B.Sc. Chemistry

SYLLABUS

(Under Choice Based Credit System - CBCS)

For the students admitted in the academic year 2019 -2020

PG & RESEARCH DEPARTMENT OF CHEMISTRY
(DST-FIST Sponsored & DBT-STAR Scheme)
BISHOP HEBER COLLEGE (Autonomous)
(Reaccredited with 'A' Grade (CGPA – 3.58/4.0) by the NAAC
(Recognized by UGC as "College of Excellence")

PG & Research Department of Chemistry

Bishop Heber College (Autonomous),Trichy -17

Vision:

The PG & Research Department of Chemistry envisions…

To transform students into globally-competent graduates by providing a vibrant, Innovative and all-inclusive learning environment that fosters Values, Professional ethics and Social Consciousness.

Mission:

To reach its vision the Department would

- offer a Quality and Comprehensive Curriculum
- facilitate a Competent Learning Environment
- create an Integrated Research Culture
- foster Industry – Academia Network for education
- inspire to Innovate

Programme Outcomes – B. Sc. Chemistry

On successful completion of B.Sc. Chemistry program, the Grandaunt will be able to

KNOWLEDGE

PO1: Comprehend knowledge of basic concepts, fundamental principles and the scientific theories related to various scientific phenomena and their relevance to day-to-day life.

PO2: Exhibit a scientific acumen and outlook in all walks of life in order to provide creative solutions for a sustainable future.

PO3: Critically analyze and interpret scientific data in a logical and systematic manner to arrive at objective conclusions.

ATTITUDES

PO4: Show inclination to lifelong learning and adaptability to challenging situations.

SKILLS

PO5: Acquire the ability to synthesize, separate and characterize compounds using laboratory and instrumentation techniques.

PO6: Handle scientific instruments and tools with ease and to choose the appropriate scientific methods and experiments to test and produce reliable results.

PO7: Communicate effectively in oral, written and electronic formats and display personal and interpersonal skills.

PO8: Exhibit analytical skills and problem-solving skills using the principles of chemistry and its allied fields.

ETHICAL & SOCIAL RESPONSIBILTY

PO9: Practice professional, ethical, moral and social values in personal and social life and would contribute to nation building.

Programme Specific Outcomes - B.Sc. Chemistry

On successful completion of B.Sc. Chemistry program, the Graduand will be able toIntellectual Skills:

PSO 1: Demonstrate knowledge and understanding of essential facts, concepts, principles andtheories related to the different areas of chemistry.

Practical Skills:

PSO 2: Perform documented laboratory procedures involved in synthetic and analytical work, inrelation to inorganic and organic systems by following standard laboratory safety protocols.

Transferable Skills:

PSO 3: Apply numeracy, mathematical and digital skills to error analysis, order-of-magnitudeestimations, standard unit usage, modes of data presentation and scientific documentation.

PSO 4: Use the evidence based comparative chemistry approach to explain the chemical theproperties and reactions of various types of elements and compounds

PROGRAM ARTICULATION MATRIX

B.Sc. CHEMISTRY

S. No	Name of the Course	Course Code	CORRELATION WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES												
			PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
1.	General Chemistry-I	U19CH101	H	H	M	L	L	L	L	L	-	H	L	M	H
2.	Volumetric Analysis& Applied Experiments	U19CH1P1	H	H	H	L	H	H	L	H	-	H	H	M	H
3.	General Chemistry-II	U19CH202	H	H	L	-	-	-	M	H	-	H	-	M	H
4.	Applications ofComputer in Chemistry	U19CH2:P	H	M	M	M	-	M	L	M	-	H	-	M	H
5.	Textile Chemistry	U19CH2S1	H	H	-	M	-	-	L	-	-	H	-	-	H
6.	General Chemistry -III	U19CH303	H	H	H	-	-	-	-	M	-	H	-	-	H
7.	Inorganic QualitativeAnalysis	U19CH3P2	H	M	M	L	H	H	L	H	L	H	M	L	H
8.	Inorganic Chemistry-I	U19CH404	H	L	L	L	M	M	L	L	-	H	L	L	H
9.	Organic Analysis	U19CH4P3	H	H	H	-	H	H	L	H	-	H	H	L	H
10.	Organic Chemistry-I	U19CH505	H	H	-	L	-	-	L	H	-	H	-	-	H
11.	Physical Chemistry-I	U19CH506	H	H	H	-	L	M	L	H	-	H	-	M	H
12.	Gravimetry, Organic& Inorganic Preparations & Determination of Physical Constants	U19CH5P4	H	H	M	L	H	H	L	H	-	H	H	L	H
13.	Biochemistry	U19CH5:2	H	H	L	L	-	-	-	L	-	H	-	-	H
14.	Core Project	U19CH5PJ													
15.	PharmaceuticalChemistry	U19CH5S2	H	H	-	M	-	-	L	-	-	H	-	-	H
16.	Industrial Chemistry	U19CH5S3	H	H	-	L	-	-	L	-	-	H	L	L	H
17.	Inorganic Chemistry-II	U19CH607	H	H	H	M	-	-	-	H	-	H	-	-	H
18.	Organic Chemistry-II	U19CH608	H	H	-	-	M	-	L	H	-	H	-	-	H
19.	Physical Chemistry-II	U19CH609	H	H	H	-	M	M	L	H	-	H	M	M	H
20.	Physical ChemistryPractical	U19CH6P5	H	M	H	L	-	H	L	H	-	H	M	L	H
21.	Analytical Chemistry	U19CH6:3	H	H	M	M	H	H	L	H	H	H	H	M	H

Overall Consolidated Structure for B.Sc. Chemistry (2019 - 20)

Parts of the Curriculum			No. of Courses	No. of Hours	Credits	Total Credits
Part – I : Language			4	24	12	12
Part – II : English			4	24	12	12
Part – III						
Major			9	54	51	66
Core (Theory)			5	20	12	
Core (Practical)						
Core (Project)			1	4	3	
Elective (Theory)			2	10	9	11
Elective (Practical)			1	3	2	
Allied (Mathematics / Zoology)	Maths		3	13	12	22
	Zoo	T	2	10	10	
		P	1	3	2	
Allied (Physics)		T	2	8	7	
		P	1	6	3	
Part – IV						
SBEC			3	6	6	14
NMEC			2	4	4	
VLO			1	2	2	
Env. Studies			1	2	2	
Part – V						
Extension			1	-	2	3
Gender Studies			1	-	-	
Life Skills			1	-	1	
Total			**42**	**180**	**140**	**140**

Total Courses: 42
Total Credits: 140
\Total Hours : 180

Structure of B.Sc. Chemistry Curriculum

Semester- I

Course	Hours	Credit
Tamil	6	3
English	6	3
Core-I	6	6
Core-Prac.-I	3	2
Allied-I Maths	5	4
Allied-I Zoo *	**5**	**5**
ES	2	2
VLO	2	2
7	**30**	**22**

Semester- II

Course	Hours	Credit
Tamil	6	3
English	6	3
Core-II	5	5
Elective – I(Practical)	3	2
Allied-II Maths	4	4
Allied-III Maths	4	4
Allied – II Zoo*	**4**	**4**
Allied Prac. – II Zoo*	**4**	**3**
SBEC – I	2	2
7	**30**	**23**

Semester- III

Course	Hours	Credit
Tamil	6	3
English	6	3
Core-III	6	5
Core-Prac.-II	3	2
Allied-IV Phy.	4	3
Allied Prac.- Phy.	3	-
NMEC – I	2	2
6	**30**	**18**

Semester- IV

Course	Hours	Credit
Tamil	5	3
English	5	3
Core-IV	6	5
Core-Prac.-III	3	2
Allied-V Phy.	4	4
Allied Prac.- Phy.	3	3
NMEC-II	2	2
Soft Skills	2	1
Extension	-	1
9	**30**	**24**

Semester- V

Course	Hours	Credit
Core V	6	6
Core VI	6	6
Core Practical – IV	6	3
Elective – II	4	4
Core Project	4	3
SBEC – II	2	2
SBEC – III	2	2
7	**30**	**26**

Semester- VI

Course	Hours	Credit
Core VII	6	6
Core VIII	6	6
Core IX	7	6
Core Practical – V	5	3
Elective – III	6	5
Gender	--	1
7	**30**	**27**

****INTERNSHIP:** **EXTRA CREDITS - 2**

CORE COURSE I: GENERAL CHEMISTRY – I

SEMESTER: I **CODE: U19CH101**

CREDITS:4 **Total Hours: 90**
Hours/week: 6

1. Course Outcomes

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

S.No.	Course Outcomes	Level	Unit
1	Recollect the atomic structure & Concept of Quantization.	K2	I
2	Reason out the periodicity of elements with their properties.	K4	II
3	Predict the shape of molecules based on VBT and VSEPR theories.	K4	III
4	Comprehend the principles and methodology of a systematic and skillful volumetric analysis.	K2	IV
5	Apply the various concentration units for solutions.	K3	V
6	Balance chemical equations.	K3	V

2A. Syllabus

Unit I - Atomic Structure and Periodic Properties **18 Hours**

1.1 - Atomic structure: Atomic Model of Bohr - Spectrum of hydrogen - drawbacks of Bohr's theory. Dual nature of electron-Concept of Quantization – Principles of quantum Theory – Black body Radiation - Planck's Quantum theory- *de* Broglie equation, Heisenberg uncertainty principle, Schrodinger equation (Derivation not required), significance of ψ and ψ^2.)

1.2- Periodic Properties: Modern periodic Table – Full form with atomic Number - grouping of elements into different blocks, Variation of atomic volume, atomic and ionic radii, Effective nuclear charge - Slater's rule - ionization potential, comparison of IE of N and O; Mg and Al; Be and B, electron affinity and electronegativity along the periods and groups – Pauling's and Mulliken's scales of electronegativity - Factors affecting periodic properties – Aufbau's principle – Hund's rule.

Unit II - Main Block Elements **18 Hours**

2.1 s - block elements : Comparative study of alkali and alkaline earth metal compounds – size of ions and atoms – Electronegativity - Ionization potential- Solubility of oxides, halides, hydroxides, carbonates and sulphates. Diagonal relationship between Li and Mg- Anomalous behavior of Be, H_2 and Li.

2.2 Zero group elements: General trends in Ionization Energy and Electron Affinity - Isolation of Noble gases from atmosphere and uses. Special properties of Helium - Compounds of Xenon – XeF_2, XeF_4, XeF_6, $XeOF_2$, XeO_2F_2, XeO_3, $XeOF_4$ - preparation, structure and uses. Clathrates - types and uses.

2.3 p – block elements : General trends in periodic properties – Electron affinity - Electronegativity – Ions and their properties – polarizability - polarizing power - Inert pair effect – Transition from non - metallic to metallic character – oxidation states – Fajan's rule in p - block- catenation.

Unit III - Theories of Chemical Bonding **18 Hours**

3.1 Types of chemical bonds: Nature and properties **–** characteristics of ionic bonds **-**Lattice energy and Born-Haber Cycle - NaCl. Polarizing power and Polarizability of ions: Partial ionic character - Transition from ionic to covalent character and vice versa – Fajan's rule.

3.2 Hydrogen bonding: Nature, types and consequences. Intermolecular forces–London forces, van der Waals forces.

3.3 Theories of Bonding : VSEPR Theory - Shapes of simple inorganic molecules ($BeCl_2$, BF_3, $SiCl_4$, PCl_5, SF_6, IF_7, H_2O, ICl, ICl_3, BrF_3, IF_5, ICl_2^-, NH_3, XeF_6) containing lone pair and bond pairs of electrons.

3.4 MO Theory : Qualitative MO energy level diagram and bond order calculation of homo nuclear diatomic (N_2 and O_2) and hetero nuclear diatomic (CO and NO) molecules.

Unit IV- Bonding in Organic Compounds **18 Hours**

4.1 Bond Formation: The Octet rule–Lewis Structures–Multiple bonds and their characteristics -bond length, bond angle, bond energy, bond polarity of some important bonds (C-C, C-O, C-N, C=C, C-Cl, C=O, H-H, O-H, N-H and S-H) - Hybridization and geometry of molecules (sp,sp^2,sp^3 - methane, ethane, ethylene and acetylene) - sigma and pi bonds. Rigidity of pi bonds – Rotation of single bonds - Electronegativity and Bond Polarity – Dipole moments of simple organic compounds.

4.2 Electron displacement effects: Inductive, Electromeric, Resonance & Hyperconjugation (5examples each).

4.3 Cleavage of bonds: Homolytic and Heterolytic fission of carbon–carbon bonds. Reaction intermediates – Stabilities of free radicals, carbocations and carbanions (primary, secondary, tertiary).

Unit V- Theories of Acids and Bases & Principles of Volumetry **18 Hours**

5.1 Acids and bases : Arrhenius theory, Bronsted–Lowry concept and Lewis concept, Factors that influence the strength of acids and bases. pH and pKa (Problems also). Buffers – Types - buffer action – Henderson–Hasselbalch equations (problems also) - Hydrolysis of salts – neutralization. Hydrolysis of salts of strong acid and weak base & salt of weak acid and strong base- derivation of K_a, K_b and K_w (Problems).

5.2 Redox Reactions : Oxidation and reduction reactions – Oxidation number concept of some important reagents($KMnO_4$, $K_2Cr_2O_7$, CrO_3, H_2SO_5, $H_2S_2O_8$, Ferrous salts, CrO_5, $H_2C_2O_4$, I_2, $S_2O_3^{2-}$) - Balancing redox equations by oxidation number method and ion electron method.

5.3 Volumetric Analysis: Mole concept**,** Atomic Mass, Molecular Mass, Equivalent Mass of some common oxidizing and reducing agents, concentration terms - ppm, mole fraction, normality, molarity, molality. Principle of titrimetry - neutralization point & end point – standard solution – primary and secondary standards. Types – neutralization, redox, complexometric and precipitation titrations. Indicators - fluorescent indicators, redox indicator, internal indicator, universal indicators.

2B. Topics for Self-Study:

S.No.	Topics	Web Links
1	Application of Schrodinger wave equation to Particle in one dimensional Box Model.	http://home.iitk.ac.in/~madhavr/CHM102/Physical/Lec3.pdf
2	Chemistry Borazine, phosphazine	https://www.youtube.com/watch?v=YRlZ8HDttDc
3	MOT of delocalized Pi bonding(CO_3^{2-})	https://www.youtube.com/watch?v=1felJvwr5PU https://www.youtube.com/watch?v=UjS_eT7tUYQ
4	Intermediate – Carbenes	https://www.youtube.com/watch?v=YJrzXHJ9I1M
5	Practical importance of solubility product	https://www.youtube.com/watch?v=WjiXbemBXkE

2C. Text Books

1. B.R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, Milestone Publishers, New Delhi, 2017 **(Unit I, II, III)**

2. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand & Co. Ltd., New Delhi, 2012 **(Unit IV)**
   B.R. Puri, L.R. Sharma and Madan S. Pathania, Principles of Physical Chemistry Vishal Publishing Co., Jalandhar, 2017 **(Unit V)**

3. P.L.Soni, H.M. Chawla, Text Book of Organic Chemistry , Sultan Chand & Sons, New Delhi, 2004

4. R.L. Madan and G.D. Tuli, Inorganic Chemistry, S. Chand Co. Ltd., New Delhi,**2010**

5. Gurdeep Raj, Advanced Physical Chemistry, Goel Publishing House, Meerut**, 2016**

2D. Reference Books

1. J.D. Lee, "Concise Inorganic Chemistry", Oxford University Press, New Delhi, 2008.
2. Morrison and Boyd "Organic Chemistry" Pearson Eucation, 2016.
3. Peter Atkins and Julio de Paula, "Physical Chemistry" Oxford University Press, 2018.

3. Specific Learning Outcomes (Slo)

Unit/Section	Course Content	Learning Outcomes	Highest Blooms Taxonomic levels of Transaction
I	**Atomic Structure and Periodic Properties**		
1.1	Bohr's Am Model & Spectrum of Hydrogen and Draw backs	Define the details of the Bohr's am model and its H_2 spectra	K1
	Wave Particle Duality-Concept of quantization- Principles of quantum theory.	Apply the concept of Duality both microscopic & Macroscopic Particles	K3
	Black body radiation-de Broglie Equation-Heisenberg's Uncertainty principle	Identify the momentum and frequency of microscopic particles.	K2
	Schrodinger's Equation-Significance of φ and φ^2	Define the Physical Significance of the wave function	K2
	Orbital Concept	Relate stability of elements based on electronic arrangement.	K2
1.2	Periodic properties - Modern Periodic table	Justify the position of elements in the periodic table	K4
	Variation of periodic properties along period and group-	Apply periodicity with various chemical & physical properties of elements.	K3
	Principles of Orbital Occupancy-Hund's rule and Aufba Principle	Apply the Orbital fill-uprules complete electronic configurations of elements.	K3

II	Main Block Elements		
2.1	s- Block elements Comparative study -Size of ions & atoms- Electronegativity & IP	Arrange the atoms according the gradation in the atomic properties ofthe elements in the S-block	K3
	Solubility of its compounds	Apply the role of atomic properties in solubility of compounds of the s-block compounds	K3
	Diagonal relationship & anomalous behavior	Relate the properties of diagonal elements	K2
2.2	Zero group element	Relate the Unique nesses of the Zero group elements	K2
	General trends in ionization energy and electron affinity	Analyze across the groups & Periods the impact & gradation of Ionization Energy & Electron affinity	K4
	Isolation from atmosphere and uses	Explain the methods of Isolation of noble gases from atmosphere	K2
	Special properties of Helium	Compare the properties of Helium spectra	K2
	Compounds of Xenon-Preparation, structure and uses	Explain the details of the preparation of xenon compounds	K2
	Clathrates-Types and Uses	Explain the types & uses of Clathrates	K2

2.3	p-Block elements - General Trends in periodic properties	Describe the gradation in the atomic properties ofthe elements in the p-block	K2
	Electron affinity and Electronegativity - Ions and Properties-Polarizability, polarizing power,	Compare the reactivity and chemical behavior of compounds based on Polarizability principles	K4
	Inert pair effect	Identify the violation of group principle in selected elements due Inert pair effect	K2
	Transition from non-metallic metallic character	Apply the atomic properties identify the metallic nature	K3
	Fajan's Rule & p-block catenation	Analyze size selectivity of different cations and anions	K3
III	**Theories of Chemical Bonding**		
3.1	Types of chemical bonds-Nature and Properties	Recall the characteristics of Chemicals bonds	K2
	Ionic Bonds-Characteristics- Lattice energy and Born-Heber Cycle -NaCl	Identify Ionic bonds	K2
	Polarizability of Ions-Partial Ionic character-Fajans' Rule	Apply Fajan's rule in prediction of Ionicity.	K3
3.2	Hydrogen Bonding	Explain the features of hydrogen bonds	K2
	Nature-Type and Consequences	Classify stabilities of compounds based on hydrogen bonding	K2
	London Forces, Van der Waals forces	Explain the role of week interactions in chemical systems	K2
3.3	Theories of Bonding	Compare the theories of bonding	K4

	VSEPR Theory - Shapes of simple inorganic molecules containing lone pair and bond pair of electrons	Predict the geometry of simple inorganic molecules	K4
3.4	Molecular Orbital Theory	Explain the principles of Molecular orbitals	K2
	Qualitative Energy level diagram and bond order calculation For homonuclear and heteronuclear diatomic molecules	Construct the MO energy diagrams of some important diatomic molecules	K3
IV	**Bonding in Organic Compounds**		
4.1	Bond Formation –Octet rule and Lewis Structure	Draw the Lewis structure of compounds	K4
	Multiple bonds and their characteristics	Outline the Features of multiple bonds	K2
	Hybridization and geometry of molecules (sp, sp^2,sp^3)	Explain the Hybridisation scheme of alkenes, alkynes and substituted alkanes	K2
	Sigma and Pi bonds	Explain the orbital overlapment in sigma & pi bonds of simple organic compounds	K2
	Electronegativity and bond polarity	Explain the role of bond polarity in the given compound	K2
4.2	Electron displacement effects Inductive, Electromeric, Resonance and hyperconjugation (Examples)	Analyze the impact of different electronic effects in a given organic compound	K4
4.3	Cleavage of bonds	Compare the characteristics of types of fission reactions	K3

	Homolytic and Heterolytic fission of C-C bonds		
	Reaction intermediates and their stability (Free Radicals, Carbocations and Carbanions)	Classify the stabilities of reactive intermediate based on the electronic facrs	K2
V	**Theories of Acids and Bases & Principles of Volumetry**		
5.1	Theories of Acids and Bases: Arrhenius, BL, And Lewis theories	Apply the features and importance of the theories of Acids& Bases	K3
	Factors influencing the strengths ofacids and bases	Examine the strengths of acids & bases based on electronic Factors	K2
	pH and pKa	Compare the pKa& PH values of the given acids	K4
	Buffers-Types and Henderson-Hasselbalch Equation	Explain the Henderson-Hasselbalch Equation	K2
	Hydrolysis of Salts	Illustrate the mechanism of Hydrolysis of salts	K2
	Derivations of Ka, Kb, and Kw	Explain the mathematical expressions of Ka, Kb, and Kw	K2
5.2	Redox Reactions:	Recall the features of Redox reactions	K2
	Oxidation and Reduction Reactions- Oxidation number concept of some important reagents($KMnO_4$, $K_2Cr_2O_7$, CrO_3, H_2SO_5, $H_2S_2O_8$, ferrous salts, CrO_5, $H_2C_2O_4$, I_2, $S_2O_3^{2-}$,)	Apply the - Oxidation number of compounds	K3

	Balancing redox equations by oxidation number and Ion-Electron Method.	Solve a Redox reaction	K3
5.3	Volumetric Analysis:		
	Mole concept, Atomic mass, Molecular Mass, Equivalent mass of some common oxidizing and reducing agents.	Apply the mole concept different redox reagents	K3
	Concentration terms-ppm, mole fraction, Normality, Molarity, Molality.	Interconvert the concentration terms	K4
	Principle of Titrimetry: Neutralization point and end point. Standard solution- Primary and secondary standards.	Demonstrate the basic principles behind Titrimetry	K2
	Types of volumetric analysis: Neutralization, redox, Complexometry and Precipitation titrations.	Compare the significant features of the different types of volumetric Analysis	K2
	Indicars: Fluorescent, redox, Internal and Universal Indicars.	Describe the role of different types of Indicars	K2

4. Mapping (Co, Po, Pso)

L-Low M-Moderate H- High

Course Code: U19CH101 Course Title -

GENERAL CHEMISTRY –I											CODE: U19CH101		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	M	M	L	-	-	L	L		H	-	-	H
CO2	H	H	H	L	-	-	L	L		H	-	-	H
CO3	H	H	M	L	_		L	M		H	_	-	H
CO4	H	H	M	L	H	L	L	H		H	M	H	H
CO5	H	H	L	L	M	L	L	L		H	M	H	H
CO6	H	H	H	-	-	-	L	L		H	L	M	H

5. Course Assessment Methods

DIRECT:

1. Continuous Assessment Test (Model Exams) I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation,Project report, Poster preparation, Proto-type or Product Demonstration etc. (as applicable)
3. End Semester Practical Examination

INDIRECT:

1. Course-end survey

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Core Practical - I: VOLUMETRIC ANALYSIS AND APPLIED EXPERIMENTS
Semester: I **Code: U19CH1P1**
Credits : 2 **Total Hours : 45**
Hours/ week: 3

1. Course Outcomes:

After the completion of this course the students will be able:

S.No.	Course Outcomes	Level
1	Apply knowledge of principles of volumetric Analysis estimate a given analyte.	K3
2	Perform a systematic and skillful volumetric analysis	K4
3	Prepare standard solutions with different concentration units	K4
4	Choose appropriate titrimetric method for a given sample.	K5
5	Produce accurate and precise results in a prescribed format	K5
6	Determine the quality of water used for different purposes	K3

2A Syllabus

Experiments

I. Acidimetry – Alkalimetry
1. Estimation of Hydrochloric acid
2. Estimation of Sodium hydroxide

II. Permanganometry
3. Estimation of ferrous ion in Mohr's salt
4. Estimation of oxalic acid

III. Iodometry and Iodimetry
5. Estimation of copper
6. Estimation of potassium permanganate

IV. Applied Experiments (Complexometry)
7. Estimation of total hardness of water
8. Determination of Calcium in commercial Milk Powder using EDTA

V. Demonstrative Experiment

9. Preparation of Distilled and Deionised water

2B. Reference Books

Vogel, Text Book of Quantitative Chemical Analysis, 6th edition, Pearson Education, 2009.

