils and perfumes.
2. To know the importance and able to formulate the cosmetic products.
3. To understand the chemistry of water quality parameters and determination.
4. To know the importance of polymers.
5. To learn the properties of fuels and fire protectors.

UNIT-I Essential oils and Perfumes: (6 hours)

1.1. Essential oils: Definition, occurrences, isolation of essential oil - steam distillation and expression method.

1.2. Perfumes: Definition, Requirements of a good perfume, composition of perfumes - vehicle, fixative, odoriferous substance, classification of perfumery materials-animals-synthetic-formulations.

UNIT-II Cosmetics: **(6 hours)**

2.1. Creams and Powders: Face cream, vanishing cream, sun screen lotion, shaving cream, talcum powder – composition – formulation – preparation, uses and their hazards.

2.2. Cosmetics: Sprayer, hand lotion, nail lacquers, nail bleaches, bath oil, hair oil, hair dyes - composition- formulation – preparation, uses and their hazards.

UNIT-III Chemistry of water Quality parameters and determination: (6 hours)

3.1 Quality parameters: Physical, chemical and biological standards - significance of these contaminants over the quality and their determinations. Electrical conductivity - turbidity - pH, total solids, TDS - alkalinity - hardness - chlorides - DO – BOD - COD - TOC - nitrate – sulphate, fluoride.

UNIT-IV Polymers: **(6 hours)**

4.1 Introduction to Polymers: Definition - classification of polymers - addition and condensation - Preparation and uses of PVC, Orlon, PTFE, polystyrene, terylene and nylon 6, 6.

4.2 Plastics: Thermo and thermosetting plastics- examples – differences – properties - uses.

UNIT-V Fuels and Fire Protection: (6 hours)

5.1 Fuel: Definition, classification - solid, liquid and gaseous fuels, requirements of a good fuel-composition and uses of LPG, gobar gas, bio gas and water gas.

5.2 Fire Protection: Causes of fire accidents in homes, fire fighting in homes – methods of extinguishing fire, chemical fire extinguishers - merits and demerits. Importance of safety requirements Automatic fire detection cum control, causes and fire fighting.

Course Learning Outcomes:

At the end of the course, students will be able to

1. Understand the nature of essential oils and perfumes
2. Formulate the cosmetic products
3. Understand the quality parameters of water
4. Appreciate the importance of polymers
5. Compare the properties of fuels and fire protectors.

Text Books:

1. Thangamma Jacob, Text Books of Applied chemistry for home science and Allied Science, Macmillan, 1st Ed., **1990.**
2. *Industrial chemistry* by B. K. Sharma, Goel publishing house, **1995**.
3. Jayashree Ghose, —Fundamental Concepts of Applied Chemistry‖, S. Chand and Company (P) Ltd, New Delhi, 1st Ed, **2006**
4. *Hilda Butler, Pouchers- Perfumes, Cosmetics and Soaps*, 10th Edns., Springer, New Delhi, **2007**. (**Units I & II**)
5. Krishnamurthy N., Jayasubramanian K and Vallinayagam, —*Applied Chemistry"*, Prentice Hall of India, New Delhi, **1990**.

Reference:

1. Beginning Cosmetic Chemistry: Practical Knowledge for the Cosmetic Industry, P. Romanowski, R. Schueller, Allured books, 3rd Ed., **2009**

Web Reference:

1. https://www.cleariitmedical.com/2019/04/chemistry-notes-chemistry-in-everyday- life.html

SUBJECT CODE	TITLE OF THE PAPER		SKILLED BASED ELECTIVE
U22SBECH3	NANO AND CLINICAL CHEMISTRY		3
YEAR	SEMESTER	CREDITS	LECTURE HOURS
II	III	2	30

Course Objectives:

At the end of the course, students will be able to

1. To know the terminology used in nanoscience.
2. To know the characterization techniques and applications.
3. To learn about the drugs and to understand pharmacological action of the drugs.
4. To know the concepts related to blood.
5. To understand organic diagnostic agents and qualitative test of blood samples.

UNIT I Nanoscience: (6 hours)

1.1 Introduction to Nanoscience: Definition of a nano system - classification of nanocrystals - dimensionality and size dependent phenomena; Quantum dots, Nanowires and Nanotubes, 2D films; Nano and mesoporous.

1.2 Synthetic Approaches: Top down and bottom up synthetic approaches-synthesis of carbon nanotubes, gold and silver nanoparticles.

UNIT II Characterization Techniques and Applications: (6 hours)

2.1 Characterization Techniques Electron microscopy techniques-resolution Vs magnification-scanning electron microscopy, - electron gun – specimen interaction – transmission electron microscopy- Contrast transfer function.

2.2 Applications: Nanomaterials in Catalysis. Nanocomposites- Metal-Metal nanocomposites, Polymer-Metal nanocomposites, - solar cells-smart materials-molecular electronics. Medical diagnostics and treatments – biosensing - Therapeeutic applications and drug delivery.

UNIT III: Basics of Drugs and Antibiotics (6 hours)

3.1 Drugs: Definition - source of drugs - important terminologies – pharmacy - chemotherapy- Pharmacology – pharmacodynamics – pharmacophore – metabolites – antimetabolites. Causes, symptoms, prevention and treatment of common diseases-Tuberculosis-asthma, jaundice, leprosy and typhoid.

3.2 Antibiotics: Definition - structure and uses of penicillin, chloramphenicol, ampicillin, streptomycin, tetracycline and erythromycin.

UNIT IV Body Fluids: (6 hours)

4.1 Blood: Definition – composition - blood grouping - Rh factor - clotting of blood – mechanism – coagulants - vitamin K and protaminsulphate – anticoagulants - coumarine and heparin - Blood pressure – definition – hypertension - types and treatment.

4.2 Lymph: Definition – Functions – Clinical significance.

UNIT V Organic Diagnostic Agents: (6 hours)

5.1 Organic diagnostic agents: Definition - X-ray contrast media (radio opaque) - Iodipamide, Evan's blue, histamine and xylose - advantages.

5.2 Qualitative test of blood samples: Carbohydrates - Benedict's test- anthrone test and Fehling test. Proteins – ninhydrin and Biuret test. Fat - translucency – emulsification-iodine absorption and sudan III tests.

Course Learning Outcomes:

At the end of the course, students will be able to

1. Understand rudiments of nanoscience and synthetic techniques
2. Understand characterization techniques and applications
3. Understand the concepts of clinical chemistry
4. Interpret concepts related to blood and lymph.
5. Identify the diagnostic agents and qualitative test of blood samples.

TEXT BOOKS:

1. Sulbha K. Kulkarni, Nanotechnology: Principles & Practicals, springer, Nov 2014, 3rd Ed., Capital Publishing Co., New Delhi (**Units I & II**)
2. Guozhong Cao, Nanostructures & Nanomaterials Synthesis, Properties & Applications, world Scientific series in nano science and Nanotechnology, Nanotechnology, Vol 12, 2nd Ed. Jan 2011. Imperials College Press London (**Units I & II**)
3. Charles P. Poole, Frank J. Owens, "Introduction to Nanotechnology", Wiley Interscience, 2003, 1st Ed., May 20 (**Units I & II**)
2. Mathew George and Lincy joseph, Text book of pharmaceutical chemistry, **2009**. (**Unit III**)
3. Jayashree Ghose – Text book of Pharmaceutical chemistry, 2nd Edn., **2003**. (**Unit III**)
4. Lakshmi.S., Pharmaceutical Chemistry, III Edn., Sulthan Chand and Sons, New Delhi,2004. (**Unit III**)
5. R. S. Satoskar and S.R.Bandarkar – Pharmacolgy and Pharmacotherapeutics, Popular prakashan. (**Unit IV & Unit V**)

SUBJECT CODE	TITLE OF THE PAPER		NON MAJOR ELECTIVE
U22NMCH1	AGRICULTURAL CHEMISTRY		1
YEAR	SEMESTER	CREDITS	LECTURE HOURS
II	IV	2	30

Course Objectives:

1. To study macro and micro nutrients and their role.
2. To instruct the importance of plant nutrients and manure.
3. To learn about different kinds of fertilizers.
4. To understand the types and impacts of pesticides and insecticides.
5. To impart the knowledge about fungicides and herbicides.

UNIT I: Plant Nutrients-I (6 Hours)

1.1 Major Plant nutrients: Macro nutrients- N,P,K, Ca, Mg, S – Sources and their role in plant growth - forms of nutrients absorbed by plants.

1.2 Minor Plant Nutrients: Minor Nutrients – Fe, Mn, Cu, Zn, Mo – Sources and their role in plant growth.

UNIT II: Plant Nutrients-II (6 Hours)

2.1 Plant Nutrients-II: Factors affecting nutrients absorption – requirement of crops – availability, fixation and release of nutrients- deficiency symptoms in plants.

2.2 Manures: Cow dung, Blood meal, Fish manures.

UNIT III: Fertilizers and their environmental effects: (6 Hours)

3.1 Fertilizers: Classification of NPK fertilizers - sources – natural and synthetic – complex – liquid fertilizers, their properties – use and relative efficiency. Secondary and micro nutrients fertilizers - mixed fertilizers - Vermi composting – handling and storage.

3.2 Environmental effects: Effects in soil, surface water and ground water.

UNIT IV: Pesticides and Insectides (6 Hours)

4.1 Pesticides: Definition - classification - organic and Inorganic pesticides – Mechanism of action – characteristics safe handling of pesticides - impact of pesticides on soil, plants and environment.

4.2 Insectides: Definition- plant products- nicotine, pyrethrin.

UNIT V: Fungicides and Herbicides (6 Hours)

5.1 Fungicides: Definition - classification - mechanism of action – sulphur, copper, mercury compounds, dithanes, dithiocarbamate.

5.2 Herbicides: Acaricides - rodenticides - attractants- repellants.

Course Learning Outcomes:

1. Knowledge about the need of macro and micro nutrients for plants.
2. Insight into the influence of fertilizers and manures and their types.

3. Characteristics of pecticides, insecticides, fungicides and herbicides and their impact.

Text Book:

1. Biswas, T.D and Mukherjee, S.K Text book of Soil Science **1987**
2. Daji A. J. A text book of Soil Science, Asia publishing house, Madras **1970**
3. Tisdale S.L. Nelson W.L and Beaton J. D. Soil fertility and fertilizers, Macmillan Pub Co. New York **1990**.
4. Hesse P.R., A Text book of Soil chemical analysis John Murray New York **1971**.
5. Buchel K.H, Chemistry of pesticides, John Willey and Sons New York **1983**
6. Sree Ramulu V.S Chemistry of Insecticides and Fungicides, Oxford and IBH publishing Company., New Delhi **1979**
7. Hesse P.R., John Murray, "*A Textbook of Soil Chemical Analysis*", New York, **1971**.
8. Sree Ramulu U. S., "*Chemistry of Insecticides and Fungicides*", Oxford and IBH Publishing Co., New Delhi, **1979**. (Unit V)

Reference Books:

1. Tisdale, S.L., Nelson, W.L. and Beaton, J. D., "*Soil Fertility and Fertilizers*", Macmillian Publishing Company, New York, 1990.
2. Buchel, K.H., "*Chemistry of Pesticides*", John Wiley & Sons, New York, **1983**.

SUBJECT CODE	TITLE OF THE PAPER		NON MAJOR ELECTIVE
U22NMCH2	COSMETICS CHEMISTRY		2
YEAR	SEMESTER	CREDITS	LECTURE HOURS
III	V	2	30

Course Objectives:

1. To know about the different types of chemicals used in soaps and detergents.
2. To know about basic ingredients in cosmetics.
3. To learn about basic knowledge in chemical consumer Products.

UNIT I: Soaps (6 Hours)

1.1 Making of Soaps: Manufacture of Hard and Soft Soaps, formulation of toilet soaps. Different ingredients used in soft soaps and shaving soaps.

1.2 Types of Soaps: Kitchen soaps – Laudry soaps – Cleaning soaps – Personal soaps – Novelty soaps – Perfumed soaps – Medicated soaps – glycerin Soaps – transparent soaps – liquid soaps.

UNIT II: Detergents (6 Hours)

2.1 Anionic detergents: Manufacture and applications.

2.2 Cationic detergents: Manufactures and applications

UNIT III: Cosmetics (6 Hours)

3.1 Ingredients: Introduction about raw materials in cosmetics - (oil, waxes, color, preservative and fragrance).

3.2 Shampoo: Different kinds shampoo –anti-dandruff, anti-lice, herbal and baby shampoo hair dye – manufacture of conditioners (raw materials and uses only)

UNIT IV: Skin Products (6 Hours)

4.1 Preparation of cosmetics: Skin and hair - skin lighteners, sun screen lotions - skin toners anti wrinkling creams.

4.2 Lip care: Lip gloss – lipsticks - lip liners, moisturizers - crack creams, Sun cream and UV rays protecting cream.

UNIT V: Toxicity (6 Hours)

Toxic chemical ingredients – skincare product – toiletries product – carcinogens – other chemical.

Course Learning Outcomes:

1. Students learn about the useful chemicals used in soap and detergents.
2. Students learn about the cosmetics and skin products.

Text Books:

1. *Industrial chemistry* by B. K. Sharma, Goel publishing house, **1995**.
2. Thangamma Jacob, Text Books of Applied chemistry for home science and Allied Science, Macmillan, 1st Ed., **1990**.

3. Modern Technology of Cosmetics, NIIR Board, Asia Pacific Business Press Inc., New Delhi, **2004**.
4. Jayashree Ghose, "Fundamental Concepts of Applied Chemistry", S. Chand and Company (P) Ltd, New Delhi, 1st Ed, **2006**
5. *Hilda Butler, Pouchers- Perfumes, Cosmetics and Soaps*, 10th Edns., Springer, New Delhi, **2007**.
6. Krishnamurthy N., Jayasubramanian K and Vallinayagam, "*Applied Chemistry"*, Prentice Hall of India, New Delhi, **1990**.

Reference:

1. Beginning Cosmetic Chemistry: Practical Knowledge for the Cosmetic Industry, P. Romanowski, R. Schueller, Allured books, 3rd Ed., **2009**.

SUBJECT CODE	TITLE OF THE PAPER		COMMON PAPER
U22ES	PART – IV: ENVIRONMENTAL STUDIES		1
YEAR	SEMESTER	CREDITS	LECTURE HOURS
I	I	2	30

Unit: 1 **THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES.**
Definition, scope and importance.
Need for public awareness.

Unit: 2 **NATURAL RESOURCES:**
Renewable and non-renewable rescurces:
Natural resources and associated problems.

a) Forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources - Case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity - Case studies.

e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources - Case studies.

f) Land resources: Land as resources, land degradation, man induced Landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

P.T.O

Unit: 3 ECOSYSTEMS

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystems:-
  a. Forest ecosystem
  b. Grassland ecosystem
  c. Desert ecosystem
  d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit: 4 BIODIVERSITY AND ITS CONSERVATION

- Introduction – Definition: Genetic, species and ecosystem diversity.
- Biogeographical classification of India.
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation.
- Hot-spots of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India.
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
- Biological Diversity Act 2002/ BD Rules, 2004.

Unit: 5 ENVIRONMENTAL POLLUTION

Definition,
Causes, effects and control measures of:
a. Air Pollution
b. Water Pollution
c. Soil Pollution
d. Marine Pollution
e. Noise pollution
f. Thermal Pollution
g. Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.
- Pollution case studies.

P.T.O

- Disaster management: floods, earthquake, cyclone and landslides.
- Ill-Effects of Fireworks: Firework and Celebrations, Health Hazards, Types of Fire, Firework and Safety.

Unit: 6 SOCIAL ISSUES AND THE ENVIRONMENT

- From Unsustainable to Sustainable development.
- Urban problems related to energy.
- Water conservation, rain water harvesting, watershed management.
- Resettlement and rehabilitation of people; its problems and concerns - Case studies.
- Environmental ethics: Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion,
- Nuclear accidents and holocaust - Case studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and Control of Pollution) Act.
- Wildlife Protection Act.
- Forest Conservation Act.
- Issues involved in enforcement of environmental legislation.
- Public awareness.

Unit: 7 HUMAN POPULATIONS AND THE ENVIRONMENT

- Population growth, variation among nations.
- Population explosion – Family Welfare Programmes.
- Environment and human health.
- Human Rights - Value Education.
- HIV/ AIDS - Women and Child Welfare.
- Role of Information Technology in Environment and human health.
- Case studies.

Unit: 8 FIELD WORK

- Visit to a local area to document environmental assets-river / forest/ grassland/ hill / mountain.

P.T.O

References:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Public Ltd Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt ltd, Ahamedabad – 380013, India, E-mail: mapin@icenet.net (R).
3. Brunner R.C. 1989, Hazardous Waste Incineration, McGraw Hill Inc 480 p.
4. Clark R.S. Marine Pollution, Clanderson Press Oxford (TB).
5. Cunningham, W.P.Cooper, T.H.Gorhani E & Hepworth, M.T. 2001.
6. De A.K. Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford University, Press 473p.
9. Hawkins, R.E. Encyclopedia of India Natural History, Bombay Natural History Society, Bombay (R)
10. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge University Press 1140 p.
11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws Himalaya Pub. House, Delhi 284 p.
12. Mckinney, M.L. & Schoch R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition 639 p.
13. Mhaskar A.K. Matter Hazardous, Techno-Science Publications (TB)
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E.P. 1971 Fundamentals of Ecology. W.B. Saunders Co. USA. 574 p
16. Rao MN & Datta, A.K. 1987 Waste Water treatment, Oxford & IBH Publication Co. Pvt Ltd 345 p.
17. Sharma B.K. 2001 Environmental chemistry Goel Publ House, Meerut.
18. Survey of the Environment, The Hindu (M).
19. Townsend C. Harper, J and Michael Begon, Essentials of Ecology, Blackwell science (TB)
20. Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media (R).
21. Trivedi R.K. and P.K. Goel, Introduction to air pollution, Techno-Science Publications (TB).
22. Wagner K.D. 1998 Environmental Management. W.B. Saunders Co. Philadelphia USA 499 p
23. http://nbaindia.org/uploaded/Biodiversityindia/Legal/33%20Biological%20Diversity%20Rules,%202004.pdf.

(M) Magazine (R) Reference (TB) Textbook

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CODE: U22ES

SEMESTER – I
QUESTION PAPER PATTERN

MAX MARKS: 75 **DURATION: 3 HOURS**

SECTION A (20 x1 = 20 Marks)

- Twenty (20) Multiple Choice Questions (MCQ).
- Unit 1 will carry 2 MCQs (Question Nos 1 and 2)
- Unit 2 will carry 3 MCQs (Question Nos 3 to 5)
- Unit 3 will carry 3 MCQs (Question Nos 6 to 8)
- Unit 4 will carry 3 MCQs (Question Nos 9 to 11)
- Unit 5 will carry 3 MCQs (Question Nos 12 to 14)
- Unit 6 will carry 3 MCQs (Question Nos 15 to 17)
- Unit 7 will carry 3 MCQs (Question Nos 18 to 20)

SECTION B (5 x 5 = 25 Marks)

- Five questions with either or pattern.
- For each question answer should not exceed 300 words.
- Question No 21a and 21b will be from Unit 2
- Question No 22a and 22b will be from Unit 3
- Question No 23a will be from Unit 4
- Question No 23b will be from Unit 5
- Question No 24a and 24b will be from Unit 6
- Question No 25a and 25b will be from Unit 7

SECTION C (3 X 10 = 30 Marks)

- 3 questions need to be answered out of 5 (Open choice).
- For each question answer should not exceed 1200 words.
- Question No 26 will be from Unit 1
- Question No 27 will be from Unit 4
- Question No 28 will be from Unit 5
- Question No 29 will be from Unit 6
- Question No 30 will be from Unit 8

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SUBJECT CODE	TITLE OF THE PAPER		COMMON PAPER
U22VE	PART – IV: VALUE EDUCATION		2
YEAR	SEMESTER	CREDITS	LECTURE HOURS
II	IV	2	30

UNIT I:

PHILOSOPHY OF LIFE Human Life on Earth (Kural 629), Purpose of Life (Kural 46) Meaning and Philosophy of Life(Kural 131, 226) The Law of Nature (Kural 374) Glorifying All form of Life in this Universe (Kural 322, 327) – Protecting Nature /Universe (Kural 16, 20, 1038)

UNIT II:

INDIVIDUAL QUALITIES Basic Culture (Kural 72, 431) Thought Analysis (Kural 282, 467, 666) Regulating desire (Kural 367), Guarding against anger (Kural 158, 305, 306, 314), To get rid of Anxiety (Kural 629), The Rewards of Blessing (Kural 3), Benevolence of Friendship (Kural 786), Love and Charity (Kural 76), Self – tranquility/Peace (Kural 318)

UNIT III:

SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE) Family (Kural 45), Peace in Family (Kural 1025), Society (Kural 446), The Law of Life (Kural 952), Brotherhood (Kural 807) , The Pride of Womanhood (Kural 56) Five responsibilities/duties of Man : a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives (Kural 43, 981), Thriftness (Thrift)/Economics (Kural 754), Health (Kural 298), Education (Kural 400), Governance (Kural 691), People's responsibility/ duties of the community (Kural 37), World peace (Kural 572)

UNIT IV:

MIND CULTURE Mind Culture (Kural 457) Life and Mind - Bio - magnetism, Universal Magnetism (God – Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelising the Mind, Stages - Meditation (Kural 261, 266, 270), Spiritual Value (Kural 423)

UNIT V:

TENDING PERSONAL HEALTH Structure of the body, the three forces of the body, life body relation, natural causes and unnatural causes for diseases (Kural 941), Methods in Curing diseases (Kural 948, 949) The Five units, simple physical exercises.