3. Short Learning Objectives

	Course Content	Learning Outcomes	BTM-Level
1	**Acidimetry – Alkalimetry** 1. Estimation of Hydrochloric acid 2. Estimation of Sodium hydroxide	Evaluate the strength of acids and bases.	K5
2	**Permanganometry** 1. Estimation of ferrous ion in Mohr's salt 2. Estimation of oxalic acid	Determine the concentrations of iron and oxalic acids by Permanganometry	K5
3	**Iodometry and Iodimetry** 1. Estimation of copper 2. Estimation of potassium permanganate	Dtermine the quantity of copper and $KMnO_4$ using Iodine.	K5
4	**Applied Experiments (Complexometry)** 1. Estimation of tal hardness of water 2. Determination of Calcium in commercial Milk Powder using EDTA	Estimate the extent of hardness in given water sample. Estimate the quantity of calcium present in commercial milk powder	K5
5	**Demonstrative Experiment** Preparation of Distilled and Deionized water	Describe the set up of a water distillation and a deionizer unit	K2

4. Mapping Scheme for the PO, PSOs and Cos

L-Low **M-Moderate** **H- High**

VOLUMETRIC ANALYSIS AND APPLIED EXPERIMENTS													**Code: U19CH1P1**
Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	H	L		H	H		L		H	H		H
CO2	H	H	H		H	H		H		H	H		H
CO3	H	H	H		H	H		H		H	H	H	H
CO4	H	H	H		H	H		H		H	H		H
CO5	H	H	H		H	H	H	H		H	H	H	H
CO6	H	H	H	L	H	H		H		H	H		H

5. Course Assessment Methods Direct:

1. Continuous Internal Assessment
2. Model Exams I and II
3. End Semester Practical Examination

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CORE COURSE II: GENERAL CHEMISTRY – II

SEMESTER : II **CODE: U19CH202**

CREDITS:5 **Total Hours : 75**

Hours / week: 5

1. Course Outcomes

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

S.No.	Course Outcomes	Level	Unit
1	Apply the IUPAC nomenclature name hydrocarbons	K3	I
2	Describe the chemistry of alkanes, cycloalkanes, alkenes, dienes and alkynes	K2	II
3	Describe the chemistry of Compounds of Boron, Nitrogen and Oxygen family	K2	III
4	Apply Gas laws to explain the behaviour of gaseous and liquid states in specific systems	K3	IV
5	Classify colloids their characteristics and applications	K3	V
6	Describe the principles concerning solid state structures	K3	V

2A. Syllabus

Unit I - Chemistry of Hydrocarbons **15 Hours**

1.1 IUPAC nomenclature of cyclic & acyclic alkanes: General structure of IUPAC names- Parent name – Root name- locants- branched and unbranched alkanes, alkyl groups, alkenes, dienes and alkynes (upto 20 carbon system).

1.2 Alkanes - Physical properties of Alkanes – Structure and reactions of C-C bonds – Oxidation, Aromatization, Pyrolysis and free radical substitution. Petroleum and petrochemicals - cracking, synthetic petrol, refining of gasoline, reforming, knocking, diesel engine fuel, Octane number and Cetane number.

1.3 Cycloalkanes - Preparation using Wurtz reaction, Kolbe's Electroytic Synthesis, Dieckmann's ring closure and reduction of aromatic hydrocarbons – Substitution and ring opening reactions – Baeyer's strain theory.

Unit II - Chemistry of Unsaturated Hydrocarbons **15 Hours**

2.1 Alkenes: Physical Properties of alkenes – electrophilic and free radical addition reactions (with mechanism) addition reactions of hydrogen, hydrogen halides, (Markownikoff's rule), hydrogen bromide (peroxide effect) and Water. Hydroboration, formation of diols using Bayer's reagent, peroxybenzoic acid and OsO_4, oxidation of alkenes (ozonolysis and acidic $KMnO_4$), allylic substitution by NBS.

2.2 Dienes: Classification – isolated, conjugated and cumulated dienes. 1,3-Butadiene – preparation, chemical reactions – 1,2- and 1,4 -additions, Thiel's theory - Diels-Alder reaction.

2.3 Alkynes: Preparation using-CaC_2**,** dehydrohalogenation of vicinal halides – Kolbe's electrolysis method, Properties – Addition of H_2O, HCN, Halogens and HX, reduction using Lindlar's catalyst, Na and liq. NH_3, Cyclisation of acetylene, Ozonolysis and oxidation with hot alk. $KMnO_4$ and chromic acid – Acidity of alkynes.

Unit III - Chemistry of Group III ,V & VI Elements 15 Hours

3.1 Boron family: Comparative study of boron family, inert pair effect, preparation, properties, structure and uses of boric acid, borax, diborane and borazole. **(Self study: compounds of Al, precious gems, alums)**

3.2 Nitrogen family: Comparative study of halides and oxides of nitrogen group elements, preparation, properties of Oxy acids of nitrogen (HNO_2 and HNO_3) & Oxy acids of phosphorous(H_3PO_3, H_3PO_4, $H_3P_2O_7$) - preparation, properties and structure of hydrazine.

3.3 Oxygen family: Anomalous behavior of oxygen- preparation, properties, structure, Oxidation states and uses of sulphuric acid, Caro's acid, Marshall's acid and oleic acid. Classification of oxides based on chemical behaviour (acidic, basic, amphoteric and neutral oxides) and based on oxygen content (normal, peroxide, superoxide, suboxide and mixed oxide). Preparation, oxidizing and reducing character of H_2O_2.

Unit IV- States of Matter –I 15 Hours

4.1 Gaseous state: Laws of gases– Avagadro's law –Ideal gas equation–R in different units. Kinetic theory of gases. *van der* Waals equation of state – modification of the equation at high, low and moderate pressures and temperature -law of corresponding states - critical states **(with derivation)** - determination of critical constants.

4.2 Liquid state: Vapour pressure– Trouton's rule. Liquid crystals – types, applications of liquid crystals.

UNIT V- States of matter –II 15 Hours

5.1 Colloidal state: Classifications of colloids – Methods of preparation of colloids -peptization, coagulation- Gold Number Rule – Bredict's Arc Method – Chemical Methods – Applications: Reverse osmosis – Desalination of sea water – Dialysis – Delta formation – Artificial rain – Purification of water (addition of polyvalent electrolytes), Sewage disposal- Cottrell's precipitator. Amphoteric nature of colloids, micelle formation of soaps & detergents. Cleansing action of soap.

5.2 Solid state: Elements of symmetry, space lattice and Unit cell, Bravais lattice–seven crystal systems – lattice energy – law of rational indices – Miller indices – X-ray diffraction – Bragg's equation with derivation. Packing in Crystals, Determination of crystallite size using Sherrer Eqation by powder XRD.

2B. Topics for Self-Study:

S.No.	Topics	Web Links
1	Petrochemical Paradox	https://www.youtube.com/watch?v=VQlbiQj_49o
2	Preparation of Liquid crystal	https://www.youtube.com/watch?v=ul2_mYkrkiE
3	Colloids around as	https://www.youtube.com/watch?v=5ckvg2aeNbc&t=429s
4	Packing efficiency in HCP structures	https://www.youtube.com/watch?v=TvRkqL2xid0&t=382s

2C. Text Books

1. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand Co Ltd., New Delhi, 2012. **(Unit I, II, III)**
2. B.R. Puri and L.R. Sharma and Madan S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., Jalandhar, 2017 **(Unit IV, V)**
3. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, New Delhi, 2017 **(Unit V)**
4. P.L. Soni, H.M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, 2004.
5. R.L. Madan and G.D. Tuli, Inorganic Chemistry, S. Chand Co . Ltd., New Delhi, 2010.
6. Gurdeep Raj, Advanced Physical Chemistry, Goel Publishing House, Meerut, 2016.
7. Vogel, Text Book of Qualitative Chemical Analysis, 6th edition., Pearson Education, 2009.

2D. Reference Books

1. J.D. Lee, "Concise Inorganic Chemistry", Oxford University Press, New Delhi, 2008.

2. Morrison and Boyd "Organic Chemistry" Pearson Education, 2016.

3. Peter Atkins and Julio de Paula, "Physical Chemistry" Oxford University Press, 2018.

3. Specific Learning Outcomes (Slo)

Unit/ Sec.	Course Content	Learning Outcomes	Blooms Taxonomic levels of Transaction
I	**Chemistry of Hydrocarbons**		
1.1	**IUPAC Nomenclaturecyclic & acyclic alkanes** :General structure of IUPAC names- Parent name – Root name- locants-branched and unbranched alkanes, alkyl groups, alkenes, dienes and alkynes.(up 20 carbon system)	Apply the IUPAC nomenclature name hydrocarbons	K3
1.2	**Alkanes**: Physical properties of Alkanes	Interpret the general trends in the physical properties of alkanes	K3
	Structure and reactions of C-C bonds	Describe the structure and reactions of C-C bonds	K3
	Oxidation, Aromatization, Pyrolysis and free radical substitution.	Describe the reactions of alkanes	K2
	Peroleum and petrochemicals- cracking, synthetic petrol, refining of gasoline, reforming, knocking, diesel engine fuel and cetane number	Outline the importance of alkanes as petrochemicals	K2
1.3	**Cycloalkanes** : Preparation using Wurtz reaction, Dieckmann's ring closure and reduction of aromatic hydrocarbons – Substitution and ring opening reactions	Describe the methods of preparation of cycloalkanes Write the methods of preparation of a given cycloalkanes	K2 K3

	Baeyer's strain theory	Predict the stability of the different cycloalkanes	K5
II	**Chemistry of unsaturated hydrocarbons**		
2.1	**Alkenes**: Physical Properties of alkenes	Compare the physical properties of alkenes.	K3
	Electrophilic and free radical addition reactions (with mechanism)	Describe the mechanistic details of addition reactions in alkenes	K2
	Addition reactions of hydrogen, hydrogen halides, (Markownikoff's rule),	Predict the product of addition reactions using Markownikoff's rule	K5
	Hydrogen bromide (peroxide effect) and Water. Hydroboration, formation of diols using Bayer's reagent, peroxybenzoic acid and OsO_4, oxidation of alkenes (ozonolysis, and acidic $KMnO_4$),	Utilize the different oxidation reagents for interconversion of functional groups.	K3
	Allylic substitution by NBS	Write the conditions and mechanism of the given allylic substitution	K3
2.2	**Dienes** : Classification – isolated, conjugated and cumulated dienes – butadiene	Classify the diene based on the conjugation.	K2
	Preparation	Apply the general methods of preparation of dienes given cases.	K3
	Chemical reactions – 1, 2 and 1,4 additions, Thiels theory - Diels-Alder reaction.	Predict addition products based on Thiels, Markovikoff and Diels- Alder reactions	K5

2.3	**Alkynes**: Preparation – using CaC_2**,** dehydrohalogenation of vicinal dihalides – Kolbe's electrolysis method -	Describe the steps involved in the preparation of alkynes of different sizes	K2
	Properties – Addition of H_2O, HCN, Halogens and HX, reduction using Lindlar's catalyst, Na and liq. NH- Cyclisation of acetylene, ozonolysis and oxidation with hot alk. $KMnO_4$ and chromic acid – acidity of alkynes.	Predict products of the reactions of alkynes	K3
III	**Chemistry of Group III ,V & VI Elements**		
3.1	**Boron family** : Comparative study of boron family	Illustrate the characteristic of the boron family	K3
	Inert pair effect	Apply inert pair effect explain the electronic arrangement of theams	K3
	Preparation, properties, structure and uses of boric acid, borax, diborane and borazole.	Describe the properties and uses of boron and its derivatives	K2
	Self study: compounds of Al, precious gems, alums	Identify compounds of Aluminium, precious gems and alums	K3
3.2	**Nitrogen family** : Comparative study of halides and oxides of nitrogen group elements,	Compare the chemistry of halides and oxides of nitrogen group elements	K2
	Preparation, properties of Oxy acids of nitrogen (HNO_2 and HNO_3) & Oxy acids of phosphorous(H_3PO_3, H_3PO_4, $H_3P_2O_7$) -	Describe the preparation and properties of the oxy acids of nitrogen and phosphorous	K2
	Preparation, properties and structure of hydrazine.	Describe the preparation, properties and structure of hydrazine	K2

3.3	**Oxygen family:** Anomalous behaviour of oxygen	Explain the Anomalous behaviour of oxygen	K2
	Preparation, properties, structure, Oxidation states and uses of sulphuric acid, Caro's acid, Marshall's acid and oleic acid.	Describe the preparation methodology, properties, structure and uses of mineral acids	K2
	Classification of oxides based on chemical behaviour (acidic, basic, amphoteric and neutral oxides) and based on oxygen content (normal, peroxide, superoxide, suboxide and mixed oxide).	Categorize the oxides based on their chemical behaviour and oxygen content	K3
	Preparation, oxidizing and reducing character of H_2O_2.	Utilize H_2O_2 as reducing and oxidizing agent in specific reactions	K3
IV	**States of Matter-I**		
4.1	**Gaseous state** – laws of gases – Avagadro's law – Ideal gas equation – R in different units.	Justify by applying ideal gas equation how a gas responds changes in P, V, n, or T.	K5
	Kinetic theory of gases. *van der* Waals' equation of state – modification of the equation at high, low and moderate pressures and temperature, -law of corresponding states -	Discuss the modifications of *van der* Waals' equation with respect pressure and temperature	K2
	Critical states (with derivation) - determination of critical constants	Calculate the critical constant values	K3
4.2	**Liquid state** – vapour pressure – Troun's rule.	Calculate the molar heat of vaporization of a liquid using Troun's rule	K3
	Liquid crystals – types, applications of liquid crystals.	Summarize the properties of liquid crystals and their applications	K2

V	States of Matter- II		
5.1	Colloidal state –Classifications of colloids Methods of preparation of colloids -peptisation, coagulation	Classify different colloids used in day day life.	K4
	Applications – reverse osmosis – desalination of sea water – dialysis – delta formation – artificial rain – purification of water (addition of polyvalent electrolytes), Amphoteric nature and micelle formation of soap -detergent action of soap – sewage disposal- Cottrell's precipitar.	Explain the applications of colloids	K2
5.2	Solid state – Elements of symmetry, space lattice and Unit cell, Bravais lattice – seven crystal systems – lattice energy –	Analyze specific crystal structures by applying Elements of symmetry	K4
		Compute the parameters of a crystal lattice.	K4
	Law of rational indices – Miller indices – X-ray diffraction – Bragg's equation with derivation. Packing in Crystals, Determination of crystallite size using Sherrer's Eqationby powder XRD	Relate diffraction intensities mathematically structural parameters and derive extinction conditions based on Bragg's equation	K4
		Evaluate the packing of crystals and calculate crystal size.	**K5**

4. Mapping Scheme for the PO, PSOs and COs

L-Low M-Moderate H- High

GENERAL CHEMISTRY – II												**CODE: U19CH202**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	H	--	--	--	--	M	H	--	H	--	--	H
CO2	H	H	--	--	--	--	M	H	--	H	--	--	H
CO3	H	H	--	--	--	--	M	H	--	H	--	--	H
CO4	H	H	H	--	--	--	M	H	--	H	--	M	H
CO5	H	H	--	--	--	--	M	H	--	H	--	--	H
CO6	H	H	--	--	--	--	M	H	--	H	--	M	H

5. Course Assessment Methods

DIRECT:

1. Continuous Assessment Test (Model Exams) I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation,Project report, Poster preparation, Proto-type or Product Demonstration etc. (as applicable)
3. End Semester Practical Examination

INDIRECT:

1. Course-end survey

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SBEC I: TEXTILE CHEMISTRY

Semester: II **Code: U19CH2S1**
Credits: 2 **Total Hours: 30**
Hours/ week: 2

1. Course Outcomes

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

S.No.	Course Outcomes	Level	Unit
1	Describe the types and properties of Fibers	K2	I
2	Outline the manufacturing processes of the cotton and synthetic fibers	K2	II
3	Compare and classify Dyes based on their nature	K2	III
4	Elaborate the bonding interactions of dyes with Fibers	K2	III
5	Apply the principles of the dyeing process	K3	IV
6	Comprehend the entire process of manufacture of clothing	K2	V

2A. Syllabus

UNIT–I Structure of Fibres 06 Hours

1.1 Introduction - Classification of fibres: natural, synthetic and semi synthetic fibres.
1.2 Structure of textile fibres: Cotton, wool, silk, nylon, polyester, polyacrylamide.
1.3 Physical, chemical and biological properties and uses of cellulose fibre(cotton), protein fibre(silk and wool) and synthetic fibres (nylon and polyester).

UNIT–II Manufacture and Processing of Fibres 06 Hours

2.1 Synthetic fibres: Preparation, properties and Uses of Nylon 6, Nylon 66, Polyester and polyacrylamide.
2.2 Semi - Synthetic fibres: Rayon - manufacture of viscose rayon, cuprammonium rayon and Acetate rayon.
2.3 Mercerization- Mercerisation process and its applications.

UNIT–III Dyes 06 Hours

3.1 Dyes – Requisites of a dye –Theories of colour - Witt Theory and Modern theory.
3.2 Classification of dyes with examples – according to application and structure. (**Preparation not required**)
3.3 Dye-Fibre interactions: Ionic, Covalent, van der Waals, H-bonding interactions.
3.4 Dyeing assisting agents: NaOH, Na_2CO_3, aluminium sulphate, chromic sulphate.

UNIT–IV **Principles of Dyeing Processes** **06 Hours**

4.1 General concept of dyeing process: affinity of a dye, conditions for dyeing, selection of dye stuff.
4.2 Dyeing methods – Direct dyeing, Stock dyeing, Yarn dyeing, piece dyeing and garment dyeing.
4.3 Silk dyeing.

UNIT– V **Treatment Processes** **06 Hours**

5.1 After treatment processes - Stripping of dyes, low temperature dyeing.
5.2 Sizing and Bleaching: Sizing agents and applications, Reductive and oxidative bleaching agents.
5.3 Brightening agents: Optical brightening agents-Types and uses

2B. Topics for Self-Study:

S.No.	Topics	Web Links
1	**Structure of Fibres**	http://www.materials.unsw.edu.au/tutorials/online-tutorials/2-glass-fibres https://www.youtube.com/watch?v=ZUroZZFx-B4 https://www.youtube.com/watch?v=Ew22Lc3I9K8 https://www.youtube.com/watch?v=sqKbgqFpwbo
2	**Manufacture and Processing of Fibres**	youtube.com/watch?v=fNdsOraykNI https://www.youtube.com/watch?v=k2GKVG-2qeM https://www.youtube.com/watch?v=QHgNoSYlhYs
3	**Dyes**	https://www.youtube.com/watch?v=sLcT7P-ZS4E https://www.youtube.com/watch?v=2sHlLNzTpUU https://www.youtube.com/watch?v=_-ZKef9nyLA
4	**Principles of Dyeing Processes**	https://www.youtube.com/watch?v=8R4lAladUj0 https://www.youtube.com/watch?v=k-N_1TfNtFg https://www.youtube.com/watch?v=vc8e2wjmfbw
5	**Treatment Processes**	https://www.youtube.com/watch?v=BHiSlnq9Kaw https://www.youtube.com/watch?v=m1xU6ELQ5Mw https://www.youtube.com/watch?v=YEc4s31no94

2C. Text Books

1. B.K. Sharma, “Industrial Chemistry”, Goel Publishing Co., 1997 **(Unit- I, II, III).**
2. Jain and Jain, “Engineering Chemistry”, Dhanpat Rai & Sons, 1995 **(Unit- IV, V).**

2D. References

1. Bernard. P. Corbman, "Textile (Fibre to Fabric)", The Gregg / Mcgraw-Hill, Marketing series, 1983.
2. J N.Chakraborty, "Fundamentals and Practices in Colouration of Textiles," Woodhead Publishing India , 2010.
3. Arora, "Textile chemistry" Abishek Publications, 2011.
4. Rajbir Singh, "Synthetic dyes", Mittal Publications, 2002.