TEXTBOOKS

1. Philosophy of Universal Magnetism (Bio-magnetism, Universal Magnetism) The World Community Service Centre Vethatri Publications (for Unit IV)
2. Pope, G.U., Dr. Rev., Thirukkural with English Translation, Uma Publication, 156, Serfoji Nagar, Medical College Road, Thanjavur 613004 (for All Units)
3. Value Education for Health, Happiness and Harmony, The World Community Service Centre Vethatri Publications (for All Units).

SUBJECT CODE	TITLE OF THE PAPER		COMMON PAPER
U22SS	PART – IV: SOFT SKILLS		3
YEAR	SEMESTER	CREDITS	LECTURE HOURS
III	V	2	30

UNIT I:

Know Thyself / Understanding Self Introduction to soft skills self discovery – Developing positive attitude – Improving perceptions – Forming values.

UNIT II:

Interpersonal Skills/ Understanding Others Developing interpersonal relationship – Team building –group dynamics –Net working- Improved work relationship

UNIT III:

Communication Skills/ Communication with others Art of Listening –Art of reading – Art of speaking –Art of writing –Art of writing emails-e mail etiquette

UNIT IV:

Corporate Skills/ Working with Others Developing body language –Practising etiquette and mannerism – Time management – Stress management.

UNIT V:

Selling Self/ Job Hunting Writing resume /cv-interview skills – Group discussion – Mock interview Mock GD –Goal setting –Career planning

TEXT BOOKS

1. Meena. K and V.Ayothi (2013) A Book on Development of Soft Skills (Soft Skills: A Road Map to Success) P.R. Publishers & Distributors, No, B-20 &21, V.M.M Complex, Chatiram Bus Stand, Tiruchirapalli -620 002. (Phone No: 0431-2702824: Mobile No: 94433 70597, 98430 7442) Alex K. (2012)
2. Soft Skills – Know Yourself & Know the World, S.Chand & Company LTD, Ram Nagar, New Delhi -110 055. Mobile No: 94425 14814 (Dr.K.Alex)

REFERENCE BOOKS

1. Developing the leader within you John C Maxwell
2. Good to Great by Jim Collins
3. The Seven habits of highly effective people Stephen Covey
4. Emotional Intelligence Daniel Goleman
5. You can Win Shive Khera Principle centred leadership Stephen Covey

SUBJECT CODE	TITLE OF THE PAPER		COMMON PAPER
U22GS	PART – IV: GENDER STUDIES		4
YEAR	SEMESTER	CREDITS	LECTURE HOURS
III	VI	1	15

UNIT I:

Concepts of Gender: Sex-Gender-Biological Detertninism- Patriarchy- Feminism – Gender Discrimination -Gender Division of Labour -Gender Stereotyping-Gender Sensitivity - Gender Equity - Equality-Gender Mainstreaming Empowerment

UNIT II:

Women‘s Studies Vs Gender Studies: UGC‘s Guidelines - VII to Xl Plans- Gender Studies: Beijing Conference and CEDAW-Exclusiveness and Inclusiveness.

UNIT III:

Areas of Gender Discrimination: Family Sex Ratio-Literacy -Health -Governance Religion Work Vs Employment- Market - Media - Polities Law Domestic Violence — Sexual Harassment — State Policies and Planning

UNIT IV:

Women Development and Gender Empowerment: Initiatives International Women‘s - International Women‘s Year - National Policy for Empowerment of Women – Women Empowerment Year 2001- Mainstreaming Global Policies.

UNIT V:

Women‘s Movements and Safeguarding Mechanism: In India National / State Commission for Women (NCW) - All Women Police Station Family Court- Domestic Violence Act - Prevention of Sexual Harassment at Work Place Supreme Court Guidelines – Maternity Benefit Act - PNDT Act - Hindu Succession Act 2003 Eve Teasing Prevention Act – Self Help Groups 73 and 74 Amendment for PRIS.

TEXTBOOKS

1. Bhasin Kamala, Understanding Gender: Gender Basics, New Delhi: Women Unlimited 2004
2. Bhasin Kamala, Exploring Masculinity: Gender Basics, New Delhi: Women Unlimited, 2004
3. Bhasin Kamala, What is Patriarchy? : Gender Basics, New Delhi: Women Unlimited, 1993
4. Pernau Margrit Ahmad Imtiaz, Reifeld Hermut (ed.,) Family and Gender: Changing Values in Germany and India, New Delhi: Sage Publications, 2003
5. Agarwal Bina, Humphries Jane and Robeyns Ingrid (ed.,)
6. Capabilities, Freedom, and Equality: Amartya Sen‘s Work from a Gender Perspective, New Delhi: Oxford University Press, 2006

7. Rajadurai.S.V, Geetha.V, Themes in Caste Gender and Religion, Tiruchirappalli: Bharathidasan University, 2007 Misra Geetanjali, Chandiramani Radhika (ed.,)
8. Sexuality, Gender and Rights: Exploring Theory and Practice in South and Southeast Asia, New Delhi: Sage Publication, 2005 Rao Anupama (ed.,)
9. Gender &Caste: Issues in Contemporary Indian Feminism, New Delhi: Kali for Women, 2003
10. Saha Chandana, Gender Equity and Gender Equality: Study of Girl Child in Rajasthan, Jaipur: Rawat Publications, 2003
11. Krishna Sumi,(ed.,) Livelihood and Gender Equity in Community Resource Management New Delhi: Sage Publication, 2004
12. Wharton .S Amy, The Sociology of Gender: An Introduction to Theory and Research, USA: Blackwell Publishing, 2005.
13. Mohanty Manoranjan (ed.,) Class, Caste, Gender: Readings in Indian Government and Politics- 5, New Delhi: Sage Publications, 2004.
14. Arya Sadhna, Women, Gender Equality and the State, New Delhi: Deep & Deep Publications, 2000.

ALLIED CHEMISTRY SYLLABUS

For

B.Sc., BOTANY
B.Sc., GEOLOGY
B.Sc., ZOOLOGY
B.Sc., PHYSICS MAJOR STUDENTS

SEMESTER I & II/III & IV

(Students admitted during the academic year **2022-2023 batch onwards**)

CHOICE BASED CREDIT SYSTEM (CBCS)

POST GRADUATE AND RESEARCH DEPARTMENT OF CHEMISTRY

(DST-FIST Sponsored Department)

NATIONAL COLLEGE (Autonomous)

(Nationally re-accredited at 'A^{+}' Level by NAAC with CGPA of 3.61 on 4.00 Scale)

College with Potential for Excellence by UGC,

DBT-STAR & DST-FIST Sponsored College

Tiruchirappalli-620 001

SUBJECT CODE	TITLE OF THE PAPER		ALLIED CORE
U22ACH1	ALLIED CHEMISTRY-I (FOR BOTANY, GEOLOGY & ZOOLOGY STUDENTS)		1
YEAR	SEMESTER	CREDITS	LECTURE HOURS
I	I	3	75

Course Objectives:

The students will be able:

1. To learn about standard solutions and types of titrimetric reactions.
2. To know various types of bonds and their properties.
3. To explore the compositions of food additives and various methods for the detection and preventions of food adulterants.
4. To impart the knowledge and classifications of dyes and its industrial importance.
5. To explore the various types of carbohydrates and amino acids.

UNIT I Basics of Quantitative Analysis (15 hours)

1.1. Error analysis: accuracy, precision, determinate, indeterminate errors, relative error and absolute error. **1.2. Quantitative analysis:** Titrimetry- principle - standard solutions, equivalence point, end point, equivalent weights of oxidizing and reducing agents, molarity, molality, normality, mole fraction, primary and secondary standards - types of titrimetric reactions - acid-base titrations and redox titrations with examples.

UNIT II Chemical Bonding (15 hours)

2.1 Ionic bond: Nature of Ionic bond – structures of NaCl, KCl & CsCl- Factors influencing the formation of ionic bond. **2.2. Covalent bond:** nature of covalent bond– VSEPR theory - shapes of $BeCl_2$, BF_3, CH_4, PCl_5, IF_7, NH_3 & H_2O.

2.3. Hydrogen bonding: Theory of Hydrogen bonding - Inter and Intra molecular hydrogen bonding consequences of hydrogen bonding, van der Waals and London Dispersive forces in simple molecules.

UNIT III Food Chemistry (15 hours)

3.1 Food additives: Artificial sweeteners -saccharin cyclamate and aspartame- food flavors Esters and aldehydes (any two) antioxidants- emulsifying agents (any two), food preservatives - vinegar and citric acid- leavening agents- baking powder- yeast. Taste enhancers- Monosodium glutamate (MSG) and Ajinomoto.

3.2 Adulterants in food: Definition, classification, injurious adulterants/contaminants in foods and their health effects, simple method of detection and prevention of food adulterants.

UNIT – IV Dyes (15 Hours)

4.1 Color and constitution: Theory of color and constitution. Classification according to structure and application.

4.2 Dyes: Preparation and uses of the following dyes. (i) Azodyes - methyl orange. (ii) Triphenyl methane dyes - Malachite green. (iii) Phthalein dyes - Phenolphthalein and fluorescein. (iv) Vat dye – Indigo. (v) Anthraquinone dye – Alizarin.

UNIT V Chemistry of Biomolecules (15 hours)

5.1 Carbohydrates: Classification of carbohydrates, glucose & fructose – preparation, properties – mutarotation - manufacture of sucrose, test for sugars.

5.2 Amino acids: Preparation and properties of glycine and alanine - peptides - definition – proteins - classification based on physical properties and biological functions - structure of proteins – primary and secondary – Test for proteins: Biuret and Ninhydrin tests.

Course Learning Outcome:

Students are able to

1. Understand volumetric principle and to prepare standard solutions.
2. Recognize various types of bond.
3. Understand the compositions of food additives and various methods for the detection and preventions of food adulterants.
4. Gain knowledge and classifications of dyes and its industrial importance.
5. Explore the various types of carbohydrates and amino acids.

Text books:

1. P. L. Soni, Mohan Katyal, "*Text book of Inorganic Chemistry*", 20th Revised Edition (**2007**), Sultan Chand & Sons, New Delhi. (Unit I & II)
2. P. L. Soni and H. M. Chawla, "*Text book of Organic Chemistry*", (**1994**), Sultan Chand & Sons, New Delhi (Unit III)
3. P.L. Soni and O.P. Dharmaha, "*Text book of Physical chemistry*", S. Chand and Sons. (Unit IV & V)

Reference Books:

1. Inorganic Chemistry – Puri and Sharma
2. Inorganic Chemistry – R. D. Madan – Sultan Chand
3. Principles of Organic Chemistry – R. K. Bansal - New Age International
4. Applied Chemistry by K.Bagavathi - Sundari, MJP Publishers.

Web Resources

1. https://en.wikibooks.org/wiki/Introduction_to_Inorganic_Chemistry
2. https://ocw.mit.edu/courses/5-04-principles-of-inorganic-chemistry-ii-fall-2008/
3. https://chem.libretexts.org/Courses/Athabasca_University/Chemistry_350:_Organic_Chemistry_I
4. https://www.coursera.org/learn/physical-chemistry
5. https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps
6. https://ps.uci.edu/stuaff/content/uci-openchemistry-lectures

SUBJECT CODE	TITLE OF THE PAPER		ALLIED CORE
U22ACH2	ALLIED CHEMISTRY PRACTICAL (FOR BOTANY & ZOOLOGY, PHYSICS AND GEOLOGY STUDENTS)		2
YEAR	SEMESTER	CREDITS	LECTURE HOURS
I & II	I & II/III & IV	3	75

Course Objectives:

1. To know the principles of the volumetry.
2. To have a knowledge on various types of titrations.
3. To know the preparation of standard solutions.
4. To have Knowledge about normality, equivalent weight of compounds.
5. To have a knowledge about analyzing organic compounds

I VOLUMETRIC ANALYSIS

1. Estimation of HCl using NaOH (Standard Sulphuric acid)
2. Estimation of oxalic acid using NaOH (Std. oxalic acid)
3. Estimation of sodium carbonate using HCl (standard sodium carbonate)
4. Estimation of ferrous sulphate using potassium permanganate (Std. Mohr's salt)
5. Estimation of oxalic acid using potassium permanganate (Std. oxalic acid)
6. Estimation of $KMnO_4$ by thio using standard $K_2Cr_2O_7$ solution.

II ORGANIC ANALYSIS

Qualitative analysis of the following organic compounds

1. Carboxylic acid
2. Amide/Diamide (Aromatic/Aliphatic)
3. Primary aromatic amine
4. Aromatic aldehyde
5. Aromatic ketone
6. Carbohydrate

Course Outcomes:

After successful completion of the course, students will be able to

1. Prepare standard solutions.
2. Know knowledge about normality, equivalent weight of compounds.
3. Analyze organic compounds.

Text Books:

1. Practical Chemistry by A.O. Thomas, Scientific Book Centre, Cannanore, **2003**.
2. Basic Principles of Practical Chemistry, V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Sultan Chand & Sons, New Delhi, 2nd Ed., **2004**.

Reference Book:

1. Vogel's textbook of quantitative chemical analysis Mendham, John. Denney, Ronald C. Barnes, John D. Thomas, M., 7th Ed., Prentice Hall, New York, 6th Ed., **2000**.

Scheme of Valuation

Maximum Marks: 75 Marks

Procedure writing: 10 Marks

Viva-voce: 05 Marks

Volumetric Practical: 30 Marks

< 2% error: 30 Marks

2-3% error: 25 Marks

3-4% error: 20 Marks

> 4% error: 10 Marks

Organic Analysis: 30 Marks

Split up mark for Organic Analysis as follows:

Nitrogen Present/absent	: 06 Marks
Aromatic/Aliphatic	: 06 Marks
Saturated/Unsaturated	: 06 Marks
Functional Group	: 12 Marks

SUBJECT CODE	TITLE OF THE PAPER		ALLIED CORE
U22ACH3	ALLIED CHEMISTRY-II (FOR BOTANY, GEOLOGY & ZOOLOGY STUDENTS)		3
YEAR	SEMESTER	CREDITS	LECTURE HOURS
I	II	3	75

Course Objective:

1. To learn about coordination complexes and its importance.
2. To instruct the different types of catalysis and industrial applications of fuel gases.
3. To understand the basis of organic reactions and their mechanisms and to study about the various types of synthetic polymers.
4. To classify the drugs based on the structural moiety and its physiological effect. To identify chemical based drugs to treat and prevent different types of diseases.
5. To identify the properties and uses of insecticides, pesticides and fertilizer.

UNIT - I Coordination Chemistry (15 hours)

1.1 Coordination Chemistry: Coordinate Bond – Nature of coordinate bond, Werner's theory and structure of some complexes - $Ni(CO)_4$, $[Co(NH_3)_6]Cl_3$, $K_4[Fe(CN)_6]$ - Classification of complexes, IUPAC Nomenclature of mononuclear complexes.

1.2 chelation and its industrial importance with particular reference to EDTA - biological role of haemoglobin and chlorophyll - applications of complexes in qualitative and quantitative analysis.

UNIT - II Industrial Chemistry and Catalysis: (15 hours)

2.1 Industrial Chemistry: Fuel gases - Water gas, producer gas, L.P.G. gas, gobar gas and natural gas - Fertilizers - NPK and mixed fertilizers - micronutrients and their role in plant life - biofertilizers..

2.2 Catalysis: Homogeneous and heterogeneous catalysis – Theories of homogeneous and heterogeneous catalysis – catalytic promoters – catalytic poisons – Enzyme catalysis – Factors affecting enzyme catalysis.

UNIT - III Organic Reaction and Synthetic polymers: (15 hours)

3.1 Organic reactions: Osazone test, biuret test, condensation reactions for aldehydes and ketones, Esterification reaction, Diazotization followed by coupling and phthalein fusion test. **3.2 Synthetic Polymers:** Polymers - Definition, types of polymers, difference between thermosetting and thermoplastic polymers. Preparation of caprolactam, Teflon, nylon 66, polyester, PVC, Polyethylene and epoxy resins.

Unit-IV Medicinal Chemistry: **(15 hours)**

4.1 Medicinal Chemistry: Classification of drugs - Sulpha drugs: synthesis of sulphanilimide, structure and uses of sulphadiazine- PABA Mechanism of drug action.

4.2 Antibiotics: Broad spectrum antibiotics and their uses. Structure and uses of Penicillin, Chloramphenicol and streptomycin.

UNIT V Insecticides, Pesticides and Fertilizers (15 hours)

5.1 Insecticides and Pesticides: Definition - classification Inorganic pesticides; lead arsenate, Paris green, lime, sulphur, hydrocyanic acid- organic pesticides, (DDT and Gammexane) Fungicides - repellants.

5.2 Fertilizers - Definition - nutrients for plant - role of various elements in plants growth natural and chemical fertilizers - classification of chemical fertilizers –NPK fertilizer, urea, super phosphate and potassium nitrate – mixed fertilizer.

Course Learning Outcome:

Students are able to

1. Understand complexes and their industrial importance.
2. Different types of catalysis and industrial applications of fuel gases.
3. Identify different types of organic reactions and polymers.
4. Classify the drug and to identify chemical based drugs to treat and prevent different types of diseases.
5. Learns about properties and uses of insecticides, pesticides and fertilizer.

Text books:

1. P. L. Soni, Mohan Katyal, "*Text book of Inorganic Chemistry*", 20th Revised Edition (**2007**), Sultan Chand & Sons, New Delhi. (Unit I & II)
2. P. L. Soni and H. M. Chawla, "*Text book of Organic Chemistry*", (**1994**), Sultan Chand & Sons, New Delhi (Unit III)
3. P.L. Soni and O.P. Dharmaha, "*Text book of Physical chemistry*", S. Chand and Sons. (Unit IV & V)

Reference Books:

1. Inorganic Chemistry – Puri and Sharma
2. Inorganic Chemistry – R. D. Madan – Sultan Chand
3. Principles of Organic Chemistry – R. K. Bansal - New Age International
4. Applied Chemistry by K.Bagavathi - Sundari, MJP Publishers.
5. Polymer Science ,Gowarikar. V.R. Viswanathan, N.V. Jayader Sreedhar. Wiley Eastern Ltd., New Delhi, 2005.

Web Resources

1. https://en.wikibooks.org/wiki/Introduction_to_Inorganic_Chemistry
2. https://ocw.mit.edu/courses/5-04-principles-of-inorganic-chemistry-ii-fall-2008/
3. https://chem.libretexts.org/Courses/Athabasca_University/Chemistry_350:_Organic_Chemistry_I
4. https://www.coursera.org/learn/physical-chemistry
5. https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps
6. https://ps.uci.edu/stuaff/content/uci-openchemistry-lectures

SUBJECT CODE	TITLE OF THE PAPER		ALLIED CORE
U22ACH4	ALLIED CHEMISTRY-I (FOR PHYSICS STUDENTS)		1
YEAR	SEMESTER	CREDITS	LECTURE HOURS
II	III	3	60

Course Objectives:

The students will be able:

1. To learn about standard solutions and types of titrimetric reactions.
2. To know various types of bonds and their properties.
3. To explore the compositions of food additives and various methods for the detection and preventions of food adulterants.
4. To impart the knowledge and classifications of dyes and its industrial importance.
5. To know the laws and concepts of thermodynamics.

UNIT I Basics of Quantitative Analysis (12 hours)

1.1. Error analysis: accuracy, precision, determinate, indeterminate errors, relative error, absolute error.

1.2. Quantitative analysis: Titrimetry - principle - standard solutions, equivalence point, end point, equivalent weights of oxidizing and reducing agents, molarity, molality, normality, mole fraction, primary and secondary standards - types of titrimetric reactions - acid-base titrations and redox titrations with examples.

UNIT II Chemical Bonding (12 hours)

2.1 Ionic bond: Nature of Ionic bond – structures of NaCl, KCl & CsCl- Factors influencing the formation of ionic bond.

2.2. Covalent bond: nature of covalent bond – VSEPR theory - shapes of $BeCl_2$, BF_3, CH_4, PCl_5, IF_7, NH_3 & H_2O.

2.3. Hydrogen bonding: Theory of Hydrogen bonding - Inter and Intra molecular hydrogen bonding consequences of hydrogen bonding, van der Waals and London Dispersive forces in simple molecules.