3. Specific Learning Outcomes (SLO)

Unit	Course Content	Learning Outcomes	Blooms Taxonomic levels of Transaction
I	**Structure of Fibres**		
	1.1 Introduction - Classification of fibres: natural, synthetic and semi synthetic fibres.	Classify the fibers with examples	K2
	1.2 Structure of textile fibres: Cotton, wool, silk, nylon, polyester, polyacrylamide.	Categorize the textile fibers based on the nature of fibers.	K2
	1.3 Physical, chemical and biological properties and uses of cellulose fibre(cotton), protein fibre(silk and wool) and synthetic fibres (nylon and polyester).	Write the properties and uses of fibres	K2
II	**Manufacture and Processing of Fibres**		
	2.1 Synthetic fibres: Preparation, properties and Uses of Nylon 6, Nylon 66, Polyester and polyacrylamide.	Explain the chemistry of synthetic fibers	K2
	2.2 Semi - synthetic fibres: Rayon - manufacture of viscose rayon, cuprammonium rayon and Acetate rayon.	Explain the manufacturing of rayon	K2
	2.3. Mercerization- Manufacture of mercerized cotton and its applications.	Describe the manufacturing process of mercerized cotton	K2
III	**Dyes**		
	3.1 Dyes – Requisites of a dye –Theories of colour - Witt Theory and Modern theory.	Comprehend the theories of color	K2
	3.2 Classification of dyes with examples – according application and structure. (**Preparation not required**)	Classify dyes based on the structure and application.	K2

	3.3 Dye-Fibre interactions: Ionic, Covalent, van der Waals, H-bonding interactions.	Explain the different types of Dye fiber interaction.	K2
	3.4 Dyeing assisting agents: NaOH, Na_2CO_3, aluminium sulphate, chromic sulphate.	Comprehend the role of dyeing assisting agents	K2
		Describe the role of dyeing assisting agents	K2
IV	**Principles of Dyeing Processes**		
	4.1 General concept of dyeing process: affinity of a dye, conditions for dyeing, selection of dye stuff.	Explain the concept of dying process	K2
	4.2 Dyeing methods – Direct dyeing, p dyeing, Stock dyeing, Yarn dyeing, piece dyeing and garment dyeing.	Describe the dyeing methods with examples	K2
	4.3 Silk dyeing.	Apply the different dyeing methods explain the significance of silk dying process	K3
	Unit V Treatment Processes		
	5.1 After treatment processes - Stripping of dyes, low temperature dyeing.	Explain the After -treatment process.	K2
	5.2 Sizing and Bleaching: sizing agents and applications, Reductive bleaching, oxidative bleaching agents.	Distinguish the chemistry of various types of bleaching agents.	K2
	5.3 Brightening agents: - Optical brightening agents-Types and uses.	Identify the types of brightening agents.	K2
		Test the various types of brightening agents	K2

4. Mapping Scheme for COs, POs and PSOs

L-Low **M-Moderate** **H- High**

TEXTILE CHEMISTRY										Code: U19CH2S1			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	H	H	H	H	-	H	M	L	H	L	L	L
CO2	H	H	M	L	L	-	L	L	L	H	M	M	M
CO3	H	H	H	H	H	-	H	M	M	H	H	H	H
CO4	H	H	M	H	H	-	M	M	M	H	H	H	H
CO5	H	H	M	H	M	-	M	M	M	H	H	H	H
CO6	H	H	M	H	M	-	H	M	H	H	H	H	H

5. Course Assessment MethodsDirect:

1. Continuous Assessment Test (Model Exams) I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Proto-type or Product Demonstration etc. (as applicable)
3. End Semester Practical Examination

INDIRECT:

1. Course-end survey

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ELECTIVE I- PRACTICAL
APPLICATIONS OF COMPUTER IN CHEMISTRY

Semester : II **Code : U19CH2:P**
Credits: 2 **Total Hours : 45**
Hours/ Week : 3

1. Course Outcomes

On completion of the course the student will be able to

S.No.	Course Outcomes	Level
1	Draw Chemical structure, reaction pathways and apparatus set up using Chemistry drawing Tools	K3
2	Perform basic quantum chemical calculations using ARGUS LAB	K3
3	Relate the structure with the properties of chemical compounds using Online and offline software	K3
4	Retrieve Physical and Chemical properties using relevant software	K3
5	Convert output & input files required digital formats	K2
6	Visualize the different Molecular orbitals of chemical compounds	K2

2A. Syllabus

Experiments

1. Calculation of Heat of formation of conformers using ARGUS Lab Software.
2. Calculation of Strain energies of alicyclic rings using ARGUS Lab Software.
3. Visualization of Molecular orbitals and lone pairs in simple molecules using ARGUS Lab Software.
4. Calculation of bond energies, bond orders and bond lengths of delocalized and resonance stabilized bonds.
5. Introduction chemistry drawing ols - *ISIS draw*, *Chemsketch*, *Chemdraw*, *Chemdoodle* - Drawing chemical structure, writing chemical equation.
6. Drawing the structure of alkanes from methane n-dodecane. Calculation of their Properties and Comparing their Melting and Boiling Points.
7. Construction of Linear and Branched chain alkanes containing 5,6,7 & 8 carbons and Tabulating their properties like Melting and Boiling Points.
8. Drawing the cis- and trans- isomers of 1,2-dichloroethene, 1,2-dicarboxyethene and 1,2- diphenylethene. Calculation and Comparison of their dipolemoments.
9. Sketch the apparatus setup for a distillation process using Chemdraw.

10. Draw the molecular structure of the given Natural Product and get its physical Properties: (a) Caffein (b) Nicotine.
11. Depict the mechanism of a simple S_N1 reaction using Chemdraw. Indicate the mobility of electrons by arrows.
12. Using the template ol draw any 5 fused aromatic ring systems and find their IUPAC Names using 'structure name' option

S.No	Course Content	Learning Outcomes	Blooms Taxonomic levels of Transaction
1	Calculation of Heat of formation of conformers using ARGUS Lab Software	Compute Heat of formation of given conformers using Argus software	**K3**
2	Calculation of Strain energies of alicyclic rings using ARGUS Lab Software	Use Argus Lab find out the strain energies of alicylic rings	**K3**
3	Visualization of Molecular orbitals and lone pairs in simple molecules using ARGUS Lab Software	obtain the molecularorbitals and lone pair ofelectrons in molecules using Argus software	**K2**
4	Calculation of bond energies, bond orders and bond lengths of delocalized and resonance stabilized bonds.	Compute the bond energies, bond orders and bond lengths of different types of bonds	**K3**
5	Introduction chemistry drawing ols - *ISIS draw*, *Chemsketch*, *Chemdraw*, *Chemdoodle* - Drawing chemical structure, writing chemical equation	Draw any chemical structureusing drawing ols like ISISdraw, Chemsketch, Chemdraw, Chemdoodle	**K2**
6	Drawing the structure of alkanes from methane n-dodecane. Calculationof their Properties and Comparing their Melting and Boiling	Construct the structure and compare the properties (melting and boiling points) of alkanes Relate the Chemical &	**K3**

	Points	Physical properties obtained from calculations Chemical structures.	
7	Construction of Linear and Branched chain alkanes containing 5,6,7 & 8 carbons and Tabulating their properties like Melting and Boiling Points.	Retrieve the properties (melting and boiling point, dipolemoment etc) of branched alkanes from CHEMDRAW.	**K3**
8	Drawing the cis- and trans- isomers of 1,2-dichloroethene, 1,2-dicarboxyethene and 1,2- diphenylethene. Calculation and Comparison of their dipolemoments.	Determine the dipole moment of cis and trans isomers using ARGUS LAB.	**K3**
9	Sketch the apparatus setup for a distillation process using Chemdraw	Draw the apparatus setup fordistillation process	**K2**
10	Draw the molecular structure of the given Natural Product and get its physical Properties: (a) Caffein (b) Nicotine.	Retrieve the physical properties of natural products along with its structure from the chemdraw software	**K3**
11	Depict the mechanism of a simple S_N1 reaction using Chemdraw. Indicate the mobility of electrons by arrows.	Depict the mechanistic pathway of S_N1 reaction using Chem draw	**K2**
12	Using the template draw any 5 fused aromatic ring systems and find their IUPAC Names using 'structure name' option.	Draw the structure of fused aromatic rings along with its IUPAC names	**K3**

2C. Text Books

1. Course Handout on "Basics of Computation ols for Chemists" developed and published by PG & Research Dept. of Chemistry, Bishop Heber College,Trichy.2020.(for private Circulation Only)

2. User Manual of Chemdoodle- https://www.ichemlabs.com/downloads/ChemDoodle3DUserGuide.pdf
3. User Manual of Chemdraw - https://www.perkinelmer.com/lab-products-and-services/resources/software-downloads.html
4. User Manual of Argus Lab Software - http://www.arguslab.com/arguslab.com/ArgusLab.html

2D. References

1. Guy H. Grant & W. Graham Richards, Computational Chemistry, Oxford University Press, 2005.
2. Andrew R. Leach, "Molecular modeling Principles & Applications", Prentice Hall, 2nd edition, 2008.

4. Mapping Scheme for COs, POs and PSOs

ELECTIVE I - PRACTICAL

Applications of Computer In Chemistry **Code : U19CH2:P**

Mappin	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M		M	-	M	-			H			H
CO2	H	M	H	M	-	H	-	H		H		H	H
CO3	H	M	H	M	-	H	-	H		H		H	H
CO4	H	M		M	-	H	-			H			H
CO5		L		M	-		H			H			H
CO6	H	M	M	M	-	L	-	M		H		M	H

Core - III: GENERAL CHEMISTRY – III

SEMESTER : III **CODE: U19CH303**
CREDITS: 5 **Total Hours : 90**
Hours/Week: 6

1. Course Outcomes

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

S.No.	Course Outcomes	Level	Unit
1	Summarize the chemistry of halogens, oxyacids of halogens, the trends in properties and reactivity of the f-block elements and d-block elements and their compounds, alcohols, phenols, aliphatic halogen compounds, benzene and its derivatives.	K4	I-IV
2	Describe the anomalous behavior of fluorine, differences between pseudo-halogens interhalogens and halogens, chemistry of cyanogens, thiocyanogen and Astatine, separation of lanthanides, extraction of actinides and chemistry of aromatic alcohols.	K4	I, II, IV
3	Compare the structural and chemical aspects of haloacids, oxyhalides, interhologens, ethers, epoxides and mono-, di, and trihydric alcohols.	K5	I, III
4	Explain the role of the concepts - solubility product, common ion effect in group separation.	K4	II
5	Comprehend the structure of benzene and the effect of substituent in benzene ring.	K5	IV
6	Explain the theories of reaction rate, types and Mechanism of adsorption, the concept of catalysis and the factors affecting catalysis.	K5	V

2A. Syllabus

Unit–I Chemistry of Halogens and d-block elements 18 Hours

1.1 Halogens & Interhalogens - Diatomic nature –oxidizing property – Electron affinity - Electronegativity - size effect. Comparison of halogens with O, N & C groups - Anamolous behavior of fluorine – Chemical properties of haloacids and oxyhalides. Interhalogens – Preparation, structure and bonding of AX, AX_3, AX_5 and AX_7 type interhalogens - uses. Pseudo-halogens - Comparison with halogens - Preparation, properties and uses of cyanogen and thio-cyanogen, Chemistry of Astatine, Oxyacids of halogens – $HClO_4$, $HClO_3$, $HClO_2$, HClO.

1.2 d-block elements – Introduction - General characteristics (metallic character, atomic and ionic radii, oxidation states, colour, complex formation and magnetic properties). Preparation, properties and uses of some Important compounds (Zeigler- Natta catalyst, Prussian blue, sodium nitroprusside, Turnbull's blue, Wilkinson's catalyst, $KMnO_4$, $K_2Cr_2O_7$).

Unit–II f-Block Elements and Principles of Qualitative analysis 18 Hours

2.1 Lanthanides–general study of lanthanides involving electronic configuration, oxidation states, and complexation behavior, Lanthanides – separation by Ion-exchange and solvent extraction methods – lanthanide contraction.

2.2 Actinides–-occurrence–electronic configuration–oxidation states and complexation behaviour–extraction of thorium and uranium – and uses, Actinide contraction.

2.3. Principles of Qualitative Analysis - Reactions involved in the detection of anions and cations: F^-, Cl^-, Br^-, NO_3^-, CO^{2-}, SO_4^{2-}, PO^{3-}, $C_2O_4^{2-}$,BO^{3-}, Pb^{2+}, Cd^{2+}, Bi^{3+},Cu^{2+}, Fe^{2+}, Al^{3+}, Ni^{2+}, Co^{2+}, Zn^{2+}, Ca^{2+}, Ba^{2+}, Sr^{2+}, Mg^{2+} and NH_4^+ ions. Solubility product, Common ion effect, Interfering and Non-Interfering radicals, principle involved in group separation and in the preparation of Na_2CO_3 extract.

Unit–III Chemistry of Alcohols, Ethers and Organohalogens 18 Hours

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

3.2 Ethers - Nomenclature, preparation, chemical reactions –cleavage reactions and auto oxidation, Zeisel's method. Epoxides – preparation and Properties.

3.3 Organohalogens - Nomenclature – Aliphatic halogen compounds – preparation, properties and uses of CH_2Cl_2, $CHCl_3$, CCl_4 and vinyl chloride – Commercially important halogen compounds – Westorn, Freon, DDT and BHC - Synthesis and uses.

Unit–IV Aromatic Compounds 18 Hours

4.1 Aromaticity - Nomenclature of benzene derivatives, structure of benzene – molecular formula and Kekule structure – Stability and C-C bond length of benzene, MO picture, MOT of aromaticity, Application of Huckel's rule to benzene, naphthalene and anthracene.

4.2 Effects of substituent in benzene ring–Reactivity and orientation–Theory of reactivity-Electrophilic substitution reactions – Mechanism of nitration, halogenation, sulphonation, Mercuration, Friedel-Crafts alkylation and acylation.

4.3 Phenols: Preparation, properties, and reactions of Phenol - Coupling reaction - Acidity of Phenols- Preparation, properties and reactions of Resorcinol, Catechol and Quinol.

Unit–V Kinetics & Catalysis 18 Hours

5.1 Definition– Determination of rate using Concentration versus Time curves – Rate laws and Rate constants for zero, I, II and III order reactions– unit of rate constants – Order and Molecularity – Derivation of expressions for rate constants for zero, I, II and III order reactions–half–life period (**Problems**) - Pseudo first order reaction, methods of determination of order of reactions - integration, graphical, half-life and Ostwald's isolation methods. Factors affecting rate of reaction.

5.2 Temperature dependence of reaction rate–Arrhenius parameters and calculations–Theories of reaction rate - Simple Collision Theory – limitations -ARRT – thermodynamic derivation of rate constant. Steady State Approximation - Lindemann's Hypothesis of unimolecular reactions.

5.3 Adsorption- Introduction - Types of adsorption and Mechanisms – Factors affecting Adsorption - adsorption isotherms - Freundlich, Gibb's and Langmuir isotherms (Derivation not required).

5.4 Catalysis - Introduction - Types of catalysis – Intermediate compound formation Theory and Adsorption theory- Factors affecting the catalysis – Positive and Negative Catalysts - Catalytic promoters and poisons – Auto catalysis - Enzyme catalysis – Derivation of Michaelis–Mentenequation.

2B. Topics for Self-Study:

S.No.	Topics	Web Links
1	Charge Transfer Spectra	https://careerendeavour.in/wp-content/uploads/2018/09/coordination-chemistry.pdf
2	Magnetic properties of inner transition elements	https://unacademy.com/lesson/magnetic-properties-of-f-block-elements/DSZI4Z60
3	Macromolecules (Crown ethers) and its applications	https://ttu-ir.tdl.org/bitstream/handle/2346/18570/31295007060477.pdf?sequence=1
4	industrial applications of enzymes	https://www.sepmag.eu/blog/industrial-uses-of-enzymes
5	Craig's rule for Aromaticity	https://youtu.be/sUtqD9qv5S8

2C. Text Books:

1. B.R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, Milesne Publishers, NewDelhi, 2017 **(Unit- I, II, V).**
2. Arun Bahl and B.S. Bahl, *Advanced Organic Chemistry*, S. Chand Co. Ltd., New Delhi, 2012 **(Unit-III).**
3. B.R. Puri, L.R. Sharma and Madan S. Pathania, *Principles of Physical Chemistry*, Vishal Publishing Co., Jalandhar, 2017 **(Unit- IV).**

2D. Recommended Reference Books:

1. J.D. Lee, "*Concise Inorganic Chemistry*", Oxford University Press, New Delhi, 2008.
2. Morrison and Boyd "*Organic Chemistry*" Pearson Education, 2016.
3. Peter Atkins and Julio de Paula, "*Physical Chemistry*" Oxford University Press, 2018.
4. R.L. Madan and G.D. Tuli, *Inorganic Chemistry*, S.Chand Co. Ltd., New Delhi,2010.
5. Gurdeep Raj, *Advanced Physical Chemistry*, Goel Publishing House, Merrut, 2016.
6. V.B. Patania, *Chemical Kinetics*, Campus Publications, New Delhi, 2004.

3. Specific Learning Outcomes (SLO)

Unit/Section	Course Content	Learning Outcomes	Blooms Taxonomic levels of Transaction
I	**Chemistry of Halogens and d-block Elements**		
1.1	Properties of Halogens and interhalogens: Diatomic nature, oxidizing property, electron affinity, electronegativity, size effect	Relate the periodic trends and reactivity of halogens and interhalogens	K4
	Comparison of halogens with O, N & C groups	Compare and contrast the properties of halogens with the O, N and C groups	K4
	Anamolous behavior of fluorine	List out the anomalous behavior of fluorine	K2
	Chemical properties of haloacids and oxyhalides	Consolidate the chemistry of haloacids and oxyhalides	K3
	Preparation, uses, structure and bonding of AX, AX_3, AX_5 and AX_7 type interhalogens	Summarize the chemistry of different types of interhalogens	K3

	Comparing pseudo-halogens with halogens	Compare the properties of pseudo-halogens and halogens	K2
	Preparation, properties and uses of cyanogen and thio-cyanogen	Summarize the chemistry of cyanogens and thiocyanogen	K2
	Chemistry of Astatine	Outline the chemistry of astatine	K2
	Chemistry of oxyacids of halogens – $HClO_4$, $HClO_3$, $HClO_2$, HClO	Compare the chemistry of different oxy acids of halogens	K5
1.2	Introduction to d-block elements and their general characteristics (metallic character, atomic and ionic radii, oxidation states, colour, complex formation and magnetic properties)	Compare the general characteristics of the different d-block elements	K4
	Preparation, properties and uses of Zeigler- Natta catalyst, Prussian blue, sodium nitroprusside, Turnbull's blue, Wilkinson's catalyst, $KMnO_4$, $K_2Cr_2O_7$	Interpret the chemistry of Zeigler- Natta catalyst, Prussian blue, sodium nitroprusside, Turnbull's blue, Wilkinson's catalyst, $KMnO_4$ and $K_2Cr_2O_7$	K4
II	**f- Block elements and Principles of Qualitative Analysis**		
2.1	General study of lanthanides involving electronic configuration, oxidation states, lanthanide contraction and complexation behavior	Comprehend the general properties of lanthanides	K4
	Separation of lanthanides by ion-exchange and solvent extraction methods	Outline the various processes involved in the separation of lanthanide ions	K2
2.2	Occurrence, electronic	Analyze the general	K4

	configuration, oxidation states, actinide contraction and complexation behaviour of actinides	properties of lanthanides	
	Extraction of thorium and uranium and their uses	Illustrate the extraction of thorium and uranium and their uses	K2
2.3	Reactions involved in the detection of anions and cations: F^-, Cl^-, Br^-, NO_3^-, CO_3^{2-}, SO_4^{2-}, PO_4^{3-}, $C_2O_4^{2-}$, BO_3^{3-}, Pb^{2+}, Cd^{2+}, Bi^{3+}, Cu^{2+}, Fe^{2+}, Al^{3+}, Ni^{2+}, Co^{2+}, Zn^{2+}, Ca^{2+}, Ba^{2+}, Sr^{2+}, Mg^{2+} and NH_4^+ ions	Categorize the reactions involved in the detection of some cations and anions.	K4
	Interfering and Non-Interfering radicals	Identify the interfering and non-interfering radicals	K3
	The concept of solubility product and common-ion effect	Examine the concepts of solubility product and common-ion effect	K4
	Principle involved in group separation and in the preparation of Na_2CO_3 extract	Describe the principle involved in group separation	K4
III	**Chemistry of Alcohols, Ethers and Organo Halogens**		
3.1	Classification and nomenclature of monohydric alcohols	Organize the various monohydric alcohols	K3
	Preparation of alcohols by reduction of aldehydes, ketones, carboxylic acids and hydrolysis of esters	Distinguish the preparation of alcohols	K4
	Hydrogen bonding and acidic nature of alcohols. Reactions of alcohols - Etherification, Alkylation reaction of halogen acids, dehydrogenation,	Summarize the properties of alcohols	K5

	oxidation		
	Chemistry of dihydric and trihydric alcohols	Apply the chemistry of dihydric and trihydric alcohols	K3
	Preparation, uses and properties of glycerol (cleavage reactions of polyhydric alcohols with $Pb(OAc)_4$, HIO_4, OsO_4) - Preparation, uses and properties of Explain the chemistry of glycerol	Utilize the chemistry of glycerol and glyceryl trinitrate	K3
3.2	Nomenclature, preparation and chemical reactions of ethers (cleavage reactions and au oxidation by Zeisel's method) - Preparation and properties of epoxides	Describe the chemistry of ethers and epoxides	K3
	Nomenclature, preparation, properties and uses of aliphatic halogen compounds (CH_2Cl_2, $CHCl_3$, CCl_4 and vinyl chloride)	Explain the chemistry of aliphatic halogen compounds	K4
IV	**Aromatic Compounds**		
4.1	Nomenclature of benzene derivatives	Name the benzene derivatives using IUPAC rules.	K3
	Structure of benzene - molecular formula and Kekule structure – stability and C-C bond length of benzene, MO picture	Explain the structure of benzene	K4
	MOT of aromaticity, application of Huckel's rule benzene, naphthalene and anthracene	Explain the MOT of aromaticity and Huckle's rule	K5
	Effects of substituent in benzene ring	Distinguish the effects of various substituents in	K4

		benzene ring	
	Electrophilic substitution reactions	Apply electrophilic substitution mechanism in formation of benzene derivatives	K4
4.2	Effects of substituent in benzene ring–Reactivity and orientation–Theory of reactivity	Predict products based on reactivity and orientation principles	K3
	Electrophilic substitution reactions – Mechanism of nitration, halogenation, sulphonation, Mercuration, Friedel-Crafts alkylation and acylation	Elucidate the mechanism of given electrophilic substitution reactions	K4
4.3	Preparation, properties, and reactions of Phenol - Coupling reaction - Acidity of Phenols	Apply the chemistry of phenols for interconversion of functional groups	K4
	Preparation, properties and reactions of Resorcinol, Catechol and Quinol	Understand the chemistry of resorcinol, catechol and quinol	K2
V	**Kinetics and Catalysis**		
5.1	Definitions	Define terms commonly used in chemical kinetics	K1
	Determination of rate using Concentration versus Time curves – Rate laws and Rate constants for zero, I, II and III order reactions– unit of rate constants	Summarize the rate Laws.	K2
	Order and Molecularity	Find out the order and molecularity of a given reactions	K2
	Derivation of expressions for rate constants for zero, I, II and	Derive the expressions for rate constants of zero, I, II	K5

	III order reactions–half–life period (Problems)	and III order reactions	
	Pseudo first order reaction, methods of determination of order of reactions - integration, graphical, half-life and Ostwald's isolation methods	Elaborate the methods of determining the rate of reactions of different order and half-life of a reaction	K2
	Factors affecting rate of reaction	Outline the factors affecting the rate of a reaction	K2
5.2	Temperature dependence of reaction rate–Arrhenius parameters and calculations	Relate the temperature dependence of reaction rates	K3
	Theories of reaction rate - Simple Collision Theory – limitations -ARRT	Illustrate ARRT	K2
	Thermodynamic derivation of rate constant	Derive the thermodynamic basis of rate constant	K2
	Steady State Approximation - Lindemann's Hypothesis of unimolecular reactions	Apply steady state approximation in derivation of rate laws.	K3
5.3	Introduction to adsorption and types of adsorption	Classify the types of adsorption	K2
	Factors affecting Adsorption and the Mechanisms of adsorption	Relate the factors affecting adsorption and the mechanism involved	K2
	Adsorption isotherms - Freundlich, Gibb's and Langmuir isotherms (Derivation not required)	Interpret the different adsorption isotherms	K2
5.4	Introduction to catalysis and types of catalysis	Summarize the characteristics of the typesof catalysis	K2

	Intermediate compound formation Theory and Adsorption theory	Describe the theories of adsorption	K2
	Factors affecting the catalysis – Positive and Negative Catalysts - Catalytic promoters and poisons	List out the factors affecting positive and negative catalysts	K3
	Enzyme catalysis – Derivation of Michaelis–Menten equation	Derive the Michaelis Menten equation.	K2

4. Mapping scheme for COs, POs and PSOs

L-Low **M-Moderate** **H- High**

GENERAL CHEMISTRY – III												**CODE: U19CH303**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**H**	**H**	**L**	**-**	**-**	**-**	**-**	**M**	**-**	**H**	**-**	**-**	**H**
CO2	**H**	**H**	**H**	**-**	**-**	**-**	**-**	**M**	**-**	**H**	**-**	**-**	**H**
CO3	**H**	**H**	**H**	**-**	**-**	**-**	**-**	**M**	**-**	**H**	**-**	**-**	**H**
CO4	**H**	**H**	**H**	**-**	**-**	**-**	**-**	**M**	**-**	**H**	**-**	**-**	**H**
CO5	**H**	**H**	**H**	**-**	**-**	**-**	**-**	**M**	**-**	**H**	**-**	**-**	**H**
CO6	**H**	**H**	**H**	**-**	**-**	**-**	**-**	**M**	**-**	**H**	**-**	**M**	**H**

5.Course Assessment Method Direct:

1. Continuous Assessment Test (Model Exams) I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Proto-type or Product Demonstration etc. (as applicable)
3. End Semester Practical Examination

Indirect:

1. Course end survey **********

Core Practical - II: INORGANIC QUALITATIVE ANALYSIS

Semester: III **Code: U19CH3P2**
Credits: 2 **Total Hours :45**
Hours/Week : 3

1. Course outcomes:

After the completion of this course the students will be able to

S.No.	Course Outcomes	Level
1	Recall the basic Principles of Inorganic Qualitative Analysis.	K2
2	Apply the various principles identify the cations and anions systematically.	K3
3	Exhibit analytical skill in identifying a given inorganic mixture using Systematic semi micro method with green approach.	K4
4	Separate the cations in different groups	K3
5	Confirm the cations and anions by Confirmatory tests	K5
6	Present a Scientific report without violating protocols and procedures.	K4

2A. Syllabus

Experiments

I. Cations to be analysed:
Lead, Copper, Bismuth, Cadmium, Iron, Aluminium, Zinc, Manganese, Cobalt, Nickel, Barium, Calcium, Strontium, Magnesium and Ammonium.