UNIT III Food Chemistry (12 hours)

3.1 Food additives: Artificial sweeteners – saccharin, cyclamate and aspartame - food flavors - Esters and aldehydes (any two) antioxidants- emulsifying agents (any two), food preservatives - vinegar and citric acid - leavening agents - baking powder- yeast. Taste enhancers- Monosodium glutamate (MSG) and Ajinomoto.

3.2 Adulterants in food: Definition, classification, injurious adulterants/ contaminants in foods and their health effects, simple method of detection and prevention of food adulterants.

UNIT – IV Dyes (12 hours)

4.1 Color and constitution: Theory of color and constitution. Classification of dye according to structure and method of application.

4.2 Dyes: Preparation and uses of the following dyes: (i) Azodyes - methyl orange (ii) Triphenyl methane dyes - Malachite green. (iii) Phthalein dyes - Phenolphthalein and fluorescein. (iv) Vat dye – Indigo. (v) Anthraquinone dye – Alizarin.

UNIT – V Thermodynamics: (12 hours)

5.1 Basics of laws of Thermodynamics: First law of thermodynamics - second law of thermodynamics - need for the law - different statements of the law.

5.2 Carnot's cycle: Carnot's cycle and efficiency of heat engine - Carnot's theorem - entropy - definition - physical significance of entropy – Nernst heat theorem - third law of thermodynamics.

Course Learning Outcomes:

Students are able to

1. Understand volumetric principle and to prepare standard solutions.
2. Recognize various types of bond.
3. Understand the compositions of food additives and various methods for the detection and preventions of food adulterants.
4. Gain knowledge and classifications of dyes and its industrial importance.
5. Students are able to understand the laws and concepts of thermodynamics, which is useful to Physics major students.

Text books:

1. P. L. Soni, Mohan Katyal, "*Text book of Inorganic Chemistry*", 20th Revised Edition (**2007**), Sultan Chand & Sons, New Delhi. (Unit I & II)
2. P. L. Soni and H. M. Chawla, "*Text book of Organic Chemistry*", (**1994**), Sultan Chand & Sons, New Delhi (Unit III)
3. P.L. Soni and O.P. Dharmaha, "*Text book of Physical chemistry*", S. Chand and Sons. (Unit IV & V)

Reference Books:

1. Inorganic Chemistry – Puri and Sharma
2. Inorganic Chemistry – R. D. Madan – Sultan Chand
3. Principles of Organic Chemistry – R. K. Bansal - New Age International
4. Applied Chemistry by K.Bagavathi - Sundari, MJP Publishers.

Web Resources

1. https://en.wikibooks.org/wiki/Introduction_to_Inorganic_Chemistry
2. https://ocw.mit.edu/courses/5-04-principles-of-inorganic-chemistry-ii-fall-2008/
3. https://chem.libretexts.org/Courses/Athabasca_University/Chemistry_350:_Organic_Chemistry_I
4. https://www.coursera.org/learn/physical-chemistry
5. https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps
6. https://www.britannica.com/science/thermodynamics
7. https://ps.uci.edu/stuaff/content/uci-openchemistry-lectures

SUBJECT CODE	TITLE OF THE PAPER		ALLIED CORE
U22ACH5	ALLIED CHEMISTRY-II (FOR PHYSICS STUDENTS)		3
YEAR	SEMESTER	CREDITS	LECTURE HOURS
II	IV	3	75

Course Objectives:

The students will be able:

1. To learn about coordination complexes and its importance.
2. To differentiate various photo physical processes and their mechanism and to describe acids and bases based on various theories.
3. To understand the basis of organic reactions and their mechanisms and to study about the various types of synthetic polymers.
4. To impart the knowledge of nuclear and radiation chemistry.
5. To instruct the different types of catalysis and industrial applications of fuel gases.

UNIT - I Coordination Chemistry (15 hours)

1.1. Coordinate Bond: Nature of coordinate bond, Werner's theory and structure of some complexes - $Ni(CO)_4$, $[Co(NH_3)_6]Cl_3$, $K_4[Fe(CN)_6]$ - Classification of complexes, IUPAC Nomenclature of mononuclear complexes.

1.2. Applications of Coordinate compounds: Chelation and its industrial importance with particular reference to EDTA - biological role of haemoglobin and chlorophyll - applications of complexes in qualitative and quantitative analysis.

UNIT - II Photochemistry and Acids & Bases: (15 hours)

2.1 Photochemistry: Laws governing the absorption of light - Lambert's law and Beer's law - Grotthus law, Stark-Einsten's law and - quantum efficiency - comparison between thermal and photochemical reactions – Phosphorescence, fluorescence, bioluminescence and photosensitization-definition with example.

2.2 Acids & Bases: Arrhenius, Brønsted-Lowry and Lewis theories – pH – Determination of pH by colorimetric method – Buffers – Mechanism of buffer action.

UNIT - III Organic Reaction and Synthetic polymers: (15 hours)

3.1 Organic reactions: Osazone test, biuret test, condensation reactions for aldehydes and ketones, Esterification reaction, Diazotization followed by coupling and phthalein fusion test (one example for each).

3.2 Synthetic Polymers: Polymers - Definition, types of polymers, difference between thermosetting and thermoplastic polymers. Preparation of caprolactam, Teflon, nylon 66, polyester, PVC, Polyethylene and epoxy resins.

UNIT - IV Nuclear Chemistry and Radioactivity: (15 hours)

4.1 Nuclear Chemistry: Composition of nucleus – Nuclear forces – Nuclear binding energy – theories of nuclear stability - Isotopes - detection and study of isotopes – isobars – isomers – isotones.

4.1 Radioactivity: Discovery of radioactivity – Detection and Measurement of radioactivity – Nuclear fission – Nuclear fusion – comparison of nuclear fission and nuclear fusion - applications of radioisotopes.

UNIT V Industrial Chemistry and Catalysis: (15 hours)

5.1 Industrial Chemistry: Fuel gases - Water gas, producer gas, L.P.G. gas, gobar gas and natural gas - Fertilizers - NPK and mixed fertilizers - micronutrients and their role in plant life - bio fertilizers.

5.2 Catalysis: Homogeneous and heterogeneous catalysis – Theories of homogeneous and heterogeneous catalysis – catalytic promoters – catalytic poisons – Enzyme catalysis – Factors affecting enzyme catalysis

Course Learning Outcomes:

Students are able to

1. Understand complexes and their industrial importance.
2. To differentiate various photo physical processes and their mechanism and to describe acids and bases based on various theories.
3. Identify different types of organic reactions and polymers.
4. Understand about nuclear and radiation chemistry.
5. Different types of catalysis and industrial applications of fuel gases.

Text books:

1. P. L. Soni, Mohan Katyal, "*Text book of Inorganic Chemistry*", 20th Revised Edition (**2007**), Sultan Chand & Sons, New Delhi. (Unit I & II)
2. P. L. Soni and H. M. Chawla, "*Text book of Organic Chemistry*", (**1994**), Sultan Chand & Sons, New Delhi (Unit III)
3. P.L. Soni and O.P. Dharmaha, "*Text book of Physical chemistry*", S. Chand and Sons. (Unit IV & V)

Reference Books:

1. Inorganic Chemistry – Puri and Sharma
2. Inorganic Chemistry – R. D. Madan – Sultan Chand
3. Principles of Organic Chemistry – R. K. Bansal - New Age International
4. Applied Chemistry by K.Bagavathi - Sundari, MJP Publishers.
5. Polymer Science, Gowarikar. V.R. Viswanathan, N.V. Jayader Sreedhar. Wiley Eastern Ltd., New Delhi, 2005.

Web Resources

1. https://en.wikibooks.org/wiki/Introduction_to_Inorganic_Chemistry
2. https://ocw.mit.edu/courses/5-04-principles-of-inorganic-chemistry-ii-fall-2008/
3. https://chem.libretexts.org/Courses/Athabasca_University/Chemistry_350:_Organic_Chemistry_I
4. https://www.coursera.org/learn/physical-chemistry
5. https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps
6. https://ps.uci.edu/stuaff/content/uci-openchemistry-lectures

Semester	Course code	Title of the Course	Hours	Credits
I	**U22CC-1**	**CORE COURSE 1: GENERAL CHEMISTRY – I**	**5**	**5**
CO. No.	**CO-Statement**			**Cognitive Level (K-Level)**
	On successful completion of this course, students will be able to			
CO-1	acquire the knowledge about periodicity and periodic trends, Nomenclature			**K1**
CO-2	understand the basic of Titrimetric Analysis, real and ideal gases			**K2**
CO-3	understand the polar effects and reactive intermediates of hydrocarbons			**K2**
CO-4	apply the kinetic molecular theory and find the velocities of molecules			**K3**
CO-5	analyze the bonding in molecules and molecular geometry			**K4**
CO-6	evaluation of molecular weight by osmometry, ultra-centrifuge, viscometry and light scattering			**K5**

Semester	Course code	Title of the Course	Hours	Credits
I	U22CC-1	CORE COURSE 1: GENERAL CHEMISTRY – I	5	5

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	9	9	9	3	3
CO2-K2-Understanding	9	9	9	9	3	3
CO3-K2-Understanding	9	9	9	9	3	3
CO4-K3-Applying	9	9	3	3	3	3
CO5-K4- analyzing	9	3	3		3	1
CO6-K5- Evaluating	9	1	3		3	3
Weightage	54	40	36	30	18	16

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
I & II	**U22CC-2**	**CORE COURSE 2: MAJOR PRACTICAL I VOLUMETRIC ANALYSIS**	**3**	**5**
CO. No.	**CO-Statement On successful completion of this course, students will be able to**			**Cognitive Level (K-Level)**
CO-1	acquire the knowledge about normality, equivalent weighty of compounds			**K1**
CO-2	understand methods of preparation of solutions with different concentration			**K1**
CO-3	understand the principles of acid base titrations			**K2**
CO-4	apply advanced titrimetric technics			**K3**
CO-5	analysis of titrimetric techniques			**K4**
CO-6	evaluate the environmental problem			**K5 & K6**

Semester	Course code	Title of the Course	Hours	Credits
I & II	U22CC-2	CORE COURSE-II MAJOR PRACTICAL-I-VOLUMETRIC ANALYSIS	3	5

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	9	9	9	9	9
CO2-K1-Understanding	9	9	9	9	9	3
CO3-K3-Applying	9	9	9	9	3	3
CO4-K4-Analyzing	9	9	9	3	3	3
CO5-K5-Evaluating	9	9	3	3	3	3
CO6-K6-Creating	9	3	3	3	3	3
Weightage	54	48	42	36	30	24

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
II	**U22CC-3**	**CORE COURSE 3: GENERAL CHEMISTRY – II**	**5**	**5**
CO. No.	**CO-Statement**			**Cognitive Level (K-Level)**
	On successful completion of this course, students will be able to			
CO-1	acquire the knowledge about metallurgy and S-block elements			**K1**
CO-2	understand the nomenclature, preparations and reactions of cyclic and acyclic alkanes			**K2**
CO-3	apply VSEPR theory and predict the structure of coordination and metallic bonds			**K3**
CO-4	overview the synthetic applications of alkene, alkynes, dienes			**K4**
CO-5	analyze the conformations of cyclic and acyclic hydrocarbons			**K5**
CO-6	analysis of completely and partially miscibility of liquid systems			**K5**

Semester	Course code	Title of the Course	Hours	Credits
II	U22CC-3	COURSE CORE 3: GENERAL CHEMISTRY – II	5	5

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	3	3	3	3	3	3
CO2-K2-Understanding	9	3	3	3	3	3
CO3-K3-Applying	9	9	3	3	3	1
CO4-K4-Analyzing	3	1	3	3	1	3
CO5-K5-Evaluating	3	3	3	3	3	1
CO6-K5-Evaluating	3	3	3	3	3	3
Weightage	30	22	18	18	16	14

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
III	**U22CC-4**	**CORE COURSE 4: GENERAL CHEMISTRY – III**	**4**	**5**
CO. No.	**CO-Statement**			**Cognitive Level (K-Level)**
	On successful completion of this course, students will be able to			
CO-1	acquire the knowledge about P-block elements and qualitative analysis			**K1**
CO-2	understand the preparations and reactions of ethers, epoxides, organometallic compounds and lipids			**K2**
CO-3	apply the collisions theory on effect on temperature on reactions rate			**K3**
CO-4	overview the synthesis and properties of alcohols, alkyl halides			**K4**
CO-5	evaluate the order of the of reactions by kinetics laws			**K5**
CO-6	check and solve various problems based on chemical kinetics of zero, first, second, third, half-life and pseudo-first order reactions			**K5**

Semester	Course code	Title of the Course	Hours	Credits
III	U22CC-4	COURSE CORE 4: GENERAL CHEMISTRY – III	4	5

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	3	3	3	3	3
CO2-K2-Understanding	9	3	9	3	3	3
CO3-K3-Applying	9	9	3	3	3	3
CO4-K4-Analyzing	3	3	1	3	3	3
CO5-K5-Evaluating	3	3	3	3	3	1
CO6-K5-Evaluating	3	3	3	3	3	1
Weightage	36	24	22	18	18	14

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
III & IV	**U22CC5**	**PRACTICAL –II SEMI MICRO ANALYSIS**	**3**	**5**
CO. No.	**CO-Statement On successful completion of this course, students will be able to**			**Cognitive Level (K-Level)**
CO-1	detect the simple acid radicals and the interfering radicals			**K1**
CO-2	eliminate the interfering radicals, understand the possible combinations of the radicals and their detection			**K2**
CO-3	understand the idea behind the grouping of cations, like common ion effect, ionic product, solubility product			**K3**
Co-4	understand and perform the separation of cations in to groups, detection of cations			**K4**
CO-5	understand why the cations in a particular group must be eliminated before proceeding to the subsequent groups			**K4**
CO-6	learn to do the flame test and to understand the idea of performing a flame test. Learn the proper use of Kip's apparatus, and centrifuge machine. Gain confidence while working in the chemistry lab, making them confident of getting a job a chemical company/industry.			**K4**

Semester	Course code	Title of the Course	Hours	Credits
II	U22CC-5	CORE COURSE V: SEMI MICRO ANALYSIS	3	3

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	3	3	3	1	1
CO2-K2-Understanding	3	3	3	3	1	1
CO3-K3-Applying	3	3	3	3	1	1
CO4-K4-Analyzing	3	3	3	3	1	1
CO5-K4- Analyzing	3	3	3	3	1	1
CO6-K4- Analyzing	3	3	3	3	1	1
Weightage	24	18	18	18	6	6

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
III	**U22SBECH2**	**SKILL BASED ELECTIVE–II: CHEMISTRY IN DAILY LIFE**	**2**	**2**
CO. No.	**CO-Statement**			**Cognitive Level (K-Level)**
	On successful completion of this course, students will be able to			
CO-1	acquire the knowledge about essential oils, perfumes and cosmetics			**K1**
CO-2	understand the basics of polymers, plastics and fuels			**K2**
CO-3	understand the water quality parameters and their determination			**K2**
CO-4	apply the physical, chemical and biological standards and find the quality of water			**K3**
CO-5	analyze the methods of extinguishing fire and fire extinguishers			**K4**
CO-6	evaluation of perfumes by formulations			**K5**

Semester	Course code	Title of the Course	Hours	Credits
III	U22SBECH2	SKILL BASED ELECTIVE–II: CHEMISTRY IN DAILY LIFE	2	2

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	3	9	3	3	9
CO2-K2-Understanding	9	3	9	3	3	9
CO3-K2-Understanding	9	3	3	9	9	3
CO4-K3-Applying	3	3	3	3	3	3
CO5-K4-Analyzing	3	3	3	3	1	1
CO6-K5- Evaluating	1	0	1	1	1	1
Weightage	34	15	28	22	20	26

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
III	**U22SBECH3**	**SKILL BASED ELECTIVE–III NANO AND CLINICAL CHEMISTRY**	**2**	**2**
CO. No.	**CO-Statement On successful completion of this course, students will be able to**			**Cognitive Level (K-Level)**
CO-1	acquire the knowledge of nanoscience and synthetic approach of nanoparticles			**K1**
CO-2	understand the various characterization techniques of nanomaterials			**K2**
CO-3	understand pharmacological action of the drug			**K2**
CO-4	application of nanomaterials in various fields			**K3**
CO-5	interpret concepts related to blood and lymph			**K4**
CO-6	identify the diagnostic agents and qualitative test of blood samples			**K4**

Semester	Course code	Title of the Course	Hours	Credits
III	U22SBECH3	SKILL BASED ELECTIVE–III NANO AND CLINICAL CHEMISTRY	2	2

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	9	9	9	9	3
CO2-K2-Understanding	9	9	9	9	3	3
CO3-K2-Understanding	9	9	9	9	3	3
CO4-K3-Applying	9	9	3	3	3	3
CO5-K4- Analyzing	3	3	3	1	3	3
CO6-K4- Analyzing	9	3	3	1	3	3
Weightage	48	42	36	32	24	18

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
IV	**U22CC-5**	**CORE COURSE 4: GENERAL CHEMISTRY – IV**	**4**	**5**
CO. No.	**CO-Statement**			**Cognitive Level (K-Level)**
	On successful completion of this course, students will be able to			
CO-1	acquire the knowledge about chemistry of halogen and zero group elements.			**K1**
CO-2	the Classify the organic compounds according to Huckel's rule of aromaticity.			**K2**
CO-3	understand the utility of the synthetic organic reagents.			**K3**
CO-4	explain the nucleophilic substitution reaction mechanisms and applications of solid state as well as colloids.			**K4**
CO-5	analyze the methods of X–ray diffraction, liquid state and colloids.			**K5**
CO-6	formulate the preparation, properties of mononuclear and polynuclear aromatic hydrocarbons and predict the products formation.			**K6**

Semester	Course code	Title of the Course	Hours	Credits
III	U22CC-6	COURSE CORE 4: GENERAL CHEMISTRY – IV	4	4

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	9	9	3	3	3
CO2-K2-Understanding	9	9	9	9	3	3
CO3-K3-Applying	9	9	3	3	3	3
CO4-K4-Analyzing	9	3	1	3	3	3
CO5-K5-Evaluating	3	3	3	3	3	3
CO6-K6-Creating	3	3	1	3	3	1
Weightage	42	36	26	24	18	16

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
IV	U22NMCH1	NON–MAJOR ELECTIVE–I AGRICULTURAL CHEMISTRY	2	2
CO. No.	CO-Statement On successful completion of this course, students will be able to			Cognitive Level (K-Level)
CO-1	acquire knowledge on concepts and principles of plant nutrients			K1
CO-2	understand the various types of fertilizers and applications			K2
CO-3	understand the environmental and health impacts of pesticides and fertilizer			K2
CO-4	apply the mechanism of action of fungicides and herbicides			K3
CO-5	identify the diagnostic agents and qualitative test of blood samples			K4
CO-6	evaluate the impact of pesticides on soil, plants and environment			K5

Semester	Course code	Title of the Course	Hours	Credits
IV	U22NMCH1	NON–MAJOR ELECTIVE–I AGRICULTURAL CHEMISTRY	2	2

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	9	9	9	9	9
CO2-K2-Understanding	9	9	9	9	9	3
CO3-K2-Understanding	9	9	9	9	9	3
CO4-K3- Applying	9	9	9	3	3	3
CO5-K4- Analyzing	9	3	3	3	3	3
CO6-K5- Evaluating	9	9	3	3	3	3
Weightage	54	48	42	36	36	24

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
III	**U22CH7**	**INORGANIC CHEMISTRY-I**	**75**	**5**
CO. No.	**CO-Statement**			**Cognitive Level (K-Level)**
	On successful completion of this course, students will be able to			
CO-1	acquire the knowledge about metallurgy of transition and inner transition elements			**K1**
CO-2	understand the basic concepts of coordination compounds			**K2**
CO-3	understand the chemistry of biological and metal carbonyl compounds			**K2**
CO-4	apply the isomerism, reaction mechanisms, and applications of coordination compounds			**K3**
CO-5	analyze the various concepts of acid-bases and non-aqueous solvents			**K4**
CO-6	evaluation the types of isomers, reaction mechanism and applications of coordination compounds			**K5**

Semester	Course code	Title of the Course	Hours	Credits
V	U22CH7	CORE 1: INORGANIC CHEMISTRY - I	5	5

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	9	9	9	1	9
CO2-K2-Understanding	9	9	9	9	1	9
CO3-K2-Understanding	9	9	9	9	1	9
CO4-K3- Applying	9	9	3	9	1	9
CO5-K4- Analyzing	9	3	3	9	1	3
CO6-K5- Evaluating	1	1	1	1	1	1
Weightage	46	40	34	46	6	40

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
V	**U22CH8**	**CORE COURSE-8 ORGANIC CHEMISTRY -I**	**5**	**5**
CO. No.	**CO-Statement On successful completion of this course, students will be able to**			**Cognitive Level (K-Level)**
CO-1	recall the stereo & optical isomerism of Organic Compounds			**K1**
CO-2	Summarize the formation of Six-membered hetero cyclic systems and fused rings			**K2**
CO-3	organize the acid and base catalyzed reactions			**K3**
Co-4	plan and solve the Organic reaction mechanisms			**K4**
CO-5	justify the different classes of carboxylic acids and their preparations			**K5**
CO-6	compile the relationships between Alkaloids, Terpenoids & Steroids			**K6**