II. Anions to be analysed:
Carbonate, Sulphide, Sulphate, Nitrate, Chloride, Bromide, Fluoride, Borate, Oxalate and Phosphate.

2C. Text Books

1. V. Venkateswaran , R. Veeraswamy, A.R. Kulandaivelu, Basic Principles of Practical Chemistry, S. Chand & Co., New Delhi,1997.

2D. References

1. Vogel, Text Book of Quantitative Chemical Analysis, 6th Edition, Pearson Education, 2009.

3. Specific Learning Outcomes:

Unit	Course content	Learning Outcomes	Blooms Taxonomic level of Transaction
1.	Cations to be analysed: Lead, Copper, Bismuth, Cadmium, Iron, Aluminium, Zinc, Manganese, Cobalt, Nickel, Barium, Calcium, Strontium, Magnesium and Ammonium	To identify the cations and anions in a mixture	K4
2.	Anions to be analysed: Carbonate, Sulphide, Sulphate, Nitrate, Chloride, Bromide, Fluoride, Borate, Oxalate and Phosphate	To analyse systematically the given unknown samples.	K5
		To practice laboratory ethics and to adopt the ethical values in the semi-micro analysis	K5

4. Po, Pso & Co Mapping

INORGANIC QUALITATIVE ANALYSIS											**Code: U19CH3P2**		
Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	M	H	L	H	H	-	M	-	H	M	-	H
CO2	H	M	M	L	H	H	L	H	-	H	M	-	H
CO3	H	M	H	L	H	H	L	H	-	H	M	-	H
CO4	H	M	M	L	H	H	L	H	-	H	M	-	H
CO5	H	M	M	L	H	H	L	H	-	M	H	-	M
CO6	H	M	M	L	H	H	H	H	H	M	H	H	M

5. Course Assessment Methods Direct:

Continuous Internal Assessment

1. Model Exams I and II
2. End Semester Practical Examination

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Core Course - IV **INORGANIC CHEMISTRY- I**

Semester: IV **Code: U19CH404**
Credits: 5 **Total Hours : 90**
Hours/ Week : 6

1. Course Outcomes

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

S.No.	Course Outcomes	Level	Unit
1	Predict the hybridization of Coordination compounds and the stable and unstable metal complexes using EAN rule	K5	I
2	Discuss the different types of nucleophilic substitution reactions in Octahedral andSquare planar complexes	K4	II
3	Apply different methods calculate dipole moment of molecules	K3	III
4	Explainthe magnetic and electrical properties of molecules and complexes	K2	III
5	Summarize the importance of metal carbonyls, metal nitrosyls and metal olefins	K2	IV
6	Illustrate the principles of gravimetric analysis and the types of different binary compounds	K2	V

2A. Syllabus

Unit – I **Coordination Chemistry – I** **18 Hours**

1.1 Types of ligands, IUPAC nomenclature.Differencesbetween Double and Single Salts.
1.2 Werner theory – Sidgwick theory – EAN rule - Valence bond theory – Postulates. sp^3,dsp^2, and sp^3d^2hybridisations with examples and limitations.
1.3 Crystal Field Theory – Postulates - shapes of d-orbitals- splitting of t_2g and eg levels, CFSE, Octahedral and Tetrahedral splitting with examples and limitations.
1.4 Molecular orbital theory – Postulates, application to octahedral complexes only.

Unit–II **Coordination Chemistry – II** **18 Hours**

2.1 Isomerism – Stability of complexes – factors affecting the stability of complexes.
2.2 Unimolecular and bimolecular nucleophilic substitution reactions in Octahedral and Squareplanar complexes – Trans effect and its applications.
2.3 Biologically important co-ordination compounds–Chlorophyll, Haemoglobin and Vitamin-B_{12} - structure and application (Elucidation is not required)
2.4 Application of coordination compounds–detection of potassium ions, separation of copperand cadmium ions.

Unit – III **Electrical and Magnetic Properties** **18 Hours**

3.1 Induced dipole moment–polarisability, polarization of a molecule in an electric field–Clausius–Mosotti equation and Debye equation (derivation not required) – measurement of dipole moment for molecules – vapour temperature method, dilute solution method. Bond moments-bond angle relationship, dipole moment and molecular structure (CO_2, NH_3, CCl_4 and *o, m* and *p*-dichlorobenzene)

3.2 Magnetic permeability, magnetic flux, density (B), magnetic field intensity (H), B and Hrelationships, magnetic susceptibility, magnetic moment(M), Diamagnetism, Paramagnetism, Ferromagnetism, anti-ferromagnetism, measurements of magnetic susceptibility – Gouy Method -number of unpaired electrons-spin only value for magnetic moment – application to structural Problemsof $K_3[Fe(CN)_6]$, $K_4[Fe(CN)_6]$ and $[Ni(CO)_4]$.

Unit–IV **Organometallic Compounds** **18 Hours**

4.1 Pi acceptor ligands - Introduction **-** Metal carbonyls–Mononuclear carbonyls -18 electron rule and polynuclear carbonyls of Ni, Fe, Cr, Co and Mn – synthesis, reactions, structure and uses.

4.2 Nitrosyl compounds–classification, preparation, properties and structure of nitrosyl chloride andsodium nitroprusside.

4.3 Metal olefins (Zeise's salt)- Cyclopentadienes (Ferrocene)- preparation, aromatic character, reactions of the aromatic rings, structure and bonding.

Unit–V **Binary Compounds and Gravimetry** **18 Hours**

5.1 Hydrides - Types-salt like, covalent, diamond like, interstitial hydrides and uses
Nitrides - Types-salt like, covalent, diamond like, interstitial, nitride complexes and uses
Carbides - Types-salt like, covalent, interstitial and applications.
Borides -Borides having isolated B atoms, Borides having chain of B atoms, Borideshaving extended 2-dimensional network, Borides having 3- dimensional network and uses

5.2 Gravimetric Analysis - Principles of gravimetry - characteristics of precipitating agents – choice of precipitants–types of precipitants - condition of precipitation - Use of sequestering agents -Precipitation from homogeneous solution. Digestion, washing and ignition of the precipitate. Co-precipitation and post precipitation.

2B. Topics for Self-Study:

S.No.	Topics	Web Links
1	Crystal theory of square planar complexes	http://chemiris.labs.brocku.ca/~chemweb/courses/chem232/CHEM2P32_Lecture_11.html
2	Molecular orbital theory of tetrahedral complexes	https://www.dalalinstitute.com/wp-content/uploads/Books/A-Textbook-of-Inorganic-Chemistry-Volume-1/ATOICV1-7-2-Molecular-Orbital-Theory-Octahedral-Tetrahedral-or-Square-Planar-Complexes.pdf
3	Porphyrins and Hemoglobin	https://basicmedicalkey.com/porphyrins-and-hemoglobin/
4	application to structural Problems of copper II sulphate	https://www.ebi.ac.uk/chebi/searchId.do?printerFriendlyView=true&locale=null&chebiId=31440&viewTermLineage=null&structureView=&
5	Cross coupling reactions	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6860378/
6	Binary compounds boranes	https://courses.lumenlearning.com/introchem/chapter/boranes-boron-hydrogen-compounds/

2C. Text Books :

1. B.R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, Milesne publishers, New Delhi, 2017 (Unit- I-V)
2. R.D. Madan, *Modern Inorganic Chemistry*, S.Chand & Co., New Delhi, 2003. (UnitI-IV)
3. J.D. Lee, *Concise Inorganic Chemistry*, Oxford University Press, New Delhi, 2008.

2D. Recommended Reference Books:

1. Gurdeep Raj, *Advanced Inorganic Chemistry*, Goel publishing, Meerut, 2014.
2. Kamalesh Bansal, *Coordination Chemistry*, Campus Publications, New Delhi, 2003.
3. G.S. Sodhi, *Inorganic Chemistry*, Viva Books, New Delhi, 2006.
4. D. Banerjee, *Coordination Chemistry*, Asian Books, 2007.

3. Specific Learning Outcomes (SLO)

Unit	Course Content	Learning outcomes	Blooms Taxonomic levels of Transaction
Unit – I : Coordination Chemistry – I			
1.1	Types of ligands	Explain different types of ligands	K2
	IUPAC - nomenclature	Make use of the various rules for nomenclature of co-ordination compounds	K3
	Differences between Double and	Distinguish between	K4

	Single Salts.	Double and Single Salts	
1.2	Werner theory – Sidgwick theory – EAN rule .	Discuss the postulates of Werner's theory	K3
		Apply EAN rule.	K3
	Valence bond theory – Postulates. sp^3, dsp^2, and sp^3d^2 hybridizations with examples and limitations	Discuss the merits and limitations of VBT	K2
		Explain valence bond theory with suitable examples for high spin and low spin complexes	K2
		Identify the high spin and low spin complexes	K3
		Predict the hybridization of Coordination compounds	K5
1.3	Crystal Field Theory – Postulates - shapes of d-orbitals - splitting of t2g and eg levels, CFSE, Octahedral and Tetrahedral splitting with examples and limitations	List out the postulates of CFT	K2
		Discuss the splitting of d-orbitals in Octahedral and Tetrahedral field	K2
1.4	Molecular orbital theory – Postulates, application octahedral complexes only.	Explain the postulates of MOT	K2
		Discuss the MOT of octahedral complexes	K2
Unit–II Coordination Chemistry – II			
2.1	Isomerism – Stability of complexes – facrs affecting the stability of complexes.	Define the types of Isomerism	K2
		Explain the factors affecting the stability of complexes	K2
		Determine the stability of complexes	K2
2.2	Unimolecular and bimolecular nucleophilic substitution reactions in Octahedral and Square planar complexes – Trans effect and its applications.	Discuss the different types of nucleophilic substitution reactions in Octahedral and Square planar complexes	K4
		Explain the Trans effect and its applications.	K2
		Discuss the Trans effect in Square planer complexes	K2

2.3	Biologically important co-ordination compounds–Chlorophyll, Haemoglobin and Vitamin-B_{12} - structure and application (Elucidation is not required)	Compare the structure and application of different Biologically important co-ordination compounds	K4
2.4	Application of coordination compounds–detection of potassium ions, separation of copper and cadmium ions.	Separate copper and cadmium ions	K4
Unit – III	**Electrical and Magnetic Properties**		
3.1	Induced dipole moment–polarisability, polarization of a molecule in an electric field–Clausius–Mosotti equation and Debye equation (derivation not required) –measurement of dipole moment for molecules – vapour temperature method, dilute solutioNmethod. Bond moments-bond angle relationship, dipole moment and molecular structure (CO_2 , NH_3 , CCl_4 and o, m and p-dichlorobenzene)	Apply different methods calculate the dipole moment of different molecules	K3
3.2	Magnetic permeability, magnetic flux, density (B), magnetic field intensity (H), B and Hrelationships, magnetic susceptibility, magnetic moment(M), Diamagnetism, Paramagnetism, Ferromagnetism, anti-ferromagnetism,	Explain the different terms in magnetic properties of matter.	K2
		Compare the characteristics of diamagnetism and paramagnetism	K2
3.3	measurements of magnetic susceptibility – Gouy Method - number of unpaired electrons-spin only value for magnetic moment – application structural Problems of K 3 [Fe(CN) 6], K 4 [Fe(CN) 6] and [Ni(CO) 4	Explain the magnetic susceptibility measurements solve structure of complex ions	K2
		Explain the gouy balance method for the measurement of magnetic susceptibility	K2

Unit–IV	**Organometallic Compounds**		
4.1	Pi acceptor ligands - Introduction - Metal carbonyls–Mononuclear carbonyls – 18-electron rule and polynuclear carbonyls of Ni, Fe, Cr, Co and Mn – synthesis, reactions, structure and uses.	Summarize the synthesis, structure and uses of different metal carbonyl and poly nuclear carbonyls	K2
4.2	Nitrosyl compounds – classification, preparation, properties and structure of nitrosyl chloride and sodium nitroprusside.	Summarize the preparation, properties and structure of nitrosyl compounds	K2
4.3	Metal olefins (Zeise's salt)-Cyclopentadienes (Ferrocene)-preparation, aromatic character, reactions of the aromatic rings, structure and bonding.	Explain the salient features of the structure of the Zeise's salt and Ferrocene	K2
Unit 5	**Binary Compounds and Gravimetry**		
5.1	Hydrides - Types-salt like, covalent, diamond like, interstitial hydrides and uses	Classify the different types of Hydrides and its uses	K2
	Nitrides - Types-salt like, covalent, diamond like, interstitial, nitride complexes and uses.	Classify the different types of Nitrides and its uses	K2
5.2	Carbides - Types-salt like, covalent, interstitial and applications	Classify the different types of Carbides and its applications	K2
5.3	Borides - Borides having isolated B atoms, Borides having chain of B atoms, Borides having extended 2-dimensional network, Borides having 3- dimensional network and uses	Compare the 2-dimensional network Borides and 3-dimensional network Borides	K2
5.4	Gravimetric Analysis - Principles of gravimetry - characteristics of precipitating agents –choice of precipitants–types of precipitants - condition of precipitation - Use of sequestering agents -Precipitation from homogeneous solution. Digestion, washing and ignition of the precipitate. Co-precipitation and post precipitation.	Explain the different conditions involved in the Gravimetric analysis	K2

4. Mapping Scheme for the PO, PSOs and COs

L-Low M-Moderate H- High

INORGANIC CHEMISTRY- I										**Code: U19CH404**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	H	M	-	L	-	L	-	-	H	M	-	H
CO2	H	M	L	L	L	-	L	L	-	H	-	-	H
CO3	H	-	L	-	M	M	-	L	-	H	L	M	H
CO4	H	-	L	-	M	M	-	L	-	H	L	M	H
CO5	H	L	-	-	L	-	-	-	-	H	-	-	H
CO6	H	-	H	-	H	M	-	M	-	H	M	L	H

5. Course Assessment MethodsDirect:

3. Continuous Assessment Test (Model Exams) I, II
4. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Proto-type or Product Demonstration etc. (as applicable)
5. End Semester Practical Examination

Indirect:

1. Course-end survey

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CORE PRACTICAL III: ORGANIC ANALYSIS

Semester: IV **Code : U19CH4P3**

Credits : 2 **Total Hours : 45**

Hours/Week : 3

CORE PRACTICAL III: ORGANIC ANALYSIS

1. Course Outcomes:

After the completion of this course the students will be able:

S.No.	Course Outcomes	Level
1	Apply the knowledge of chemistry behind the qualitative organic analysis	K3
2	Compare different chemical tests to identify organic functional groups	K3
3	Report the results Scientifically	K2
4	Deduce the functional group of different organic compounds based on the inference	K4
5	Confirm the different functional groups by derivatization	K2
6	Justify the results by providing suitable confirmatory tests	K3

2A. Syllabus

I. THEORY OF ORGANIC ANALYSIS (For Self- Study)

Principles of qualitative analysis- handling of apparatus and hazardous chemicals like bromine, sodium, $NaNO_2$, concentrated acids and bases, etc. – theory of the various chemical reactions / tests- techniques of derivatization- scientific reporting.

II. ORGANIC ANALYSIS

Analysis of simple organic compounds

Characterisation of organic compounds by their functional groups and confirmation of functional groups and preparation of derivatives.

Functional Groups: Carboxylic acid, Esters, Phenols, Carbonyl compounds, Carbohydrates, Amides (Aliphatic & Aromatic), Anilides, Amines and Nitro compounds.

III. DEMONSTRATION EXPERIMENTS

a) Identification of alkaloids and flavonoids
b) Limit test - for chlorides and sulphates
c) Identification of drugs in tablets.
d) Qualitative analysis of various biomolecules (Glucose, Amino acids, Lipids).

2C. Text Books:

1. V. Venkateswaran, R.Veerasamy , A.R. Kulandaivelu, "*Basic Principles of Practical Chemistry*", Second Edition, Sultan Chand & Sons, New Delhi, 2006.

2D. Recommended Reference Books:

1. *Vogel's Text Book of Quantitative Chemical Analysis*, 6th Edition, Pearson Education, 2009.
2. *The Indian Pharmacopoea*, 3rd Edition, Volume-II, Quality Specifications World Health Organization, 1981.
3. A. V. Kasthuri, S. G.Wadodkar, S. B. Gokhale, "*Practical Pharmaceutical Chemistry-I*", 13th Edition, Nirali Publications, 2007.

3. Specific Learning Outcomes:

Unit	Course Content	Learning Outcomes	Blooms Taxonomic Levels of Transaction
Unit I Theory of Organic Analysis			
I	Principles of qualitative analysis	Apply the knowledge of chemical reaction to perform experiments in the laboratory.	K3
		Identify chemical tests for functional groups.	K3
	Handling of apparatus and hazardous chemicals like bromine, sodium, $nano_2$, concentrated acids and bases, etc. Theory of the various chemical reactions / tests	Write experimental report in a record note book systematically.	K2
Unit II Organic Analysis			
	Analysis of simple organic compounds - Characterization of organic compounds by their functional groups and confirmation of functional groups and preparation of derivatives.	Identify different functional groups of organic compounds by systematic analysis.	K4
		Perform chemical experiments, analysis procedures	K4

	Functional Groups: Carboxylic acid, Esters, Phenols, Carbonyl compounds, Carbohydrates, Amides (Aliphatic & Aromatic), Anilides, Amines and Nitro compounds	Follow SOPs for waste disposal in a safe and responsible manner.	K4
Unit III Demonstration experiments			
	Identification of alkaloids and flavonoids	Reproduce the tests and experiments	K2
	Limit test - for chlorides and sulphates Identification of drugs in tablets	Analyze drugs, natural products, and biomolecules Qualitatively.	K2
	Qualitative analysis of various biomolecules (Glucose, Aminoacids, Lipids)	Identify the biomolecules in a given sample	K2

4. Mapping Of Cos With Pos And Psos

ORGANIC ANALYSIS Code : U19CH4P3												
Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	H	L		L	L		L		H	L		H
CO2	H	H	H		H	H		H		H	H		H
CO3		H	H		H	H	H	H			H	H	
CO4		H	H		H	H		H			H		
CO5	H	H	H		H	H		H		H	H		H
CO6	H	H	H		H	H		H		H	H		H

5. Course Assessment Methods Direct:

1. Continuous Internal Assessment
2. Model Exams I and II
3. End Semester Practical Examination

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CORE COURSE V: ORGANIC CHEMISTRY – I

Semester: V **Code: U19CH505**
Credits : 6 **Total Hours : 90**
Hours/Week : 6

1. Course Outcomes

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

S.No.	Course Outcomes	Level	Unit
1	Enumerate the dimensionality of molecules and their importance in determining the reactivity.	K4	I
2	Apply the basic concepts of stereochemistry solve the problems related stereochemistry of organic compound.	K3	II
3	Classify the organic compounds in different stereoisomers.	K4	II
4	Categorize different types of reactions of carbonyl compounds based on the reactive species and products.	K4	III
5	Convert mono and di carboxylic acids in other functional groups using relevant reagents.	K4	IV
6	Distinguish the chemistry of different types of nitrogen containing organic compounds	K4	V

2A. Syllabus

Unit–I **Stereochemistry – I** **18 Hours**

1.1 Stereoisomerism – Definition – Classification into Structural and Stereo isomerism.

1.2 Optical isomerism – Optical activity – Optical and specific rotations – conditions for optical activity– Asymmetric centre – Chirality – Achiral molecule – (+) and (-) and D and L notations – Elements of symmetry – Racemization –Resolution methods (Mechanical separation, seeding, biochemical and conversion into diastereo isomers) – Asymmetric synthesis (partial and absolute asymmetric synthesis) – Walden inversion – van't Hoff's rule – Freudenberg's rule of shift.

Unit–II **Stereochemistry – II** **18 Hours**

2.1 Projection Formula–Fischer, Flying Wedge, Sawhorse and Newmann - Notations for optical isomers – Cahn – Ingold – Prelog rules – R,S notations for optical isomers with one asymmetric carbon– Erythro and Threo representations.

2.2 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, heat of hydrogenation, cyclization, melting points) – Methods of determining the configuration of geometrical isomers.

Unit–III **Carbonyl Compounds - Aldehydes and Ketones** **18 Hours**

3.1 Structure–Nomenclature- Methods of preparation, Physical and Chemical properties - Nucleophilic addition- Acid & base catalysed reactions – acidity of α-hydrogens.

3.2 Addition reactions – sodium bisulphate, hydrogen cyanide.

3.3 Reduction reaction–reduction to alcohol and alkane using Grignard reagent and $LiAlH_4$ –$NaBH_4$- Organometallic reagents (Organo Zn- Organo lithium and Organo Copper compounds) – Orbital structure of C -metal bonds, Ionic character, preparation, structure and synthetic uses.

3.4 Oxidation reaction – Oxidation of aldehydes and ketones.

3.5 Naming reactions involving carbonyl compounds - Haloform, Reformatsky and Wittig Reaction.

Unit–IV **Carboxylic Acids and Derivatives** **18 Hours**

4.1 Monocarboxylic acid–Nomenclature - methods of preparation by oxidation of primary alcohol, aldehydes, hydrolysis of nitriles, Hydrolysis of esters, Carboxylation of alkenes - Acidity of carboxylic acid- Ortho effect- – Acidity constant – chemical properties of mono carboxylic acids -salt formation –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.

Unit–V **Chemistry of Nitrogen Compounds** **18 Hours**

5.1 Nitrogen compounds - nomenclature - nitro alkanes - synthetic uses and reactions of nitroalkanes - alkyl nitrites – differences between nitroalkanes and alkyl nitrites

5.2 Aromatic nitro compounds - Physical and chemical properties of aromatic nitro, di and trinitro compounds - preparation and reduction of nitro benzene under different conditions. Chemistry of Picric acid

5.3 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 Amines and benzene diazonium chloride. Hinsberg Test.