Semester	Course code	Title of the Course	Hours	Credits
V	U22CH8	CORE COURSE-8 ORGANIC CHEMISTRY -I	5	5

Programme Outcomes (POs)						
Course Outcome (COs)	**PO1 Disciplinary Knowledge**	**PO2 Communication Skills**	**PO3 Critical Thinking, Problem Solving and Analytical Reasoning**	**PO4 Reflective thinking and Scientific reasoning. Team works with leadership Qualities.**	**PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.**	**PO6 Multicultural competency and Self-directed lifelong learning**
CO1-K1-Remembering	9	9	9	9	3	3
CO2-K2-Understanding	9	9	9	3	9	9
CO3-K3-Applying	9	9	9	9	9	9
CO4-K4-Analyzing	9	9	9	9	9	3
CO5-K5-Evaluating	9	9	3	1	3	0
CO6-K6-Creating	9	3	3	0	3	3
Weightage	54	48	42	31	36	27

Mapping Correlation	**Low**	**Medium**	**High**	**No Correlation**
Level of Correlation	1	3`	9	0

Semester	Course code	Title of the Course	Hours	Credits
V	U22CC9E	CORE COURSE ELECTIVE-IX: ANALYTICAL CHEMISTRY	5	4

CO. No.	CO-Statement On successful completion of this course, students will be able to	Cognitive Level (K-Level)
CO-1	acquire the knowledge about analytical methods, safety measures and data analysis	K1
CO-2	understand the quantitative estimations of minerals and gravimetric analysis	K2
CO-3	understand about the thermo analytical techniques	K2
CO-4	understand the importance of colorimetric estimations	K3
CO-5	analyze the functioning of various chromatographic systems	K4
CO-6	evaluate the treatment of analytical data	K5

Semester	Course code	Title of the Course	Hours	Credits
V	U22CC9E	ELECTIVE COURSE IX: ANALYTICAL CHEMISTRY	5	4

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	9	9	9	9	9
CO2-K2-Understanding	9	9	9	9	9	9
CO3-K2-Understanding	9	9	9	9	9	9
CO4-K3- Applying	9	9	9	9	9	9
CO5-K4- Analyzing	9	9	9	9	9	3
CO6-K5- Evaluating	9	9	9	3	9	3
Weightage	54	54	54	48	54	42

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
V	**U22CH10E**	**ELECTIVE CORE COURSE 2: THERMODYNAMICS AND QUANTUM CHEMISTRY**	**6**	**4**
CO. No.	**CO-Statement**			**Cognitive Level (K -Level)**
	On successful completion of this course, students will be able to			
CO-1	memorize, relate and explain the terminologies of first, second and third law of thermodynamics.			**K1**
CO-2	understands Joule-Thomson effect, classifies heat of reaction and thermo chemical laws.			**K2**
CO-3	apply the concepts of thermodynamics to natural and industrial processes.			**K3**
CO-4	analyze the various systems and their coexistence in phase equilibrium.			**K4**
CO-5	interpret the concept of chemical potential and partial molar properties, apply the third law of thermodynamics and relate free energy and chemical reactions.			**K4**
CO-6	check and solve various problems based on First, second and third law of thermodynamics.			**K5**

Semester	Course code	Title of the Course	Hours	Credits
V	U22CH10E	ELECTIVE CORE COURSE 2: THERMODYNAMICS AND QUANTUM CHEMISTRY	6	4

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	9	9	9	3	3
CO2-K2-Understanding	9	9	9	9	3	3
CO3-K3-Applying	9	9	9	9	3	3
CO4-K4-Analyzing	9	9	3	3	3	3
CO5-K4- Analyzing	9	9	3	3	3	3
CO6-K5- Evaluating	9	1	3		3	3
Weightage	54	46	36	33	18	18

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
V & VI	**U22CH11P**	**CORE COURSE-XI PHYSICAL CHEMISTRY PRACTICAL-III**	**3**	**5**
CO. No.	**CO-Statement On successful completion of this course, students will be able to**			**Cognitive Level (K-Level)**
CO-1	acquire the knowledge about transition temperature and phase diagram			**K1**
CO-2	understand the basics of conductometry and potentiometry			**K2**
CO-3	understand the optical rotation and UV spectrum of coordination complexes			**K2**
CO-4	apply the cell constant and find the equivalent conductance of strong electrolyte			**K3**
CO-5	analyze the effect of impurity on critical solution temperature of phenol-water system			**K4**
CO-6	evaluation of K_f and molecular weight by Rast method			**K5**

Semester	Course code	Title of the Course	Hours	Credits
V & VI	U22CH11P	CORE COURSE-11 PHYSICAL CHEMISTRY PRACTICAL-III	3	5

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	3	9	3	3	9
CO2-K2-Understanding	9	3	9	9	9	9
CO3-K2-Understanding	9	3	9	9	9	9
CO4-K3- Applying	9	3	3	9	9	3
CO5-K4- Analyzing	3	1	3	3	3	1
CO6-K5- Evaluating	1	0	1	3	1	1
Weightage	40	13	34	36	34	32

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
V&VI	**U22CH12P**	**Core Course-12 GRAVIMETRY AND ORGANIC ANALYSIS PRACTICAL- IV**	**6**	**6**
CO. No.	**CO-Statement**			**Cognitive Level (K -Level)**
	On successful completion of this course, students will be able to			
CO-1	relate the functional groups present in Organic compounds			**K1**
CO-2	outline the various types of Estimations			**K2**
CO-3	examine the elements and functional groups present in Organic Compounds			**K3**
CO-4	interpret and characterize the functional groups			**K4**
CO-5	analyze the boiling points and melting points of the organic compounds.			**K5**
CO-6	design and develop organic compounds preparations.			**K6**

Semester	Course code	Title of the Course	Hours	Credits
V&VI	U22CH12P	Core Course-12 GRAVIMETRY AND ORGANIC ANALYSIS PRACTICAL- IV	6	6

Programme Outcomes (POs)						
Course Outcome (COs)	**PO1- Disciplinary Knowledge**	**PO2- Communication Skills**	**PO3- Critical Thinking, Problem Solving and Analytical Reasoning**	**PO4- Reflective thinking and Scientific reasoning. Team works with leadership Qualities.**	**PO5- Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.**	**PO6- Multicultural competency and Self-directed lifelong learning**
CO1-K1-Remembering	9	9	9	9	9	3
CO2-K2-Understanding	9	9	9	9	9	3
CO3-K3-Applying	9	9	9	9	9	9
CO4-K4-Analyzing	9	9	9	9	9	3
CO5-K5-Evaluating	9	9	9	3	3	0
CO6-K6-Creating	3	3	9	0	1	3
Weightage	48	48	54	39	40	21

Mapping Correlation	**Low**	**Medium**	**High**	**No Correlation**
Level of Correlation	1	3`	9	0

Semester	Course code	Title of the Course	Hours	Credits
V	U22NMCH2	NON–MAJOR ELECTIVE–II COSMETIC CHEMISTRY	2	2
CO. No.	CO-Statement On successful completion of this course, students will be able to			Cognitive Level (K-Level)
CO-1	gain knowledge and understand the principles of cosmetic science and skin care			K1
CO-2	understand the different types of basic ingredients for soap, shampoo			K2
CO-3	fundamentals of sun protection and the formulation of Sunscreens, and lip care			K2
CO-4	identify and apply the knowledge of raw materials			K3
CO-5	formulate cosmetics for skin care and hair care			K4
CO-6	Evaluate cosmetics for various physico-chemical properties.			K5

Semester	Course code	Title of the Course	Hours	Credits
V	U22NMCH2	NON–MAJOR ELECTIVE–II COSMETIC CHEMISTRY	2	2

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	9	9	9	9	9
CO2-K2-Understanding	9	9	9	9	9	3
CO3-K2-Understanding	9	9	9	9	9	3
CO4-K3- Applying	9	3	3	3	3	3
CO5-K4- Analyzing	9	3	9	3	3	3
CO6-K5- Evaluating	9	9	3	3	3	3
Weightage	54	42	42	36	36	24

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
VI	**U22CH13**	**CORE COURSE-XIII INORGANIC CHEMISTRY-II**	**6**	**6**
CO. No.	**CO-Statement On successful completion of this course, students will be able to**			**Cognitive Level (K-Level)**
CO-1	acquire the knowledge of theoretical concepts and applications of metallic state			**K1**
CO-2	understand the chemistry of ionic and organometallic compounds			**K2**
CO-3	understand the basics of nuclear chemistry			**K2**
CO-4	comprehensive understanding of the structural studies of polymeric compounds			**K3**
CO-5	identifies the advanced field of industrial chemistry and nuclear chemistry			**K4**
CO-6	evaluate the half-life and average life of radioactive materials			**K5**

Semester	Course code	Title of the Course	Hours	Credits
VI	U22CH13	CORE COURSE-XIII INORGANIC CHEMISTRY-II	6	6

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	9	9	9	9	9
CO2-K2-Understanding	9	9	9	9	9	9
CO3-K2-Understanding	9	9	9	9	9	9
CO4-K3- Applying	9	9	9	9	9	9
CO5-K4- Analyzing	9	9	9	3	9	3
CO6-K5- Evaluating	9	9	3	3	3	3
Weightage	54	54	48	42	48	42

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
VI	**U22CH14**	**CORE COURSE 14: ORGANIC CHEMISTRY-II**	**6**	**6**
CO. No.	**CO-Statement**			**Cognitive Level (K -Level)**
	On successful completion of this course, students will be able to			
CO-1	identifies the preparation and uses of nitro compounds, amines, amino acids, phenols and various dyes.			**K1**
CO-2	understand the preparation, properties and basic strength of aliphatic, aromatic amines, sulphonic acids and their derivatives.			**K2**
CO-3	illustrate and apply the mechanism of various molecular rearrangements to the given substrates.			**K3**
CO-4	analyze the classifications of carbohydrates, proteins and vitamins.			**K4**
CO-5	comprehend the structure, synthesis and analysis of amino acids, proteins and carbohydrates.			**K5**
CO-6	classify, distinguish and elucidate the structures of few carbohydrates.			**K6**

Semester	Course code	Title of the Course	Hours	Credits
VI	U22CH14	CORE COURSE 14: ORGANIC CHEMISTRY-II	6	6

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	9	9	9	9	3
CO2-K2-Understanding	9	9	9	9	3	9
CO3-K3-Applying	9	9	9	9	9	3
CO4-K4-Analyzing	9	9	3	3	3	3
CO5-K5-Evaluating	9	3	3	3	3	3
CO6-K6-Creating	9	1	3	3	3	3
Weightage	54	40	36	36	30	24

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
VI	U22CH15	CORE COURSE 15: PHYSICAL CHEMISTRY-II	90	6
CO. No.	CO-Statement			Cognitive Level (K-Level)
	On successful completion of this course, students will be able to			
CO-1	acquire the basics knowledge of electrolytic conductance and also the theory of NMR, UV and IR spectra,			K1
CO-2	Understand the Jablonski diagram, Beer-Lambert's law, the laws of photochemistry and the kinetics involved in photochemical reactions, Raman effect			K2
CO-3	Understand the application of electrolytic conductance, NMR, UV and IR			K2
CO-4	Apply the kinetic molecular theory and find the velocities of molecules			K3
CO-5	analyze the position and splitting of NMR signals of molecular compounds			K4
CO-6	evaluation the spin-spin coupling constant, shielding and chemical effect			K5

Semester	Course code	Title of the Course	Hours	Credits
VI	U22CH-15	CORE COURSE 15: PHYSICAL CHEMISTRY-II	90	5

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	9	9	9	3	3
CO2-K2-Understanding	9	9	9	9	3	3
CO3-K2-Understanding	9	9	9	9	3	3
CO4-K3- Applying	9	9	3	3	3	3
CO5-K4- Analyzing	9	3	3		3	1
CO6-K5- Evaluating	9	1	3		3	3
Weightage	54	40	36	30	18	16

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
VI	U22CH16E	FOOD CHEMISTRY	5	4

CO. No.	CO-Statement On successful completion of this course, students will be able to	Cognitive Level (K-Level)
CO-1	acquire the knowledge about nutrition and balanced diet	K1
CO-2	understand the basics of food adulteration and food poison	K2
CO-3	understand the food additives and beverages	K2
CO-4	apply the analytical techniques and find the common adulterants	K3
CO-5	analyze the carbonated, non-carbonated and distilled, non-distilled beverages	K4
CO-6	evaluation of quality of food by WHO standards and ISI specifications	K5

Semester	Course code	Title of the Course	Hours	Credits
VI	U22CH16E	FOOD CHEMISTRY	5	4

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1 Disciplinary Knowledge	PO2 Communication Skills	PO3 Critical Thinking, Problem Solving and Analytical Reasoning	PO4 Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5 Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6 Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	3	9	3	9	9
CO2-K2-Understanding	9	3	9	3	9	3
CO3-K2-Understanding	9	3	9	3	9	3
CO4-K3- Applying	3	1	3	1	3	3
CO5-K4- Analyzing	3	1	1	1	1	3
CO6-K5- Evaluating	1	0	1	1	1	1
Weightage	34	11	32	12	32	22

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
I	**U22ACH-1**	**Allied Core 1: ALLIED CHEMISTRY-I (FOR BOTANY, GEOLOGY & ZOOLOGY STUDENTS)**	**75**	**3**
CO. No.	**CO-Statement**			**Cognitive Level (K-Level)**
	On successful completion of this course, students will be able to			
CO-1	acquire the knowledge about standard solutions, types of titrimetric reactions and quantitative analysis			**K1**
CO-2	understand the various types of bond and properties			**K2**
CO-3	understand the various types of carbohydrates and amino acids			**K2**
CO-4	apply the various methods for the detection and preventions of food adulterants			**K3**
CO-5	overview the concept and industrial importance of dyes			**K4**
CO-6	evaluate the compositions of food additives			**K5**

Semester	Course code	Title of the Course	Hours	Credits
I	U22ACH1	Allied Core 1: ALLIED CHEMISTRY-I (FOR BOTANY, GEOLOGY & ZOOLOGY STUDENTS)	75	3

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1- Disciplinary Knowledge	PO2- Communication Skills	PO3- Critical Thinking, Problem Solving and Analytical Reasoning	PO4- Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5- Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6- Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	3	9	9	3	3
CO2-K2-Understanding	9	9	9	3	9	3
CO3-K2- Understanding	9	9	9	3	9	3
CO4-K3- Applying	9	3	9	9	3	3
CO5-K4- Analyzing	9	9	3	3	3	3
CO6-K5- Evaluating	3	3	1	3	3	3
Weightage	48	36	40	30	30	18

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
I & II III & IV	**U22ACH-2**	**Allied Core 2: ALLIED CHEMISTRY PRACTICAL (FOR BOTANY & ZOOLOGY, PHYSICS AND GEOLOGY STUDENTS)**	**3**	**3**

CO. No.	CO-Statement On successful completion of this course, students will be able to	Cognitive Level (K-Level)
CO-1	acquire the knowledge about normality, equivalent weighty of compounds	**K1**
CO-2	understand various types of titrations	**K1**
CO-3	use organic chemicals and other equipment's in laboratories	**K2**
CO-4	comprehens the qualitative and quantitate analysis	**K2**
CO-5	communicate and explain the acquired analytical knowledge	**K3**
CO-6	investigate the functional group in the organic compounds	**K4**

Semester	Course code	Title of the Course	Hours	Credits
I & II/III & IV	U22ACH2	Allied Core 2: ALLIED CHEMISTRY PRACTICAL (FOR BOTANY & ZOOLOGY, PHYSICS AND GEOLOGY STUDENTS)	75	3

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1- Disciplinary Knowledge	PO2- Communication Skills	PO3- Critical Thinking, Problem Solving and Analytical Reasoning	PO4- Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5- Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6- Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	3	3	3	9	3	3
CO2-K1- Remembering	3	3	3	9	3	3
CO3-K2- Understanding	9	3	3	3	3	3
CO4-K2- Understanding	9	3	3	3	3	3
CO5-K3- Applying	3	9	3	3	1	1
CO6-K4- Analyzing	9	3	1	1	1	1
Weightage	36	24	16	28	14	14

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
II	**U22ACH-3**	**Allied Core 3: ALLIED CHEMISTRY-II (FOR BOTANY, GEOLOGY & ZOOLOGY STUDENTS)**	**75**	**3**
CO. No.	**CO-Statement**			**Cognitive Level (K-Level)**
	On successful completion of this course, students will be able to			
CO-1	understand the coordination complexes and its applications in quantitative and qualitative analysis			**K1**
CO-2	understand pharmacological action of the drug and antibiotic			**K2**
CO-3	explain the reactions of aldehyde, ketone, ester and synthetic polymers			**K2**
CO-4	apply the role of Insecticides, Pesticides and Fertilizers in plant life			**K3**
CO-5	overview the concept of industrial chemistry and catalysts			**K4**
CO-6	identify the chemical-based drugs to treat and prevent different types of diseases			**K4**

Semester	Course code	Title of the Course	Hours	Credits
II	U22ACH3	Allied CORE 3: ALLIED CHEMISTRY-II (FOR BOTANY, GEOLOGY & ZOOLOGY STUDENTS)	75	3

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1- Disciplinary Knowledge	PO2- Communication Skills	PO3- Critical Thinking, Problem Solving and Analytical Reasoning	PO4- Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5- Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6- Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	3	9	9	3	3
CO2-K2-Understanding	9	9	3	3	9	3
CO3-K2- Understanding	9	9	3	3	9	3
CO4-K3- Applying	9	3	9	9	3	3
CO5-K4- Analyzing	3	9	3	3	1	1
CO6-K4- Analyzing	3	9	3	3	1	1
Weightage	42	42	30	30	26	14

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
III	**U22CH-4**	**Allied Core 1: ALLIED CHEMISTRY-I (FOR PHYSICS STUDENTS)**	**60**	**3**
CO. No.	**CO-Statement**			**Cognitive Level (K-Level)**
	On successful completion of this course, students will be able to			
CO-1	acquire the knowledge about standard solutions, types of titrimetric reactions and quantitative analysis			**K1**
CO-2	understand the various types of bond and properties			**K2**
CO-3	understand the laws and concept of thermodynamics			**K2**
CO-4	apply the various methods for the detection and preventions of food adulterants			**K3**
CO-5	overview the concept and industrial importance of dyes			**K4**
CO-6	evaluate the compositions of food additives			**K5**

Semester	Course code	Title of the Course	Hours	Credits
III	U22ACH4	Allied Core 1: ALLIED CHEMISTRY-I (FOR PHYSICS STUDENTS)	60	3

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1- Disciplinary Knowledge	PO2- Communication Skills	PO3- Critical Thinking, Problem Solving and Analytical Reasoning	PO4- Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5- Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6- Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	3	9	9	3	3
CO2-K2-Understanding	9	9	3	3	3	3
CO3-K2- Understanding	9	9	3	3	3	3
CO4-K3- Applying	9	3	9	9	3	3
CO5-K4- Analyzing	9	9	3	3	3	3
CO6-K5- Evaluating	3	3	1	3	3	3
Weightage	48	36	28	30	18	18

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0

Semester	Course code	Title of the Course	Hours	Credits
IV	**U22CH-5**	**Allied Core 3: ALLIED CHEMISTRY-II (FOR PHYSICS STUDENTS)**	**75**	**3**
CO. No.	**CO-Statement**			**Cognitive Level**
	On successful completion of this course, students will be able to			**(K-Level)**
CO-1	understand the coordination complexes and its applications in quantitative and qualitative analysis			**K1**
CO-2	summarize principles of photochemistry and compare the different concept of acid and base			**K2**
CO-3	explain the reactions of aldehyde, ketone, ester and polymers			**K2**
CO-4	apply the role of bio-fertilizer and micronutrients in plant life			**K3**
CO-5	overview the concept of industrial chemistry and catalysts			**K4**
CO-6	identify the types of radioisotopes used in medicine			**K4**

Semester	Course code	Title of the Course	Hours	Credits
IV	U22ACH5	Allied Core 3: ALLIED CHEMISTRY-II (FOR PHYSICS STUDENTS)	75	3

Course Outcome (COs)	Programme Outcomes (POs)					
	PO1- Disciplinary Knowledge	PO2- Communication Skills	PO3- Critical Thinking, Problem Solving and Analytical Reasoning	PO4- Reflective thinking and Scientific reasoning. Team work with leadership Qualities.	PO5- Moral and ethical awareness. Appreciating Environmental and Sustainability Issues.	PO6- Multicultural competency and Self-directed lifelong learning.
CO1-K1-Remembering	9	3	9	9	3	3
CO2-K2-Understanding	9	9	3	3	9	3
CO3-K2- Understanding	9	9	3	1	3	3
CO4-K3- Applying	9	3	9	9	3	3
CO5-K4- Analyzing	3	9	3	3	1	1
CO6-K4- Analyzing	3	1	1	1	1	1
Weightage	42	34	28	26	20	14

Mapping Correlation	Low	Medium	High	No Correlation
Level of Correlation	1	3	9	0