2B. Topics for Self-Study:

S.No.	Topics	Web Links
1	Conformations of open-chain compounds	https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Book%3A_Organic_Chemistry_with_a_Biological_Emphasis_v2.0_(Soderberg)/03%3A_Conformations_and_Stereochemistry/3.02%3A_Conformations_of_open-chain_organic_molecules
2	Conformations of cyclic organic compounds	https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Book%3A_Organic_Chemistry_with_a_Biological_Emphasis_v2.0_(Soderberg)/03%3A_Conformations_and_Stereochemistry/3.03%3A_Conformations_of_cyclic_organic_molecules
3	R and S sequence rules	https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Supplemental_Modules_(Organic_Chemistry)/Chirality/Absolute_Configuration_R-S_Sequence_Rules
4	E and Z notation	https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Book%3A_Basic_Principles_of_Organic_Chemistry_(Roberts_and_Caserio)/19%3A_More_on_Stereochemistry/19.07%3A_E%2CZ_Notation
5.	Naming reactions involving carbonyl compounds	https://nptel.ac.in/content/storage2/courses/104101005/downloads/LectureNotes/chapter%2010.pdf
6.	Organomegnesium compounds	https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Book%3A_Basic_Principles_of_Organ

		ic_Chemistry_(Roberts_and_Caserio)/14%3A_Organohalogen_Organometallic_Compounds/14.12%3A_Organomagnesium_Compounds
7.	Acetoacetic ester synthesis	https://www.organic-chemistry.org/namedreactions/acetoacetic-ester-synthesis.shtm
8.	Malonic ester synthesis	https://www.organic-chemistry.org/namedreactions/malonic-ester-synthesis.shtm
9.	Alkaloids – an overview	https://www.intechopen.com/books/alkaloids-their-importance-in-nature-and-human-life/introductory-chapter-alkaloids-their-importance-in-nature-and-for-human-life

2C. Text Books

1. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S.Chand & Co., Ltd., New Delhi, 2012. **(Unit- III, IV, V).**

2. M.K. Jain and S.C. Sharma, Modern Organic Chemistry, Vishal Publishing &Co,2015 **(Unit-III,IV, V)**

3. D. Nasipuri, Stereochemistry of Organic Compounds, New Age International, New Delhi, 2018. **(Unit- I, II).**

4. R.T. Morrison and R.N. Boyd, Organic Chemistry, Pearson Education, New Delhi, 2016.

2D. References

1. Bhupinder Mehta& Manju Mehta, Organic Chemistry, PHI Learning Pvt. Ltd., 2015
2. P.S. Kalsi, Stereochemistry, Conformation and Mechanism, Wiley Eastern Limited, New Delhi, 2017
3. Ernest L. Eliel, Stereochemistry of Carbon Compounds, Tata McGraw Hill, New Delhi, 2008
4. L.C. Wade, Organic Chemistry, Pearson Education, New Delhi, 2016.
5. Paula Yurkanis Bruice, Organic Chemistry, Pearson Education, New Delhi, 2013.
6. Raj K. Bansal, Text Book of Organic Chemistry, New Age International Ltd., New Delhi, 2016.

3. Specific Learning Outcomes (SLO)

Unit	Course Contents	Learning Outcomes	Blooms Taxonomic levels of Transaction
	Unit -II Stereochemistry – I		
1.1	Stereoisomerism – Definition – Classification in Structural and Stereo isomerisms.	Classify the compounds in constitutional and stereoisomers	K2
1.2	Optical isomerism – Optical activity – Optical and specific rotations – conditions for optical activity	Relate chiral and achiral center in organic compounds Summarize the conditions for optical activity	K2
	Asymmetric Centre – chirality – Achiral molecule	Identify chiral /achiral compounds	K3
	Meaning of (+) and (-) and D and L notations Elements of symmetry	Classify elements of symmetry in compounds , differentiate dl & + and - notations	K2
1.3	Racemization – methods of resolution (Mechanical separation, seeding, biochemical and conversion diastereo isomers)	Explain Racemization and Resolution methods. Explain advantages and disadvantages of these methods	K2
	Asymmetric synthesis (partial and absolute asymmetric synthesis	Utilize the knowledge of asymmetric synthesis solve theoretical problems of organic reaction.	K3
1.4	Walden inversion – van't Hoff's rule – Freudenberg's rule of shift.	Identify Stereochemistry of products obtained in SN1 and SN2 substitution reactions.	K3

		Verify the Freudenberg's rule of shift with examples know Two or more asymmetric carbons make independent contribution the tal molecular rotation	K4
	Unit II	**Stereochemistry – II**	
2.1	Projection Formula–Fischer, Flying Wedge, Sawhorse and Newmann-Notations for optical isomers	Illustrate various stereochemical projections for organic compounds	K2
	Cahn – Ingold – Prelog rules – R,S notations for optical isomers with one asymmetric carbon Erythro and Threo representations.	Apply CIP rules to assign R S and EZ configurations molecules.	K3
		Identify Erythro and Threo representations.	K2
	Geometrical isomerisms in Maleic, Fumaric acids and in unsymmetrical Keximes	Classify maleic acid and fumaric acid & ketoximes using EZ notation.	K4
	Methods of distinguishing geo - metrical isomers (Dipolemoment, dehydration, heat of hydrogenation, cyclization, melting points) –	Choose various Methods of distinguishing geometrical isomers	K3
	Methods of determining the configuration of geometrical isomers.	Outline the methods of determining the configuration of geometrical isomers.	K2
	Unit III Carbonyl Compounds - Aldehydes and Ketones		
3.1	Structure–Nomenclature-	Assign names for aldehydes and kenes using IUPAC rule	K3
	Methods of preparation, Physical	Demonstarte the properties of	K2

	properties, chemical properties - nucleophilic addition- acid- base catalysed reaction – acidity of α-hydrogens Addition reactions – sodium bisulphate, hydrogen cyanide.	carbonyl compounds.	
		Explain the mechanism of nucleophilic addition reactions of aldehyde and ketones at different condition.	K2
3.3	Reduction reaction–reduction alcohol and alkane using Grignard reagent and $LiAlH_4$– $NaBH_4$	Compare the reducing abilities of Grignard reagents, $LiAlH_4$ & $NaBH_4$	K4
	Introduction organometallic reagents like Organo Zn- Organo lithium and Organo Copper compounds	Explain the chemistry of different organometallic reagents like Organo Zinc, Organo lithium and Organo Copper compounds	K2
	orbital structure of C- metal bonds, ionic character, preparation ,structure and synthetic uses.	Summarize the synthetic applications of the listed organometallic reagents.	K2
3.4	Oxidation reaction – Oxidation of aldehydes and ketones.	Select suitable oxidizing agents oxidize aldehyde and ketone group.	K4
3.5	Naming reactions involving carbonyl compounds - Haloform, Reformatsky and Wittig Reaction.	Illustrate the mechanism of listed named reactions.	K2
Unit IV Carboxylic Acids and Derivatives			
4.1	Monocarboxylic acid–Nomenclature	Assign names for all carboxylic acids	K3
	methods of preparation by oxidation of primary alcohol, aldehydes, hydrolysis ofnitriles, Hydrolysis of esters, Carboxylation of alkenes	Examine different functional groups for the preparation of carboxylic acid.	K4
	Acidity of carboxylic acid- Ortho effect- – Acidity constant	Relate Acidity and pKa of carboxylic acids with resonance stabilization	K3
	chemical properties of mono carboxylic acids - salt formation –formation of acid	Distinguish different products obtained from carboxylic acid	

	halides- formation of amides- formation of esters.	using different reagents.	K4
4.2	Dicarboxylic acids–preparation and properties of oxalic, malonic, succinic, glutaric and adipic acids	Compare the physical and chemical properties of different dicarboxylic acids	K4
4.3	Malonic and acetoacetic esters– characteristics of reactive methylene group–synthetic uses of malonic and acetoacetic esters.	Apply reactivity of active methylene group in malonic and acetoacetic for synthesis.	K3
V	**Chemistry of Nitrogen Compounds**		
5.1	**Nitrogen compounds** - nomenclature -nitro alkanes - synthetic uses and reactions of nitroalkanes - alkyl nitrites – differences between nitroalkanes and alkyl nitrites	Assign names for aliphatic and aromatic nitro & amino compounds	K2
		Compare the formation and reactions of alkyl nitrite and nitro alkanes	K4
5.2	**Aromatic nitro compounds -** Physical and chemical properties of aromatic nitro, di and trinitro compounds -	Demonstrate the physical and chemical properties of aromatic nitrocompounds	K2
	preparation and reduction of nitro benzene under different conditions. Chemistry of Picric acid	Explain the method of preparation and reduction of aromatic nitro compounds.	K2
5.3	**Amino compounds** - Classification of Aliphatic and aromatic amines –	Describe the Characteristics of the aliphatic and aromatic amines	K2
	Effect of substituents on basicity and comparison of aliphatic and aromatic amines –	Compare the basicity of different substituted aliphatic and aromatic amines.	K4
	Mechanism of carbylamine reaction and diazotization–	Apply diazotization route convert nitro - other functional groups	K3
	Preparation and synthetic importance of Amines and benzene diazonium chloride.Hinsberg Test.	Explain the preparation and synthetic uses of Amines and benzene diazonium chloride.	K2

4. Mapping (Co, Po, Pso)

L-Low **M-Moderate** **H- High**

ORGANIC CHEMISTRY – I										**Code: U19CH505**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	**H**	**H**	**-**	**L**	**-**	**-**	**L**	**H**		**H**	**-**	**-**	**H**
CO2	**H**	**H**		M	**-**	**-**	**L**	H		**H**	**-**		**H**
CO3	**H**	**H**		L	**-**	**-**	**L**	H		**H**	**-**	**-**	**H**
CO4	**H**	**H**	**-**	L	**-**	**-**	**L**	H		**H**	**-**	**-**	**H**
CO5	**H**	**H**	**-**	L	**-**	**-**	**L**	H		**H**	**-**	**-**	**H**
CO6	**H**	**H**	**-**	L	**-**	**-**	**L**	H		**H**	**-**	**-**	**H**

5. Course Assessment Methods

Direct

1. Continuous Assessment Test (Model Exams) I,II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Proto-type or Product Demonstration etc. (as applicable)
3. End Semester Practical Examination

Indirect

1. Course-end survey

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Core Course - VI: **PHYSICAL CHEMISTRY – I**

Semester: V **Course Code: U19CH506**
Credits: 6 **Total Hours : 90**
Hours/Week : 6

1. Course Outcomes:

After the completion of this course, the student will be able:

S.No.	Course Outcomes	Level	Unit
1.	Predict the feasibility and nature of reactions from the thermodynamic properties like ΔH, ΔG&ΔS values	K5	I
2.	Utilize Joule-Thomson effect liquefy gases	K3	I
3.	Apply the principle of Carnot cycle all types of heat engines and working fluids	K3	II
4.	Compute the absolute entropies of pure substances at temperatures other than 0 K from their heat capacities and heats of transition.	K3	III
5.	Predict qualitatively the effect of changing temperature, pressure or concentration on heterogeneous system in equilibrium by means of phase diagram	K5	IV
6.	Apply the colligative properties for determining the molecular weight of solutions	K3	V

2A. Syllabus

Unit–I **First Law of Thermodynamics** **18 Hours**

1.1 Definition of thermodynamic terms - system and surrounding–isolated, closed and open systems - Intensive and Extensive properties. Thermodynamic processes – Reversible and Irreversible, Isothermal and Adiabatic processes– State and Path functions.

1.2 Laws of thermodynamics: Zeroth law and First law of thermodynamics - Internal energy (E), Enthalpy(H) and Heat capacities, Relation between C_p and C_v - Calculation of q, W, ΔE and ΔH for expansion of ideal gases under isothermal and adiabatic conditions for reversible and irreversible processes (Problems). Joule – Thomson effect as an isoenthalpic process. Relationship between $\mu_{J.T}$ for ideal and real gases – inversion temperature.

1.3 Thermochemistry – Enthalpy change in chemical reactions – relationship between ΔE and ΔH - Hess's law and its applications, Standard states – standard enthalpy of formation, enthalpy of combustion, enthalpy of neutralization, Bond energy and its calculation from thermochemical data. Temperature dependence of ΔH - Kirchoff's equation.

Unit–II **Second Law of Thermodynamics** **18 Hours**

2.1 Need for the II law – Second law of thermodynamics (different statements) – Cyclic process – heat engine – Carnot's cycle and its efficiency (Problems).

2.2 Concept of entropy - Claussius Inequality - Entropy as a criterion of spontaneous and equilibrium process in isolated systems - Entropy as a function of P,V and T – Entropy change in phase changes, Entropy of mixing.

2.3 Gibbs and Helmholtz functions -ΔA and ΔG as function of P, V and T. Maxwell's relations - Gibbs – Helmholtz equation and its applications – Thermodynamic criteria for spontaneity and equilibrium.

Unit-III Third Law, Thermodynamic Applications and Partial Molar Properties
18 Hours

3.1 Third law of thermodynamics–statement–evaluation of absolute entropy from heat capacity data, Exception to third law (CO, N_2O) – Nernst Heat theorem and its expression.

3.2 Equilibrium constant and standard free energy change, *van't Hoff* isotherm (*van't Hoff* equation) –Thermodynamic derivation of law of mass action-van't Hoff's Isochore – thermodynamic interpretation of *Le Chatelier's* principle.

1.3 Partial molar properties–chemical potential and its significance – Gibbs – Duhem equation -variation of chemical potential with T, P and X (mole fraction)

Unit–IV **Phase Rule and its Applications** **18 Hours**

4.1 Meaning of the terms – phase, component and degree of freedom -derivation of Gibb's phase rule. Phase equilibria of one component systems – CO_2, water and sulphur systems. Phase equilibria of two component systems – simple eutectic systems – (Pb – Ag), Compound formation with congruent melting point (Mg-Zn) and incongruent melting point (Na-K), Freezing mixtures. (NaCl – water) – Efflorescence and Deliquescence.

4.2 Partially miscible liquid pairs - Phenol-Water, Trimethylamine–Water and Nicotine-Water systems - Effect of impurities on miscibility temperature, Immiscible liquids – Principle and Application of Steam Distillation, Nernst distribution law (thermodynamic derivation) and its applications.

Unit–V **Solutions** **18 Hours**

5.1 Dilute solutions - Colligative properties of solutions, Experimental determination of molecular weight by Relative lowering of vapour pressure, Berkely- Hartley and Cottrell's Method. Laws of osmotic pressure and its applications. thermodynamic derivation of Lowering

of Vapour Pressure, Elevation of boiling point, Depression of freezing point and Osmotic pressure.

5.2 Binary liquid mixtures - Henry's law, Raoult's law - Deviation from Raoult's law - Ideal liquid mixtures (benzene and toluene), Fractional distillation, Non-ideal systems, Azeotropes (HCl-water and ethanol-water systems).

2B. Topics for Self-Study:

S.No	Topics	Self-study links
1	First Law of Thermodynamics	https://www.grc.nasa.gov/www/k-12/airplane/thermo1.html
2	Second Law of Thermodynamics	https://amp.abc.net.au/article/12248914
3	Third Law, Thermodynamic Applications and Partial Molar Properties	https://www.youtube.com/watch?v=kswiDQ2aAKA http://www.icsm.fr/Local/icsm/files/286/JFD_Chemical-potential.pdf
4	Phase Rule and its applications	https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/DeVoes_Thermodynamics_and_Chemistry/13%3A_The_Phase_Rule_and_Phase_Diagrams/132_Phase_Diagrams%3A_Binary_Systems
5	Solutions	https://www.chemistryworld.com/podcasts/ionic-liquids/4012785.article https://www.chemistryworld.com/news/cryogenic-properties-could-promote-silkworm-fibres-into-space-exploration/4010468.article

2C. Text Books

1. B.R. Puri, L.R. Sharma and Madan S. Pathania, Elements of Physical Chemistry, Vishal Publishing Co., Jalandhar, 2017 **(Unit I- V)**

2. K.K.Sharma and L.K. Sharma, A Text Book of Physical Chemistry, 4th Edn., Vikas Publishing House (P) Ltd., New Delhi, 2016 **(Unit I - V)**

3. K.L. Kapoor, A Text Book of Physical Chemistry, Macmillan, New Delhi, 2017

4. G.W. Castellan, Physical Chemistry, Narosa Publishing House, New Delhi, 2004.

2D. References

1. B.R. Puri, L.R. Sharma and Madan S Pathania, Principles of Physical Chemistry 42nd Ed., Vishal Publishing Co., Jalandhar, 2017
2. K. Kundu and S.K. Jain,Physical Chemistry, S.Chand Co. Ltd., New Delhi, 2003
3. B.S. Bhal, G.D. Tuli and Arun Bhal, Essentials of Physical Chemistry,S. Chand and Co. Ltd., New Delhi, 2010.
4. P. Atkins and J. Paula, Physical Chemistry, Oxford University Press,New Delhi, 2018.

3. Specific Learning Outcomes (SLO)

Unit/ Section	Course Content	Learning Outcomes	Blooms Taxonomic levels of Transaction
I	**First Law of Thermodynamics**		
1.1	Definition of thermodynamic terms	Define various thermodynamic terms	K2
	System and surrounding – isolated, closed and open systems - intensive and extensive variables.	Illustrate open closed and isolated systems. Distinguish Intensive and Extensive properties.	K2
	Thermodynamic processes – reversible and irreversible, isothermal and adiabatic State and path functions	Illustrate the state and path functions. Distinguish reversible and irreversible processes. Explain isothermal and adiabatic processes.	K3
1.2	Laws of thermodynamics Thermodynamics statements (E, H, Cp, Cv, q, W, ΔE and ΔH) isothermal and adiabatic conditions for reversible and irreversible processes Joule – Thomson effect – isoenthalpic process Relationship between μ J.T for ideal and real gases Inversion temperature	State the I law of thermodynamics	K2
		Derive thermodynamic expressions for I law, work done, heat capacity and ΔH.	K3
		Explain Joule-Thomson effect.	K2
		Derive expression for Joule-Thomson co-efficient.	K3
1.3	Thermochemistry Enthalpy change in chemical reactions Relation between ΔE and ΔH of reactions	Evaluate enthalpy changes during various chemical processes.	K5

	Hess's law and its applications Standard enthalpy of formation, enthalpy of combustion, enthalpy of neutralization Bond energy calculation from thermochemical data	Apply Hess's Law for calculating ΔH values.	K3
	Kirchoff's equation	Relate the temperature dependence of internal energy and enthalpy of a thermodynamic process.	K4
II	**Second Law of Thermodynamics**		
2.1	Second law of thermodynamics Different statements of the second law	Explain the total entropy of an isolated system	K2
	Cyclic process and heat engine Carnot's cycle and its efficiency	Build the Carnot theoretical device and relate the reversible heat engine process	K3
2.2	Concept of entropy-entropy definition	Outline the concept of entropy	K2
	Claussius inequality Entropy criterion of spontaneous and equilibrium process in isolated systems	Derive the mathematical expression of Claussius in equality.	K4
	Entropy function of P,V and T Entropy change in phase changes, entropy of mixing	Derive the mathematical expression for entropy of mixing.	K4
2.3	Gibbs and Helmholtz functions	Calculate the changes in the Gibbs energy of a system as a function of temperature.	K2
		Derive Gibbs-Helmholtz equation.	K2
	ΔA and ΔGas function of P, V and T Maxwell's relations Gibbs – Helmholtz equation and its applications	Apply Gibbs-Helmholtz equation for reversible galvanic cells	K3
	Thermodynamic criteria for	Predict the spontaneity of reactions from	K3

	spontaneity and equilibrium	entropy data.	
III	**Third Law, Thermodynamic Applications and Partial Molar Properties**		
3.1	Third law of thermodynamics and statement	State the third law of thermodynamics.	K2
	Evaluation of absolute entropy from heat capacity data	Evaluate the absolute entropy from Heat capacity data.	K5
	Exception to third law	State the Exception of third law of thermodynamics	K2
	Nernst Heat theorem and its expression	Derive Nernst Heat theorem.	K3
3.2	Equilibrium constant and standard free energy change Thermodynamic derivation of law of mass action	Derive the mathematical expression for law of mass action.	K4
	Van't Hoff isotherm, van't Hoff's isochore and Le Chatelier's principle	Derive the van't-Hoff isotherm.	K3
		Derive the van't Hoff isochore.	K3
		Explain the Le chaterlier'sprinciple.	K2
3.3	Partial molar properties	Explain parital molar properties.	K2
	Chemical potential and its significance	Derive the thermodynamic expression for chemical potential.	K2
	Gibbs–Duhem equation variation of chemical potential with T,P and mole fraction	Derive Gibbs-Duhem equation.	K2
IV	**Phase Rule and its Applications**		
4.1	Terms of phase, component and degree of freedom	Define components, phases and degrees of freedom present in a system	K2
	Derivation of Gibb's phase rule	Calculate degree of freedom of a system	K4
	Phase equilibria of one component systems (CO_2, H_2O and S)	Identify triple point and metastable equilibrium. Explain the phase diagram of one component systems (CO_2, H_2O and S).	K4
	Phase equilibria of two component systems Simple eutectic systems – (Pb – Ag)	Explain the phase diagram of simple systems with Eutectic Congruent melting point and Incongruent melting	K4

	Compound formation with congruent melting point (Mg-Zn) and incongruent melting point (Na-K)	point.	
	Freezing mixtures	Identify the methods to prepare freezing mixtures with desired temperature from phase diagrams.	K3
	Efflorescence and deliquescence	Relate solid-liquid-gas equilibria with water of hydration using phase rule.	K3
4.2	Partially miscible liquid pairs	Identify partially miscible solvent pairs.	K3
	Phenol-water, trimethylamine–water and nicotine-water systems	Predict the temperature effect on two partially miscible liquids using phase diagram.	K3
	Effect of impurities on miscibility temperature and immiscible liquids	Find out the effect of temperature on miscibility of liquids	K3
	Principle and application to steam distillation	Elaborate the method of purification of organic compounds and solvents	K4
	Nernst distribution law and its applications	Derive Nernst Distribution Law.	K4
V	**Solutions**		
5.1	Dilute solutions and colligative properties of solutions	Explain colligative properties of solutions.	K4
	Experimental determination of molecular weight by relative lowering of vapour pressure	Determine molecular weight of non-volatile organic solute based on the colligative properties.	K4
	Berkely-Hartley and Cottrell's Method	Evaluate Osmotic pressure by Berkely-Hartley and Cottrell's Method.	K3
	Laws of osmotic pressure and its applications	Apply the laws of osmotic pressure for seawater purification.	K4
	Thermodynamic derivation of Lowering of Vapour Pressure, elevation of boiling	Explain the effect of temperature, pressure on boiling point, freezing point and vapour pressure	K4

	point, depression of freezing point and osmotic pressure		
5.2	Binary liquid mixtures	Identify the composition of Binary Liquid mixtures.	K3
	Henry's law, Raoult's law deviation from Raoult's law	Explain the effect of pressure on miscibility of liquids and gas. Explain the significance of Raoult's law.	K3
	Ideal liquid mixtures(benzene and toluene) purified by fractional distillation	Describe the methods of purification of homogenous mixture of solvents	K5
	Non ideal systems, azeotropes (HCl- water and ethanol-water systems).	Determine boiling point of pure and mixture of solvents. Differentiate positive and negative azeotropes.	K5

4. Mapping (Co, Po, Pso)

L-Low **M-Moderate** **H- High**

PHYSICAL CHEMISTRY – I												**Code: U19CH506**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	H	H	-	M	-	L	H	-	H	-	M	H
CO2	H	H	H	-	-	M	-	M	-	H	-	M	H
CO3	H	H	H	-	-	M	-	M	-	H	-	L	H
CO4	H	H	H	-	-	-	-	H	_	H	-	M	H
CO5	H	H	H	-	-	M	-	H	-	H	-	M	H
CO6	H	H	-H	-	-	H	-	H	-	H	-	L	H

5. Course Assessment Methods Direct

1. Continuous Assessment Test (Model Exams) I,II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Proto-type or Product

Demonstration etc. (as applicable)

3. End Semester Practical Examination

INDIRECT

1. Course-end survey

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Elective Course - II: BIOCHEMISTRY

SEMESTER: V **Code : U19CH5:2**
CREDITS : 4 **Total Hours : 60**
Hours/Week : 4

1. Course Outcomes:

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

S.No.	Course Outcomes	Level	Unit
1	Explain cell structure and functions of cell organelles, Peptides and Proteins	K2	I
2	Comprehend the dependence of body on carbohydrates and lipids for energy generation	K2	II
3	Elucidate the role of enzymes and Hormones in major metabolic pathways	K2	III
4	Discuss the Structure, functions and process of genetic transformation	K2	IV
5	Recognize nitrogen metabolism and the biological role of neurotransmitters	K2	V
6	Describe the cancer cell metabolism	K2	V

2A. Syllabus

UNIT I - Amino acids and Proteins **12 Hours**

1.1 Living Systems - Cells, structure of cell (diagram)- Basic functions of the Cell components - nucleus, mitochondria, chloroplast, cytoplasm, ribosomes, golgi bodies, lysosomes.

1.2 Amino Acids - Preparation and reactions of Amino acids - Essential and non-essential aminoacids, isoelectric point, Zwitter ions, peptide bond, function of few peptides (Enkephalins, Bradykinin, Gratomicidin -S, aspartame, glutathionine), Synthesis of Peptides- Sangers- -Merrifield.

1.3 Proteins - primary, secondary and tertiary structures and function – Ramachandran plot and significance of ψ and φ values.

UNIT II - Carbohydrates and Lipids **12 Hours**

2.1 Carbohydrates - As a basic building block– role of mono and disaccharides in biological systems – glycolysis and glycogenesis – a detailed study of glycolysis – glycogen storage, deficiency diseases – hypoglycemia – Cori's disease – Andersen's disease.

2.2 Lipids and fatty acids - Classification of lipids- simple lipids(Fats), compound lipids (phospho, glyco, sulpho lipids and lipoproteins) and derived lipids (fatty acids and glycerol) – chemical composition (simple and triglycerides) and biological significance of fats. Fatty acids –types (saturated, unsaturated and cyclic) –Essential and non-essential fatty acids. Cholesterol – LDL, VLDL and HDL – Hypercholesterolemia.

Unit–III -Enzymes and Hormones **12 Hours**

3.1 Major metabolic pathways of life - Importance of catabolism, anabolism, aerobic metabolism vs. anaerobic metabolism, TCA Cycle, Cancer cell Metabolism.

3.2 Enzymes and hormones - Simple, apoenzyme and holoenzymes, classification of enzymes –Enzyme regulation, competitive and non-competitive inhibitors - function of few enzymes in pancreatic juice. Hormones – importance, function and structure of few hormones: autocrine, paracrine and endocrine hormones (adrenalin, thyroxin, insulin, estrone and testosterone)

Unit–IV -Nucleic Acids **12 Hours**

4.1 Nucleotides – Nucleosides – heterocyclic bases and sugars in nucleic acids –RNA & DNA

4.2 Structure of DNA – Replication – transcription – translation (a detailed study)

4.3 m-RNA, r-RNA and t-RNA – structure and functions.

Unit–V-Nitrogen Metabolism and Neurotransmitters **12 Hours**

5.1 Nitrogen metabolism – introduction – urea cycle.

5.2 Neurotransmitters –Importance–structure and function of acetylcholine – GABA.

2B. Topics for Self-Study:

S. No.	Topics	Weblinks
1.	Biomolecules classification	https://youtu.be/YO244P1e9QM
2.	Nonpolar and Uncharged Polar Amino Acids	https://youtu.be/cL2_e83v3js
3.	The science of cooking-Fats and Oils	http://home.sandiego.edu/~josephprovost/BCBT100/BCBT100%20Lect%202%20class%20notes.pdf
4.	Enzymes- a fun introduction	https://youtu.be/XTUm-75-PL4
5.	How to remember hormone and their functions with easy trick	https://youtu.be/VthJDIFweH4
6.	Nucleic acids-how to use computer coding to create shapes using DNA	https://bio.libretexts.org/Courses/Community_College_of_Vermont/Human_Biology_(Gabor_Gyurkovics)/02%3A_Chemistry_of_Life/2.08%3A_Nucleic_Acids
7.	Explainer: What is neurotransmission?	https://www.sciencenewsforstudents.org/article/explainer-what-neurotransmission

2C. Text Book(s):

1. L. Veerakumari, *Biochemistry*, MJP Publishers, Chennai, 2004 **(Unit I-V).**
2. B.D. Hames and N.N. Hooper, *Instant Notes on Biochemistry*, 2nd Edition, Viva Books Pvt. Ltd ., 2011.
3. Donal Voet and Judith G. Voet, *Biochemistry*, John Wiley & Sons Inc., New York, 2008.

2D. Reference Books:

1. Patricia Trueman, *Nutrient Biochemistry*, MJP publishers, Chennai, 2006
2. Albert,L.Lehninger, Michael, M.Cox, David L. Nelson, *Principles of Biochemistry*,Prentice Hall, Second Edition, Worth Publishers, 2000
3. Eric E. Conn, Paul K. Stumpf, George Bruening and Roy H. Doi, *Outlines of Biochemistry*, Wiley Student Edition, Singapore, 2006.

3. Specific Learning Outcomes (SLO)

Unit/ Section	Course Content	Learning outcomes	Blooms Taxonomy Level of Transaction
I	**Amino acids and Proteins**		
1.1	Structure of cell (diagram)- Basic functions of the Cell components - nucleus, mitochondria, chloroplast, cytoplasm, ribosomes, golgi bodies, lysosomes	Explain the structure of a cell and basic functions of its components	K2
1.2	Preparation and reactions of Amino acids	Summarize the chemistry of amino acids	K2
	Essential and non-essential aminoacids	Classify the amino acids	
	Definitions: isoelectric point, Zwitter ions and peptide bond	Summarize the general characteristics of amino acids	K2
	Functions of few peptides (Enkephalins, Bradykinin, Gramicidin -S, aspartame, glutathionine)	outline the functions of some peptides	K2

	Synthesis of Peptides - Sangers-Merrifield	Describe the synthesis of peptides	K2
1.3	Proteins - primary, secondary and tertiary structures and function	Explain the structure and the functions of proteins	K2
	Ramachandran plot and significance of ψ and φ values	Examine the amino acid backbones based on Ramachandran plot	K2
II	**Carbohydrates and lipids**		
2.1	**Carbohydrates -** As a basic building block– role of mono and disaccharides in biologicalsystems – glycolysis and glycogenesis	Explain the importance and process of glycolysis and glycogenesis in biological systems	K2
	A detailed study of glycolysis – glycogen srage	Describe the role enzymes in the glycolysis cycle	K2
	Deficiency diseases – hypoglycemia – Cori's disease – Andersen's disease	Outline the effect of carbohydrate deficiency	K2
2.2	Classification of lipids- simple lipids **(**Fats), compound lipids (phospho, glyco, sulpho lipids and lipoproteins) and derived lipids (fatty acids and glycerol)	Classify lipids based on their structure	K2
	Chemical composition (simple and triglycerides) and biological significance of fats	Explain the chemical composition and biological role of fats	K2
	Fatty acids –types (saturated, unsaturated and cyclic) –Essential and non-essential fatty acids	Recognize the biological role of fatty acids of varied chemical nature	K2
	Cholesterol – LDL, VLDL and HDL	Describe the effects of different types of cholesterol	K2
	Hypercholesterolemia	Demonstrate the effects of high-levels of blood cholesterol	K2
III	**Enzymes and Hormones**		
3.1	Major metabolic pathways of life - Importance of catabolism and anabolism	Explain the chemistry of metabolic pathways of life	K2
	Aerobic metabolism vs. anaerobic metabolism,	Contrast aerobic and anaerobic metabolism	K2
	TCA Cycle	Describe the TCA cycle	K2

	Cancer cell Metabolism	Outline the cancer cell metabolism	K2
3.2	Enzymes and hormones - Simple, apoenzyme and holoenzymes	Differentiate the different forms of enzyme	K2
	Classification of enzymes – Enzyme regulation, competitive and non-competitive inhibitors	Identify enzyme inhibition mechanisms	K2
	Function of few enzymes in pancreatic juice	Outline the functions of a few enzymes in pancreatic juice	K2
	Hormones – importance, function and structure of few hormones: autocrine, paracrine and endocrine hormones (adrenalin, thyroxin, insulin, estrone and testosterone)	Infer the importance of hormonal balance in overall health	K2
III	**Nucleic Acids**		
4.1	Nucleotides – Nucleosides – heterocyclic bases and sugars in nucleic acids –RNA and DNA	Illustrate the components of RNA and DNA	K2
4.2	Structure of DNA	Explain the structure of DNA	K2
	Replication – transcription – translation (a detailed study)	Compare the processes of replication, transcription and translation	K2
4.3	m-RNA, r-RNA and t-RNA – structure and functions	Explain the structure and functions of different types of RNA	K2
V	**Nitrogen Metabolism and Neurotransmitters**		
5.1	Nitrogen metabolism – introduction – urea cycle	Outline the process of nitrogen metabolism	K2
5.2	Neurotransmitters – Importance – structure and function of acetylcholine – GABA	Describe the biological role of neurotransmitters	K2

4. Mapping Scheme For The PO, Psos And Cos

L-Low **M-Moderate** **H- High**

BIOCHEMISTRY										**CODE : U19CH5:2**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	H	L	L	-	-	-	L	-	H	-	-	H
CO2	H	H		L	-	-	-		-	H	-	-	H
CO3	H	H		L	-	-	-		-	H	-	-	H
CO4	H	H		L	-	-	-		-	H	-	-	H
CO5	H	H		L	-	-	-		-	H	-	-	H
CO6	H	H		L	-		-		-	H	-	-	H

5. Course Assessment Methods

Direct:

Continuous Assessment Test (Model Exams) I, II

1. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Proto-type or Product Demonstration etc. (as applicable)
2. End Semester Practical Examination

Indirect:

1. Course-end survey

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SBEC II: PHARMACEUTICAL CHEMISTRY

Semester: V **Code: U19CH5S2**
Credits : 2 **Total Hours: 30**
Hours/Week: 2

1. Course Outcomes

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

S.No.	Course Outcomes	Level	Unit
1	Explain the terminology used in pharmaceutical chemistry.	K2	I
2	Relate the structure of heterocyclic drugs derived from pyridine, pyrimidine and quinoline and their therapeutic properties.	K2	I
3	Describe the control mechanism for maintaining normal blood pressure, sugar and cholesterol	K2	II
4	Identify the medicinally important compounds of Al, Fe & As in the market.	K3	III
5	Recognize the various organic diagnostic agents, anti-neoplastic agents narcotic drugs from non-narcotic drugs used as drugs.	K3	IV & V
6	Correlate the structure mechanism and drug action of Antibiotics	K3	IV

2A. Syllabus

UNIT–I - Heterocyclic Drugs **6 hours**

1.1 Terminology used in pharmaceutical chemistry : Drug and its formulations, Pre-requisites of a drug, pharmacopia, chemotherapy, pharmaceutics, LD-50 values - Routes of administration of drugs.

1.2 Heterocylic Drugs : Structure and uses of drugs derived from the following derivatives - Pyridine derivatives - Tripleenamine and mepyramine, Quinoline derivatives - Chloroquine and primaquine, Pyrimidine derivatives - barbiturates.

UNIT–II -Blood & Its Composition **6 hours**

2.1 Composition of blood and blood plasma-function of Haemoglobin, Transport of Oxygen, R_h factor. Blood Pressure - Normal, high, low and its control mechanism.

2.2 Clinical estimation of Glucose, cholesterol and haemoglobin.

UNIT–III - Medicinally important compounds **6 hours**

3.1 Compounds of Al, As and Fe – preparation and application.
3.2 Chemistry of sulphonamides – sulphadiazine and prontosil – preparation and uses.

UNIT–IV- Organic diagnostic agents **6 hours**

4.1 X-ray contrast media (radio opaque) Iodipamide, Evan's blue, Histamine, Xylose, CT and MRI scan (Basics only) Structure and uses of i) Narcotic drugs–Morphine and SAR of morphine ii) Non-Narcotic drugs–ibuprofen.
4.2 Antibiotics – structure and mechanism of penicillin, structure of semi-synthetic penicillins – Ampicillin, structure and uses of Chloramphenical

UNIT–V- Anesthetics and Alkylating Agents **6 hours**

5.1 Anesthetics - Stages of anesthesia - Preparation and uses of general and local gaseous anesthetics – Ether, halogenated Hydrocarbons – chloroform and trichloroethylene, Local anesthetics – Cocaine and its any two derivatives, intravenous anesthetics – thiopentone sodium and propounded – Structure and uses only.
5.2 Anti-neoplastic agents – Alkylating agents (Busulfan)–Ethylene imines–Nitrogen mustards–Cyclophosphoamide. Antimetabolites – Purine analogues, Immunotherapy.

2B. Topics for Self-Study:

S.No.	Topics	Web Links
1	Heterocyclic Chemistry	https://youtu.be/o_tHj2GsPSc
2	Lipid disorders	https://youtu.be/XXEry4ZRMFI
3	Iron studies	https://youtu.be/_CWMUt8Xi_Y
4	Inhalational anaesthetic agents	https://youtu.be/RKdHImM6eYA
5.	Anticancer agents	https://youtu.be/6k2lUKEABQs

2C. Text Books

1. S. Jayashree Ghosh, *Text book of Pharmaceutical Chemistry,* S.Chand, 2008(Unit I-V)

2. Bentley and Drivers, *A Text book of Pharmaceutical Chemistry*, 14th edition, Oxford university Press, 1996

2D. Reference Books

1. Indian Pharmacopoea, Govt. of India , Indian Pharmacopoean Commission, Vol.I,2010

2. N. Murugesan, *A Text book of Pharmacology* - 6th edition, Sathya Publishers, 2004

3. S. Lakshmi, *Pharmaceutical Chemistry*-2nd edition, S. Chand, 1998.

4. Alfred Burger, *Medicinal Chemistry*- 6th edition, Wiley – Interscience Publication,2003.

3. Specific Learning Outcomes (SLO)

Unit	Course Contents	Learning Outcomes	Highest Blooms Taxonomic levels of Transaction
Unit -1 Heterocyclic Drugs			
1.1	Terminology used in pharmaceutical chemistry. Definition and explanation: Drug, pharmacopia, chemotherapy, pharmaceutics, LD50 values. Routes of administration - oral, parenteral, Bacteria - positive and negative.	Explains the various terminology used in pharmaceutical chemistry	K2
		Illustrate the routes of administration of drug.	K2
		Contrast the gram positive and negative bacteria	K2
1.2	Structure and uses of drugs Tripelennamine and mepyramine derivatives - barbiturates. - Pyridine derivatives – , Quinoline derivatives - Chloroquine and primaquine, Pyrimidine .	Illustrate the structure and utilities of drugs derived from pyridine, pyrimidine, quinoline.	K2
		Explain the structure and uses of chloroquine, primaquine, barbiturates.	K2
Unit – 2 Blood & Its Composition			
2.1	Composition of blood and blood plasma-function of Haemoglobin, Transport of Oxygen, Rh factor. Blood Pressure - Normal, high, low and its control mechanism.	Classify the blood groups and Rh factor.	K2
		Comprehend the role of Hemoglobin in oxygen transport mechanism.	K2
2.2	Clinical estimation of Glucose, cholesterol and haemoglobin.	Describe the standard clinical procedure to estimate the amount of Glucose, cholesterol and hemoglobin in serum.	K2

Unit - 3 Medicinally important compounds			
3.1	Medicinally important compounds. Compounds of Al, As and Fe – preparation and application.	Identify various compounds of Al, As and Fe in commercial applications.	K3
3.2	Chemistry of sulphonamides – sulphadiazine and prontosil – preparation and uses.	Explain the preparation and uses of sulpha Drugs	K2
Unit - 4 Organic diagnostic agents			
4.1	Organic diagnostic agents X-ray contrast media (radio opaque) Iodipamide, Evan'sblue,Histamine, Xylose ,CT and MRI scan (Basics only)	Outline the uses of organic diagnostic agents	K2
		Explain the uses of CT & MRI scans.	K2
4.2	Structure and uses of i) Narcotic drugs – Morphine and SAR of morphine ii) Non-Narcotic drugs – ibuprofen Antibiotics – structure and mechanism of penicillin, structure of semi-synthetic penicillin's–ampicillin,structure and uses of Chloramphenical.	Categorize the narcotic and non narcotic drugs.	K3
		Outline the various medicinal applications of the drugs under study.	K2
		Relate the structure and function of ampicillin with penicillin.	K2
	Unit – 5 Anesthetics and Alkylating Agents		

5.1	**Anesthetics** Stages of Anesthesia - Preparation and uses of general and local gaseous anesthetics – Ether, halogenated Hydrocarbons –chloroform andtrichloroethylene – Local anesthetics –Cocaine and its any two derivatives ,intravenous anesthetics – thiopentone sodium and propounded –Structure and Uses	Outline the stages of anesthesia	K2
		Categorize the type of gaseous anesthetics based on their uses along with the example.	K3
		Summarize the structure and uses of different classes of anesthetic agents	K2
5.2	Anti-neoplastic agents – Alkylating agents (Busulfan)– Ethyleneimines – Nitrogenmustards– Cyclophosphoamide. Antimetabolites–Purine analogues, Immunotherapy.	Outline the uses of anti neoplastics in the treatment of cancer cells.	K2
		Explain immunotherapy and its uses.	K2

4. Mapping (Co, Po, Pso)

L-Low **M-Moderate** **H- High**

PHARMACEUTICAL CHEMISTRY										**Code : U19CH5S2**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	H	H	-	M	-	-	L	-	-	H	-	-	H
CO2	H	H	-	M	-	-	L	-	-	H	-	-	H
CO3	H	H	-	M	-	-	L	-	-	H	-	-	H
CO4	H	H	-	M	-	-	L	-	_	H	-	-	H
CO5	H	H	-	M	-	-	L	-	-	H	-	-	H

CO6	H	H	-	M	-	-	L	-	-	H	-	-	H

5. Course Assessment Methods

Direct:

1. Continuous Assessment Test (Model Exams) I,II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Proto-type or Product Demonstration etc. (as applicable)
3. End Semester Practical Examination

Indirect:

1. Course-end survey

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SBEC - III INDUSTRIAL CHEMISTRY

Semester: V **Code : U19CH5S3**
Credits : 2 **Total Hours. : 30**
Hours/Week : 2

1. Course Outcomes

After the completion of this course the students will be able :

S.No.	Course Outcomes	Level	Unit
1	Describe the composition and applications of cosmetics	K2	I
2	Classify the polymers and calculate the molecular mass, average molecular mass and weight average molecular mass of polymers	K2	II
3	Discuss the production and general characteristics of industrial products - gaseous fuels, fertilizers, safety matches, fireworks and explosives	K2	III
4	Explain the types, composition, manufacture and uses of glass, cement and ceramics	K2	IV
5	Illustrate the constituents and applications of different protective coatings	K2	V
6	Correlate the basics of industrial processes learnt with the Industry environment and Prepare a Report with suitable data and graphics summarize the industrial processes	K4	V

2A. Syllabus

Unit–I **Cosmetic Chemistry** **6 hours**

1.1 Cosmetics - Introduction about raw materials in cosmetics (oil, waxes, colour, preservative and fragrance). Pre-requisites for different cosmetics and applications - skin and hair care products - skin lighteners, sun screen lotions- skin toners- anti-wrinkling creams.
1.2 Lip care - lip gloss – lipsticks - lip liners, moisturizers, crack creams. Hair-Shampoo, hair dye (raw materials and uses only).

Unit–II **Polymer Chemistry** **6 hours**

2.1 Classification of polymers based on microstructures, macrostructures and applications (thermosetting and thermoplastics). Determination of molecular mass of polymer: number average molecular mass (Mn) and weight average molecular mass (Mw) methods.
2.2 Zeigler - Natta polymers. Degree of polymerization - General preparation, properties and uses of Teflon, PAN, PVC.

Unit–III **Industrial Products** **6 hours**

3.1 Gaseous fuels - Non -petroleum fuels: Natural gas and CNG- composition and uses; - manufacture, composition and uses of Coal gas, Water gas, Producer gas and Power alcohol. Liquefied petroleum gases (LPG), Gobar gas, Benzol and semi-water gas –composition and uses

3.2 Fertilizers–Manufacture of N, P, K and mixed fertilizers, Micronutrients and their role in plant life.

3.3 General Characteristics of Safety matches, fireworks and manufacture of important explosives (TNT, Amatol, nitroglycerine NG or GTN and RDX).

Unit–IV **Glass, Cement and Ceramics** **6 hours**

Glass- Types of glass, composition, manufacture and uses. Cement- Manufacture wet and dry processes, composition of Portland cement, setting of cement, Concrete and RCC. Ceramics- Types - raw materials – white wares, manufacture and uses.

Unit–V **Protective Coatings** **6 hours**

Organic coating- Paints- requisites- constituents -Formulation of paint-uses. Varnishes - types- constituents of varnish and uses. Enamels - constituents and uses. Lacquers- constituents and uses, Emulsion paints - constituents and uses. Special paints-(luminous paint, heat resistant paint, fire resistant paint, cellulose paint, coal-tar paint, cement paint, anti-fouling paint, aluminium paint, water repellant paints and distemper.

Internal component: Inplant training: One day visit to an industry involving chemical technology in and around Tiruchirappalli, (Sugar, Cement, Textile, Paper Industries, etc) and submission of a mini report.

2B. Topics for Self -Study:

S. No.	Topic	Web links
1	**Cosmetic Chemistry**	https://www.science.org.au/curious/people-medicine/chemistry-cosmetics https://chem.libretexts.org/Bookshelves/Introductory_Chemistry/Map%3A_Chemistry_for_Changing_Times_(Hill_and_McCreary)/21%3A_Household_Chemicals/21.06%3A_Cosmetics_-_Personal_Care_Chemicals https://chemistscorner.com/how-to-become-a-cosmetic-chemist/

2.	**Polymer Chemistry**	https://www.acs.org/content/acs/en/careers/college-to-career/areas-of-chemistry/polymer-chemistry.html https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Supplemental_Modules_(Organic_Chemistry)/Polymers https://www.polychemistry.com/
3.	**Sugar and Paper**	https://www.youtube.com/watch?v=R9J7pOU5FSg https://www.youtube.com/watch?v=SDyJVr1q9kg https://www.youtube.com/watch?v=oQgOwuKozMg
4.	**Glass, Cement and Ceramics**	https://theconstructor.org/building/types-glass-properties-applications-construction/14755/ https://www.explainthatstuff.com/glass.html https://www.cement.org/cement-concrete-applications/how-cement-is-made https://www.explainthatstuff.com/ceratomics.html
5.	**Protective Coating**	https://www.researchgate.net/publication/285963223_New_developments_in_paint_and_coatings_technology https://www.resene.co.nz/paint-testing.htm https://www.sigmatest.org/Paint-Coating-Testing.html

2C. Text Books

1. Sharma B.K., "Polymer Chemistry", Goel Publishing House, Meerut, 1989. **(Unit- II)**
2. B.K. Sharma, "Industrial Chemistry", Goel Publishing Co., 1997 **(Unit- I, III, IV, V)**

2D. Recommended Reference Books

1. Jain and Jain, Engineering Chemistry, 15th Edition, Dhanapat Rai Publishigcompany, New Delhi, 2010.
2. Arora M.G M. and Yadav M.S., "Polymer Chemistry", 2nd revised edition, anmol Publications Private Ltd., New Delhi, 1989.

3. Specific Learning Outcomes (SLO)

Unit	Course content	Learning Outcomes	Highest Blooms Taxonomic level of Transaction
Unit–I	**Cosmetic Chemistry**		
1.1	Cosmetics - Introduction about raw materials in cosmetics - (oil, waxes, colour, Preservative, fragrance).	Outline the Constituents of different cosmetics and their chemistry.	K2
	Application of cosmetics - skin and hair - skin lighteners, sun screen lotions- skin toners- anti wrinkling creams.	Describe the applications of cosmetics	K2
	Lip care - lip gloss – lipsticks - lip liners, moisturizers - crack creams–Hair- Shampoo, hair dye (raw materials and uses only)	Identify the ingredients in lip care products.	K2
Unit–II	**Polymer Chemistry**		
2.1	Classification of polymers based on microstructures, macrostructures and applications (thermosetting and thermoplastics).	Classify polymers based on their structures and their applications.	K2
		Explain the methods of determination of molecular mass of polymers.	K2

	Determination of molecular mass of polymer number-average molecular mass (Mn) and weight average molecular mass (Mw) of polymers.	Compute the molecular mass of polymers by using the methods.	K2
2.2	Zeigler - Natta polymers. Degree of polymerization General preparation, properties and uses of Teflon, PAN, PVC	Illustrate preparation, properties and uses of Teflon, PAN, PVC	K2
Unit–III		**Industrial Products**	
3.1	Gaseous fuels - Non - petroleum fuels: Natural gas and CNG-composition anduses;	Classify the non- petroleum and based fuels and their composition and uses.	K2
	Manufacture, composition and uses of Coal gas, Water gas, Producer gas and Power alcohol. Liquefied petroleum gases (LPG), Gobar gas, Benzol and semi-water gas – composition and uses	Describe the manufacturing process of various fuel gases	K2
3.2	Fertilizers– Manufacture of N, P, K and mixed fertilizers, Micronutrients and their role inplant life.	Outline the classification and manufacture of fertilizers.	K2

3.3	General Characteristics of Safety matches, fireworks and manufacture of important explosives (TNT, Amatol, nitroglycerine NG or GTN and RDX).	Describe the preparation composition and characteristics of the safety matches, fireworks and important explosives.	K2
Unit–IV		**Glass, Cement and Ceramics**	
4.1	Glass- Types of glass, composition- Manufacture and uses.	Classify the types of glass and composition of glass. To explain the manufacture and uses of glass.	K2
4.2	Cement- Manufacture wet and dry processes, composition of portland cement, setting of cement, Concrete and RCC	Outline the manufacture, composition and setting of cement.	K2
4.3	Ceramics- Types- raw materials – white wares, manufacture and uses.	Classify the types of ceramics.	K2
		Illustrate the manufacture and uses of ceramics.	K2
Unit–V		**Protective Coatings**	
5.1	Organic coating- Paints- requisites- constituents - Formulation of paint- uses	Explain the requisites, constituents and formulation of paints.	K2
	Varnishes-types- constituents of varnish and uses.	Classify the types of varnishes	K2
		Illustrate the constituents and uses of varnishes.	K2
	Enamels - constituents and uses.	Outline the constituents and uses of enamels.	K2
	Lacquers- constituents and uses	Explain about the constituents and uses of lacquers.	K2

	Emulsion paints-constituents and uses	Illustrate the constituents and uses of emulsion.	K2
	Special paints-(luminous paint, heat resistant paint, fire resistant paint, cellulose paint, coal-tar paint, cement paint, antifouling paint, aluminium paint, water repellant paints and distemper)	Classify, explain and compare various special paints.	K3
	Inplant training: One day visit to be an industry involving chemical technology in and around Tiruchirappalli, (Sugar,Cement,Textile ,Paper Industries,etc) and submission of a mini report.	Correlate the basics of industrial processes learnt with the Industry environment.	K3
		Prepare a Report with suitable data and graphics to summarize the industrial processes.	K4

4. Mapping (Co, Po, Pso)

L-Low **M-Moderate** **H- High**

SBEC - III INDUSTRIAL CHEMISTRY Code : U19CH5S3

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H		L	-	-	-		-	H	-	-	H
CO2	H	H		L	-	-	-		-	H	-	-	H
CO3	H	H		L	-	-	-		-	H	-	-	H
CO4	H	H		L	-	-	-		-	H	-	-	H
CO5	H	H		L	-	-	-		-	H	-	-	H
CO6	H	H		L	-		H		-	H	M	H	H

5. Course Assessment Methods

Direct
1. Continuous Assessment Test (Model Exams) I,II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Proto-type or Product Demonstration etc. (as applicable) 3. End Semester Practical Examination
Indirect
1. Course-end survey

Core Practical - IV: GRAVIMETRY, ORGANIC AND INORGANIC REPARATIONS AND DETERMINATION OF PHYSICAL CONSTANTS

Semester: V **Code: U19CH5P4**
Credits: 3 **Total Hours: 90**
Hours/Week: 6

1. Course outcomes:

After the completion of this course the students will be able to :

S.No.	Course Outcomes	Level
1	Apply the basic principles of Gravimetric Analysis	K3
2	Estimate the accurate quantity of the precipitate by avoiding post and co -precipitation errors	K4
3	Perform single stage organic transformations and Inorganic preparations using standard procedures	K4
4	Produce the maximum quantity of the organic compound as pure crystals	K3
5	Validate the purity of the given compounds by using physical constants	K4
6	Produce a valid and authentic scientific report of the findings in the prescribed format	K4

2A. Syllabus

Experiments:

I. Gravimetric Estimation

1. Estimation of lead as lead chromate
2. Estimation of barium as barium chromate
3. Estimation of calcium as calcium oxalate monohydrate
4. Estimation of sulphate as barium sulphate

II. Organic Preparation

Preparation of an organic compound by a single stage and recrystallization of the compound.

1. Preparation of salicylic acid from methyl salicylate
2. Preparation of acetophenone oxime from acetophenone
3. Preparation of m-nitromethylbenzoate from methylbenzoate
4. Preparation of benzoic acid from benzaldehyde

III. Inorganic Preparation

1. Preparation of coordination complexes
    1. Preparation of Prussian blue
    2. Preparation of tetraaminecopper(II)sulphate
    3. Preparation of tristhioureacopper(I)chloride
2. Recording and interpreting the UV spectrum of the complex prepared (Demonstration only)

IV. Physical constant determination

1. **Theory of measurement of physical parameters**
   Principle of physical measurements – Checking the purity of samples, handling of chemicals and the apparatus.
2. **Determination of Physical Constant**
   Determination of melting and boiling points of simple organic compounds

2C. Text Books

1. V.Venkateswaran, R.Veerasamy , A.R. Kulandaivelu, Basic Principles of Practical Chemistry- Second Edition , Sultan Chand & Sons , New Delhi,2006
2. Vogel, Text Book of Quantitative Chemical Analysis, 6th Edition, Pearson Education, 2009.

2D. Reference Books

1. The Indian Pharmacopoea, 3rd Edition, Volume-II, Quality Specifications World Health Organization , 1981.
2. A. V. Kasthuri, S. G.Wadodkar, S. B. Gokhale, Practical Pharmaceutical Chemistry-I, Nirali Publications, 13th Edition, 2007.

Units	Course content	Learning Outcomes	Highest Blooms Taxonomic level of Transaction
1.	**<u>Gravimetric Estimation</u>** ➢ Estimation of lead as lead chromate ➢ Estimation of barium as barium chromate ➢ Estimation of calcium as calcium oxalate monohydrate ➢ Estimation of sulphate as barium	estimate the amount of ions using the gravimetric method estimate the accurate quantity of the precipitate by avoiding post and co -precipitation errors	K4

	sulphate		
2.	**<u>Organic Preparation</u>** Preparation of an organic compound by a single stage and recrystallization of the compound. ✓ Preparation of salicylic acid from methyl salicylate ✓ Preparation of acetophenone oxime from acetophenone ✓ Preparation of m-nitromethylbenzoate from methylbenzoate ✓ Preparation of benzoic acid from benzaldehyde	Prepare the maximum quantity of the organic compound as pure crystals.	K4
3.	**<u>Inorganic Preparation</u>** Preparation of coordination complexes Preparation of Prussian blue Preparation of tetraaminecopper(II)sulphate Preparation of tristhioureacopper(I)chloride Recording and interpreting the UV spectrum of the complex prepared (Demonstration only)	Prepare the coordination complexes by adopting suitable methodology.	K4
4.	**Physical constant determination** **Theory of measurement of physical parameters** Principle of physical measurements – Checking the purity of samples, handling of chemicals and the apparatus. **Determination of Physical Constant** Determination of melting and boiling points of simple organic compounds	Detect the purity of the prepared organic compounds by determining their physical constants.	K4

4. PO, PSO & CO Mapping

H= High M= Medium L=Low

GRAVIMETRY, ORGANIC AND INORGANICREPARATIONS AND DETERMINATION OF PHYSICAL CONSTANTS Code: U19CH5P4

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	-	-	M	M		H	-	H	M	-	H
CO2	H	H	H	L	H	H	-	H	-	H	H	-	H
CO3	H	H	-	L	H	H	-	H	-	H	H	-	H
CO4	H	H	-	L	H	H	-	H	-	H	H	-	H
CO5	H	H	H	L	H	H	-	H	-	H	H	-	H
CO6	L	H	-	L	-	-	H	-	-	L	-	H	L

5. Course Assessment Methods Direct:

Continuous Internal Assessment

1. Model Exams I and II
2. End Semester Practical Examination

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CORE : PROJECT

Semester: V **Code : U19CH5PJ**
Credits : 3 **Total Hours : 60**
Hours/Week : 4

On completion of the Course the Student will be able

S.No.	Course Outcomes	Level
1	Identify Simple scientific problems in the real-life situation related Chemical science	K5
2	Search relevant background Literature ensure the credibility of the research problem	K5
3	Develop a smart and achievable strategy solve the problem	K5
4	Develop a feasible, fool-proof and accurate method analyze the problem	K5
5	Critically analyze, corroborate with previously available knowledge and arrive at scientific findings from the observed results	K6
6	Document, Publish and Present the findings scientifically in the relevant forums by taking Cognizance of the ethical & IPR related issues	K5

Group Projects - Components for Evaluation

Preparation of Report – 25 Marks

Innovation in Choice of the problem and skills in systematic analysis and recording – 20Marks

Regularity and involvement – 20 Marks

Viva-Voce(External) – 20 Marks

Internal – 15 Marks

Core Course - VII: INORGANIC CHEMISTRY- II

Semester: VI **Code : U19CH607**
Credits : 6 **Total Hours : 90**
Hours/Week : 6

1. Course Outcomes:

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

S.No.	Course Outcomes	Level	Unit
1	Predict nuclear stability based on basic concepts in nuclear chemistry	K5	I
2	Explain detection separation and application of radio Isotopes.	K5	II
3	Explain semiconducting properties based on theories of metallic bonding	K4	III
4	Describe crystal packing of atoms in metals and their defects	K2	III
5	Distinguish the characteristics of the different types of Silicates	K4	IV
6	Correlate the features of photo physical processes and their applications.	K4	V

2A. Syllabus

Unit– I Nuclear Chemistry 18 Hours

1.1 Introduction–composition of nucleus, fundamental particles and nuclear forces – Meson field theory.
1.2 Nuclear stability – n/p ratio, mass defect, binding energy, packing fraction and magic numbers, Harkin's rule, shell and liquid drop models.
1.3 Isotopes**,** Isobars, isotones and isomers with examples. Detection of Isotopes – Aston and Dempster methods and separation of isotopes, whole number rule. Deviation of atomic weights from whole number.

Unit–II Radioactivity and Nuclear Transformations 18 Hours

2.1 Radioactivity–discovery, Types - detection and measurements (Wilson cloud chamber, G-M Counter and Cyclotron). Radioactive emanations – Theories of decay – Geiger Nuttal rule- Range of alpha particles-units of radioactivity-rate of radioactive disintegration - half life - average life.

2.2 Nuclear transmutations–Use of projectiles–Q-value of nuclear reactions – thermo nuclear reactions, Types of nuclear reactions – Nuclear reactors - Breeder reactors- trans-uranic elements - Stellar energy.

2.3 Radioactive disintegration series (U, Th, Ac, Np) - Applications of radio isotopes–Carbon dating – Radioactive waste disposal.

Unit–III **Metallic Bonding and Crystal defects** **18 Hours**

3.1 Theories of metallic bonding– Electron gas, Pauling and Band theories, Semi conductors– Extrinsic and intrinsic, n-type and p-type semiconductors and their applications - Packing of atoms in metal (bcp,ccp,hcp) – Crystal defects : Stoichiometric and Non-Stoichiometric defects - Metal Excess and Metal Deficiency defects- Frenkel and Schottky defects.

3.2 Structure of alloys–Substitutional and interstitial solid solutions–Hume Rothery rule.
3.3 Metallurgy: Occurrence of metals, Types of ores, Separation techniques based on gravity – Leaching, Froth Floatation, and Magnetic Separation- various metallurgical operations -concentration, calcinations, roasting, smelting and refining.

Unit– IV **Silicon Polymers** **18 Hours**

4.1 Silicones–manufacture, structure, properties and uses.
4.2 Silicates–Classification into discrete anions, one, two and three dimensional structures with typical examples, composition, properties and uses of beryl, asbestos, molecular sieves, talc, mica, zeolites and ultramarines.

Unit–V **Photochemistry** **18 Hours**

5.1 Difference between thermal and photochemical reactions - Laws of Photochemistry – Quantum yield- Factors affecting Quantum Yield.
5.2 Photophysical and photochemical processes — Jablonski Diagram, Phosphorescence - Fluorescence – Factors affecting Photophysical Processes. Chemiluminescence- Bio-Luminescence- Photosensitizers - Photosynthesis, Quenching and its types.
5.3 Applications of Photochemistry, Chemical Actinometer (Uranyl oxalate and Ferric oxalate actinometers)

2B. Topics for Self-Study:

S.No.	Topics	Web Links
1	How is Nuclear Stability Related to the Band of Stability and the Neutron to Proton Ratio	https://youtu.be/zAjNHmlUzaM
2	Harmful effects of radioactivity	https://youtu.be/SmgBoOR61bo

3	Metallurgical Reactors and Transfer Operations	https://youtu.be/8xDPihsuK7Q
4	Sodium Silicate As Binder In Sand Moulding Step-by-step intraoral repair of silicate/glass ceratomics	https://youtu.be/icGgssNXWck https://youtu.be/IsgeFL2S0NI
5	chemiluminescence	https://youtu.be/RMMZ3rnzUHM

2C. Text Books

1. B.R. Puri, L.R.Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, Milesne Publishers, New Delhi, 2017 **(Unit I- V)**
2. R.D. Madan and G.D. Tuli, *Inorganic Chemistry*, S. Chand & Co., New Delhi, 2010 **(Unit I-V)**
3. P.L. Soni and Mohan Katyal, *Text Book of Inorganic Chemistry*, Sultan Chand & Co.,New Delhi, 2004.

2D. Recommended Reference Books

1. Gurdeep Raj, *Advanced Inorganic Chemistry*, Goel Publications, Meerut, 2014
2. J.D. Lee, *Concise Inorganic Chemistry*, Oxford University Press, New Delhi, 2008
3. K. K. Rohatgi-Mukherjee, *Fundamentals of Phochemistry*, New Age International, NewDelhi, 2017.

3. Specific Learning Outcomes (SLO)

Unit	Course Content	Learning Outcomes	Blooms Taxonomic levels of Transaction
1.1	Composition of nucleus, fundamental particles and nuclear forces – Meson field theory.	Classify the various fundamental particles and nuclear forces.	K2
1.2	Nuclear stability – n/p ratio, mass defect, binding energy, packing fraction and magic numbers	Predict nuclear stability based on basic concepts in nuclear chemistry	K5
	Harkin's rule, shell and liquid drop models	Compare shell and liquid drop models	K2
1.3	Isotopes, Isobars, Isotones and Isomers with examples.	Distinguish Isotopes, isobars, Isotones and isomers in a	K4

		given set of nuclei.	
	Detection and separation of Isotopes – Aston and Dempster methods	Explain the experimental methods used for the detection and separation of Isotopes.	K3
	whole number rule. Deviation of atomic weights from whole number.	Calculate atomic weight of Isotopes from whole number rule.	K2
2.1	Radioactivity discovery, Types-detection and measurements (Wilson cloud chamber, G-M Counter and Cyclotron).	Describe the various methods detect and measure Radioactivity.	K2
	Radioactive emanations – Theories of decay	Differentiate the properties of α, β and γ emissions.	K3
	Geiger Natta rule- Range of alpha particles-	Relate the decay constant and range of α particles.	K2
	Units of radioactivity-rate of radioactive disintegration - half life - average life.	Calculate the half life and average life of a radioactive nucleus.	K4
2.2	Nuclear transmutations–Use of projectiles–Q-value of nuclear reactions	Distinguish exothermic and endothermic nuclear reactions.	K4
	Types of nuclear reactions - thermo nuclear reactions	Explain the types of nuclear reaction.	K4
	Nuclear reactors - Breeder reactors-trans-uranic elements - Stellar energy.	Outline the working of nuclear reactors .	K2
2.3	Radioactive disintegration series (U, Th, Ac, Np)	Discuss the different types of disintegration series.	K2
	Applications of radio Isotopes–Carbon dating	Calculate the age of a specimen from the given data .	K5
	Radioactive waste disposal.	Summarize the importance and methodology of Radioactive waste disposal.	K2
3.1	Theories of metallic bonding– Electron gas, Pauling and Band theories	Discuss the theories of metallic bonding	K2
	Semi conductors–Extrinsic and intrinsic, n-type and p-type Semi conductors and their applications	Distinguish n-type and p-type Semi conductors along with their applications	K4
	Packing of atoms in metal (bcp,ccp,hcp)	Explain the packing of atoms in metal	K2
	Crystal defects : Stoichiometric and Non-Stochiometric defects - Metal Excess	Classify the various crystal defects.	K4

	and Metal Deficiency defects- Frenkel and Schottky defects.		
3.2	Structure of alloy substitutional and interstitial solid solutions–Hume Rothery rule.	Distinguish substitutional and interstitial solids.	K4
3.3	Metallurgy: Occurrence of metals, Types of ores	List out the various types of Ores.and their Occurrence.	K1
	Separation techniques based on gravity – Leaching, Froth Floatation and Magnetic Separation	Explain the various methods of separation in metallurgy	K2
	Metallurgical operations -concentration, calcination, roasting, smelting and refining.	Explain the chemical processes involved in metallurgy.	K4
4.1	Silicones–manufacture, structure, properties and uses.	Explain the manufacturing process of silicones along with their properties and uses.	K2
4.2	Silicates–Classification in discrete anions, one, two and three dimensional structures with typical examples	Classify one, two and three dimensional structure of silicates with examples.	K4
	composition, properties and uses of beryl, asbestos, molecular sieves, talc, mica, zeolites and ultramarines.	Relate the composition, properties and uses of some important silicates.	K2
5.1	Difference between thermal and photo chemical reactions	Classify thermal and photo chemical reactions.	K2
	Laws of Photochemistry – Quantum yield- Factors affecting Quantum Yield.	Apply the laws of photochemistry calculate quantum yield..	K4
5.2	Photo physical and photo chemical processes — Jablonski Diagram, Phosphorescence - Fluorescence – Factors affecting Photo physical Processes.	Describe photo physical and processes by applying Jablonski Diagram.	K4
		List out the various factors affecting photo physical processes.	K1
	Chemiluminescence- Bio-Luminescence- Photo sensitizers - Photosynthesis, Quenching and its types.	Relate Chemiluminescence-Bio- Luminescence process. With day to day applications.	K4

		Explain the various types of Quenching.	K2
5.3	Applications of Photochemistry, Chemical Actinometer (Uranyl oxalate and Ferric oxalate actinometers)	Explain the applications of photo chemistry.	K4
		Describe the construction of actinometers.	K2

4. Mapping Scheme For Cos, Pos And Psos

L-Low **M-Moderate** **H- High**

INORGANIC CHEMISTRY- II Code : U19CH607													
Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	H	H	-	-	-	-	H	-	H	-	-	H
CO2	H	H	H	L	-	-	-	H	-	H	-	-	H
CO3	H	H	H	M	-	-	-	H	-	H	-	-	H
CO4	H	H	H	M	-	-	-	H	-	H	-	-	H
CO5	H	H	H	M	-	-	-	M	-	H	-	-	H
CO6	H	H	H	M	-		-	M	-	H	-	-	H

5.Course Assessment Methods

Direct

1. Continuous Assessment Test (Model Exams) I,II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Proto-type or Product Demonstration etc. (as applicable)
3. End Semester Practical Examination

Indirect

1. Course-end survey

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Core VIII: ORGANIC CHEMISTRY- II

SEMESTER: VI **Code : U19CH608**
CREDITS: 6 **Total Hours : 90**
Hours/Week : 6

1. Course Outcomes

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

S.No.	Course Outcomes	Level	Unit
1	Correlate the different organic reactions with the corresponding types of mechanisms.	K4	I
2	Predict the reactivity and orientation of different aromatic substrates wards Electrophiles and Nucleophiles	K5	II
3	Give reason for the formation of intermediates and products in a rearrangement reaction.	K4	III
4	Comprehend the preparation, properties, and structural elucidation of carbohydrates	K3	IV
5	Explain the chemistry of natural products (terpenes and alkaloids	K2	V
6	Compare the properties and reactivities of five, six membered and fused heterocyclic compounds.	K2	V

2A. Syllabus

Unit– I - Substitution and Elimination Reactions **18 Hours**

1.1 Aliphatic nucleophilic substitutions– stereochemical aspects and mechanism of S_N1, S_N2 and S_Ni reactions.

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

1.3 Aromatic Nucleophilic substitution reactions–Benzyne mechanism and intermediate complex formation mechanism.

1.4 Aromatic Electrophilc substitution reactions –Orientation and Reactivity –Mechanism of Nitration, Bromination, Sulphonation, Iodination, Riemer-Tiemann, Kolbe's and Friedel Craft's Reactions.

Unit– II - Molecular Rearrangements **18 Hours**

2.1 Classification - anionotropic, cationotropic, intermolecular and intramolecular rearrangement.

2.2 Pinacol–pinacolone rearrangement (Mechanism, Evidence for carbocation intermediate Formation, Migratory aptitude). Beckmann, Benzidine, Hoffmann, Curtius, Benzilic acid

rearrangements (Mechanism only), Claisen rearrangement (sigmatropic rearrangement), Cope rearrangement.

Unit– III - Natural Products **18 Hours**

3.1 Natural products - Terpenes- classification – Isoprene rule – general reactions of terpenes – structural elucidation of citral, geraniol, nerol, menthol, α-terpeniol and α- pinene.

3.2 Alkaloids–General methods of isolation and structural elucidation of conine, piperine and nicotine.

Unit– IV **Carbohydrates**

4.1 Classification of carbohydrates–Monosaccharides–preparation, properties and structural elucidation of glucose and fructose, epimerisation, 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.

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

4.3 Polysaccharides – structure and Properties of starch and cellulose **(Structural Elucidation not required).**

Unit– V - Heterocyclic Compounds **18 Hours**

5.1 Aromatic characteristics and basicity of heterocyclic compounds.

5.2 Five membered heterocyclic systems - preparation, properties and uses of furan, pyrrole, thiophene and imidazole. Electrophillic Substitution reactions of furan, pyrrole, thiophene and imidazole.

5.3 Six membered heterocyclic systems-structure, synthesis and reactions of pyridine,piperidine, purine and pyrimidine - Comparative basic characters of pyrrole, pyridine, piperidinewith amines.

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

2B. Topics for Self-Study:

S.No.	Topics	Web links
1	Elimination from cyclohexanes	https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Map%3A_Organic_Chemistry_(McMurry)/11%3A_Reactions_of_Alkyl_Halides-_Nucleophilic_Substitutions_and_Eliminations/11.11%3A_The_E2_Reaction_and_Cyclohexane_Conformation https://www.masterorganicchemistry.com/2012/10/18/the-e2-reaction-and-cyclohexane-rings/

2	Favorskii rearrangement	http://www.chemvista.org/Favorskii%20rearrangement%20and%20mechanism.html
3	Zingiberene	https://www.slideshare.net/abdelrahman_asar/zingiberene https://en.wikipedia.org/wiki/Zingiberene
4	Lipids	https://www.britannica.com/science/lipid
5	Tetrazole synthesis	https://en.wikipedia.org/wiki/Tetrazole

2C. Text Books

1. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand & Co. Ltd., New Delhi, 2012 **(Unit- I, II)**

2. MK Jain and SC Sharma, Modern Organic Chemistry , Vishal Publishing &Co.,2017 Bhupinder **(Unit- III, IV, V)**

3. R.T. Morrison & R.N.Boyd, Organic Chemistry, Pearson Education, New Delhi, 2016.

4. I.L. Finar,Organic Chemistry (Volume-2) , Pearson Education, New Delhi, 2002

2D. Reference Books

1. Mehta& Manju Mehta,Organic Chemistry , PHI Learning Pvt. Ltd., 2015
2. L.G. Wade, Organic Chemistry, Pearson Education, New Delhi,2016
3. Seyhan N.Ege Organic Chemistry: Structure and Reactivity, Houghton Mifflin Harcourt (HMH); 5th Edition 2003
4. Paula Yurkanis Bruice, Organic Chemistry, Pearson Education, New Delhi, 2013
5. Gurdeep Chatwal, Organic Chemistry of Natural Products, Himalaya Publications,Mumbai, 2014.

3. Specific Learning Outcomes (SLO)

Unit	Course Content	Learning Outcomes	Highest Blooms Taxonomic levels of Transaction
I	**Substitution and Elimination Reactions**		
1.1	Nucleophilic Substitution reactions S_N1, S_N2 and S_Ni reactions mechanism and stereochemical aspects	Categorize Nucleophilic substitution reactions along with example.	K2
		Predict the stereochemistry for the products of substitution reactions.	K4
1.2	Elimination reaction - Hoffmann and Saytzeff's eliminations, Mechanism of E_1, E_1C Band E_2 reactions. Elimination vs. Substitution.	Propose the mechanism of the reaction based on elimination product.	K4
		Compare and contrast Substitution and Elimination reactions	K2
1.3	Aromatic nucleophilic substitution reaction (SN) Benzyne mechanism and intermediate complex formation mechanism. -	Predict the products of SN reactions in Aromatic compounds	K4
		Identify the type of intermediate and its stability.	K2
1.4	Aromatic Electrophilc substitution reactions- Orientation and Reactivity -Nitration, Bromination, Sulphonation, Iodination, Riemer-Tiemann, Kolbe's and Friedel Craft's Reactions.	Predict the reactivity and orientation of different aromatic system wards Electrophiles.	K5
II	**Molecular Rearrangements**		
2.1	Classification–anionotropic, cationotropic, intermolecular and intramolecular rearrangement.	Classify the type of rearrangement based on the nature of migrating group	K3

2.2	Mechanism, Evidence for carbocation intermediate formation and Migratory Aptitude of Pinacol-Pinacolone rearrangement	Propose the mechanism of pinacol-pinacolone rearrangement.	K4
		Apply the mechanism in different substrate.	K3
		Justify the formation of different intermediates and products in the rearrangement.	K4
	Mechanism of Beckmann rearrangement, Benzidine, Hoffmann, Curtius, Benzilic acid rearrangement, Claisen rearrangement (Sigmatropic rearrangement),Cope rearrangement.	Apply the mechanism of different rearrangements for interconversion of functional groups.	K3
III	**Natural Products**		
3.1	Natural products –Terpenes – Isoprene rule – General reactions of Terpenes	Apply isoprene rule predict structure of Terpenes.	K3
		Write the reactions of Terpenes.	K2
	Structural elucidation of citral, geraniol, nerol, menthol, α-terpeniol and α- pinene	Apply reactions elucidate the structures of Terpenes	K3
3.2	Alkaloids – General methods of isolation and general methods of structural determination	Describe the methods of isolation of alkaloids determine the structure	K2
	Structural elucidation of conine, piperine and nicotine.	Apply reactions elucidate the structure of conine, piperine and nicotine	K3
IV	**Carbohydrates**		
4.1	Classification of carbohydrates– Monosaccharides–preparation, properties	Classify carbohydrates	K3
		Write the preparatory methods and reactions of monosaccharides	K2

	Structural elucidation of glucose and fructose	Discuss the structural elucidation of Glucose and Fructose	K2
	Epimerization, interconversion of glucose and fructose, chain lengthening, chain shortening of aldoses,	Interconvert carbohydrates.	K3
	mutarotation and α, β – glycoside linkages	Explain the optical properties and nature of linkage in carbohydrates	K2
	Cyclic structure, pyranose and furanose forms of D –Glucose. Tests for Carbohydrates.	Compare the structure of different forms of D-glucose	K2
4.2	Disaccharides –Structure, Properties	Explain the structure and properties of Dissacharides	K2
	general reactions- Maltose, Lactose & Sucrose	Write the general reactions of Dissacharides	K2
	Sucrose – Manufacture, properties and structural elucidation	Explain the steps involved in the manufacture of Sucrose	K2
		Apply reactions elucidate the structure of Sucrose	K3
	Polysaccharides – structure and Properties of starch and cellulose	Describe the structure and properties of polysaccharides	K2
V	**Heterocyclic Compounds**		
5.1	Aromatic characteristics and basicity of heterocyclic compounds	Predict the basicity of heterocyclic compounds based on aromatic character	K3
5.2	Five membered heterocyclic systems - preparation, properties and uses of furan, pyrrole, thiophene and imidazole	Compare the reactivity of five membered heterocyclic system.	K2
	Electrophilic Substitution reactions of furan, pyrrole, thiophene and imidazole.	Predict the products of Electrophilic substitution reactions of five membered Heterocyclic compounds	K5

5.3	Six membered heterocyclic systems- structure, synthesis and reactions of pyridine, piperidine, purine and pyrimidines	Explain the Synthesize of six membered heterocyclic compounds	K2
		Explain the reactions of six membered heterocyclic compounds with one and two heteroatoms	K2
	Comparative basic characters of pyrrole, pyridine, piperidine with amines.	Predict the basicities of five and six membered heterocyclic compounds with amines	K3
5.4	Fused rings- Synthesis of Quinoline, isoquinoline and indole by Skraup, Bischler Napieralski and Fischer Indole synthesis respectively and their reactions	Write the Synthesis and the reactions of bicyclic heterocyclic compounds	K2

4. Mapping of COs with POs and PSOs)

L-Low **M-Moderate** **H- High**

ORGANIC CHEMISTRY- II					**Code : U19CH608**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	H			M		L	H	-	H			H
CO2	H	H			M		L	H	-	H			H
CO3	H	H			M		L	H	-	H			H
CO4	H	H			M		L	H	_	H			H
CO5	H	H			-		L	H	-	H			H
CO6	H	H		-	M		L	H	-	H			H

5. Course Assessment Methods

DIRECT

1. Continuous Assessment Test (Model Exams) I,II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Proto-type or Product Demonstration etc. (as applicable)
3. End Semester Practical Examination

INDIRECT

1. Course-end survey

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Core IX: PHYSICAL CHEMISTRY – II

Semester: V **Code: U19CH609**
Credits: 6 **Total Hours : 90**
Hours/Week : 7

1. Course Outcome:

After the completion of this course, the student will be able to

S.No.	Course Outcomes	Level	Unit
1	Explain the concepts of Electrochemistry and its applications	K4	I
2	Describe the construction of different kinds of electrochemical cells	K2	II
3	Predict the thermodynamic quantities of cell reactions identify the feasibility of reactions	K3	II
4	Illustrate the principle of Molecular Spectroscopy (UV-Vis, IR, Raman, NMR and ESR) and the spectra of selected molecules	K3	III
5	Identify the functional groups and structure of simple molecules using IR spectroscopy	K2	IV
6	Interpret the NMR & ESR spectral data arrive at the structure of molecules	K3	V

2A. Syllabus

UNIT I - Electrical Conductance **18 Hours**

1.1 Conduction in metals and in electrolyte solution, specific conductance, molar conductance and equivalent conductance, Measurement of equivalent conductance, variation of equivalent conductance with concentration.

1.2 Migration of ions –Kohlrausch's law and its applications to determine λ^0 of weak electrolyte - Arrhenius theory of electrolytic dissociation – weak and strong electrolytes according to Arrhenius theory – Ostwald's dilution law – its uses to determine K_a of weak acids and K_{sp} of sparingly soluble salts and limitations.

1.3 The elementary treatment of Debye – Huckel Onsagar equation for strong electrolytes. Conductometric titrations: acid-base, precipitation with examples. Transport number and Hittorf's rule-determination of transport number by Hittorf's method and moving boundarymethod.

UNIT II - Equilibria in Electrochemical Cells **18 Hours**

2.1 Electrolytic and galvanic cells–Reversible and irreversible cells. Conventional representation of electrochemical cells. Electromotive force of a cell and its measurements – Computation of cell e.m.f.- Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH, ΔS and K)- **Problems.**

2.2 Derivation of Nernst equation, single electrode potential and Applications of Nernst equation Standard electrode potentials- Electrochemical series and its significance. Types of reversible

electrodes – Cell construction- cell reaction with Nernst equation - Reference electrodes: Standard hydrogen electrode and Calomel electrode - Western Cadmium cell.

2.3 Concentration cells – Types, emf of concentration cells with and without transference and its derivation – liquid junction potential and its derivation – applications of concentration cells – Applications of emf measurements: determination of valancy, transport number and solubility product, Potentiometric titrations – Redox and Acid-Base Titrations.

UNIT III - Molecular Spectroscopy – I **18 Hours**

3.1. Definition of spectrum. Electromagnetic radiation, quantization of different forms of energies in molecules (translational, rotational vibrational and electronic), Born Oppenheimer approximation, factors affecting line width and intensity.

3.2 UV-Visible spectroscopy–types of electronic transitions–Franck Condon principle – predissociation spectra and dissociation energy. Applications – Beer Lambert's law - OD, chromophore, auxochrome, bathochromic and hypsochromic shifts and effect of substituents.

UNIT IV - Molecular Spectroscopy – II **18 Hours**

4.1 Infrared spectroscopy–modes of vibration of diatomic, linear tri-atomic (CO_2) and non- linear tri-atomic (H_2O) molecules. Stretching and bending vibrations - selection rules, expression for vibrational frequency (derivation not required). Calculation of force constant - Applications of IR spectra (group frequencies, finger print and hydrogen bonding only).

4.2 Raman spectroscopy - conditions - Rayleigh and Raman scattering, selection rules Classical and quantum theory - Stokes and Anti-Stokes lines. Differences between Raman and IR spectroscopy - Rotational Raman spectra of non-centro symmetric molecule (HCl only). Mutual exclusion principle (CO_2 and N_2O).

UNIT V - Molecular Spectroscopy – III **18 Hours**

5.1 NMR Spectroscopy - magnetic and non - magnetic nuclei- selection rules - principle of nuclear magnetic resonance - ring current - shielding mechanism-chemical shift - factors affecting chemical shift - number of signals - spin-spin coupling - splitting of signals - NMR spectra of methyl halides, ethylene, acetylene and benzene - Chemical exchange - NMR spectrum of ethyl alcohol in detail.

5.2 ESR spectroscopy - selection rules - theory of ESR spectra - hyperfine splitting - ESR spectra of simple radicals- $^{\bullet}CH_3$, $^{\bullet}CD_3$, naphthalene radical ions only.

2B. Topics for Self-Study:

S.No.	Topics	Web Links
1	Conductometric Sensors	https://youtu.be/mulkGSJai3A
2	Ion Selective Electrodes	https://www.youtube.com/watch?v=LVocg2RjDMM
3	Chemical Reagents in UV Visible Spectroscopy	https://www.youtube.com/watch?v=UTRiVd-V3Cw
4	Challenges in application of Raman spectroscopy to biology and materials	https://pubs.rsc.org/en/content/articlepdf/2018/ra/c8ra04491k
5	2D NMR Spectroscopy for structural studies of biomolecules	https://nptel.ac.in/courses/104/108/104108097/

2C. Text Books

1. B.R.Puri, L.R.Sharma and Madan. S. Pathania, *Principles of Physical Chemistry*, 42nd Edition, Vishal Publishing Co., Jalandhar, 2017 **(Unit I-V)**
2. B.S. Bhal G.D. Tuli and ArunBhal, *Essentials of Physical Chemistry*, S. Chand & Co., New Delhi, 2010**(Unit- I, II)**
3. Gurdeep Raj, *Advanced Physical Chemistry*, Goel Publishing House, Meerut, 2016.

2D. Recommended Reference Books

1. P.Atkins and J.Paula, *Physical Chemistry*, Oxford University Press, New Delhi, 2018
2. G.W.Castellan, *Physical Chemistry*, 3rd Edition, Narosa Publishing House, New Delhi, 2004
3. K. Kundu and S.K. Jain, *Physical Chemistry*, S. Chand & Co., Ltd., New Delhi, 2003
4. K.L. Kapoor, *Text Book of Physical Chemistry*, Macmillan, New Delhi, 2017
5. G.Aruldhas, *Molecular Structure and Spectroscopy*, Prentice Hall of India, New Delhi, 2007.

4. Specific Learning Outcomes (SLO)

Unit/ Section	Course Content	Learning Outcomes	Blooms Taxonomic levels of Transaction
Unit– I Electrical Conductance			
1.1	Specific Conductance and equivalent conductance - Measurement of equivalent conductance, variation ofequivalent conductance with concentration.	Calculate Specific Conductance and equivalent conductance of the given electrolyte.	K4
1.2	Migration of ions –Kohlrausch's law and its applications to determine λ0 of weak electrolyte	Evaluate the $\lambda_0$value of Weak electrolyte using Kohlrausch's law	K4
	Arrhenius theory of electrolytic	Compare the weak and strong	K2

	dissociation – weak and strong electrolytes	electrolytes by Arrhenius theory	
	Ostwald's dilution law – its uses to determine Ka of weak acids andKsp of sparingly soluble salts and limitations	Determine the dissociation constant and solubility product by Ostwald's dilution law	K4
1.3	The elementary treatment of Debye – Huckel Onsagar equation for strong electrolytes.	Verify the Debye – Huckel Onsagar equation for strong electrolytes	K3
	Conductometric titrations – acid – base, precipitation with examples	Apply Conductometric method for estimation of acids, bases and salts	K3
	Transport number and Hittorf's rule-determination by Hittorf's method and moving boundary method	Calculate the Transport number by Hittorf's and boundary method	K3
UNIT– II	**Equilibria in Electrochemical Cells**		
2.1	Electrolytic and galvanic cells– Reversible and irreversible cells. Conventional representation of electrochemical cells.	Distinguish between the cell reactions taking place in Electrolytic cells and Galvanic cells	K2
	Electromotive force of a cell and its measurements – Computation ofcell e.m.f.- Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH, ΔS and K)-Problems.	Calculate the thermodynamic quantities of cell reactions to identify the feasibility of reactions.	K2
		Predict the thermodynamic quantities of a given system using emf data	K3
2.2	Derivation of Nernst equation - Single electrode potential and Applications of Nernst equation Standard electrode potentials- Electrochemical series and its significance.	Derive Nernst equation.	K2
		Explain the Standard electrode potential and its application	K2
		Describe the significance of the electrochemical series	K2
		Apply electrochemical series and find the redox reactions taking place in electrochemical	K3
	Types of reversible electrodes – Cell construction- cell reaction with Nernst equation- Reference electrodes:Standard hydrogen electrode and Calomel electrode -	Classify the reversible electrodes	K2
		Explain the working principle of SHE and calomel electrode	K2

	Western Cadmium cell.	Construct the electrochemical cells set up	K3
2.3	Concentration cells– Types, emf of concentration cells with andwithout transference and itsderivation. Liquid junction potential and its derivation - Applications of concentration cells	Derive the cell EMF expression for concentration cells with and without transference.	K2
		List out the applications of concentration cells	K2
	Applications of emf measurements: determination of valency, transport number and solubility product, Potentiometric titrations - Redox and Acid-Base Titrations	Calculate the valency, transport number and solubility product using emf data	K2
		Apply the principles of potentiometric redox and potentiometric acid -base titrations	K3
Unit– III		**Molecular Spectroscopy – I**	
3.1	Definition of spectrum. Electromagnetic radiation, quantization of different forms of energies in molecules (translational, rotational vibrational and electronic)	Explain the quantization of different forms of energies in molecules	K2
	Born Oppenheimer approximation, factors affecting line width and intensity.	Explain Born Oppenheimer approximation.	K2
		Summarize the factors affecting line width and intensity.	K2
3.2	UV-Visible spectroscopy - Typesof electronic transitions - Franck Condon principle- predissociation spectra and dissociation energy.	Outline the various types of electronic transitions.	K2
		Explain the basics of electronic spectra and Franck-Condon principle.	K2
		Summaraize the factors influencing predissociation of molecules.	K2

		Calculate the dissociation energy of molecules	K3
	Applications – Beer Lambert's law - OD, chromophore, auxochrome, bathochromic and hypsochromic shifts and effect of substituents	Apply Beer Lambert's law for the Quantitative analysis of given samples.	K3
		Explain the effect of substituent's on absorption	K2
Unit– IV	**Molecular Spectroscopy - II**		
4.1	Infrared spectroscopy- modes of vibration of diatomic, linear tri-atomic (CO_2) and non- linear tri-atomic (H_2O) molecules. Stretching and bending vibrations	Identify the different modes of IR vibration in linear and nonlinear molecules.	K2
	Selection rules, expression for vibrational frequency (derivation not required).	Explain the Selection rules and expression for vibrational frequency	K2
	Calculation of force constant - Applications of IR spectra (group frequencies, finger print and hydrogen bonding only).	Calculate force constant for different types of bond	K3
4.2	Raman spectroscopy -conditions - Rayleigh and Raman scattering, selection rules Classical and quantum theory - Stokes and Anti-Stokes lines.	Explain different spectral lines observed in Raman spectra	K2
	Differences between Raman and IR spectroscopy	Compare Raman and IR spectroscopy	K2
	Rotational Raman spectra of non-centrosymmetric molecule (HCl only). Mutual exclusion principle (CO_2 and N_2O).	Explain Mutual exclusion principle	K2
		Explain IR & Raman spectra of HCl.	K2
Unit– V	**Molecular Spectroscopy - III**		
5.1	NMR Spectroscopy - magnetic and non - magnetic nuclei- selection rules -	Explain the importance of magnetic and non magnetic nuclei	K2

	principle of nuclear magnetic resonance - ring current - shielding mechanism- chemical shift- factors affecting chemical shift - number of signals - spin-spin coupling - splitting of signals	Describe chemical shift and factors affecting chemical shift.	K2
		Illustrate spin-spin coupling.	K2
		Find out the number of NMR signals given by various compounds.	K3
	NMR spectra of methyl halides, ethylene, acetylene and benzene- Chemical exchange - NMR spectrum of ethyl alcohol in detail	Interpret the NMR spectra of methyl halides, ethylene, acetylene and benzene.	K3
		Explain the NMR spectra of ethyl alcohol.	K2
5.2	ESR spectroscopy - selection rules- Theory of ESR spectra - hyperfine splitting	Explain hyperfine splitting in ESR spectroscopy.	K2
	ESR spectra of simple radicals- ˙CH3, ˙CD3, naphthalene radical ions only.	Interpret the ESR spectra of CH3, CD3 and naphthalene radial.	K3

4. Mapping Scheme for the PO, PSOs and Cos

L-Low M-Moderate H- High

PHYSICAL CHEMISTRY – II Code: U19CH609													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	H	H		M	M	L	H	-	H	M	M	H
CO2	H	H	H		M	M	L	M	-	H	M	M	H
CO3	H	H	H		M	M	L	M	-	H	-	L	H
CO4	H	H	H		M	-	L	H	_	H	-	M	H
CO5	H	H	H		M	M	L	H	-	H	M	M	H
CO6	H	H	H	-	M	H	L	H	-	H	M	L	H

5. Course Assessment MethodsDIRECT:

1. Continuous Assessment Test (Model Exams) I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Proto-type or Product Demonstration etc. (as applicable)
3. End Semester Practical Examination

INDIRECT:

1. Course-end survey

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Elective Course - III: ANALYTICAL CHEMISTRY

Semester: VI **Code: U19CH6:3**
Credits: 5 **Total Hours : 90**
Hours/Week : 6

1. Course Outcomes:

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

S.No.	Course Outcomes	Level	Unit
1	Adhere first aid procedures and safety measures in Laboratory	K3	I
2	Choose the suitable methodology for purification of compounds.	K3	II
3	Analyze the given set of data statistically identify errors.	K4	II
4	Apply the principles and methods estimate selected organic compounds in a given sample	K3	III
5	Apply the principles and applications of electro analytical and colorimetric methods	K3	IV
6	Apply a suitable chromatographic technique separate various substances present in a mixture. (K3)	K3	V

2A. Syllabus

Unit– I Good Laboratory Practices (GLP) Hours 18

1.1 Safety measures - Storage and handling of corrosive, flammable, explosive, toxic, carcinogenic and poisonous chemicals. Simple first aid procedure for accidents - acid in eye, alkali in eye, acid burns, alkali burns, bromine burns, poisoning, inhalation of gases and heat burns - Calibration of Glassware - Requisites for making standard Measuring flask, Pipette and Burette.

1.2 Green Chemistry - Introduction and basic principles of green chemistry - green solvents - green reactions - microwave induced green synthesis.

Unit– II Analytical Methods Hours 18

2.1 Organic estimations - Principles and methods to estimate glucose, phenol, aniline, ketone, Estimation of oils and fats, Iodine value, Saponification value.

2.2 Methods of purification–steam distillation, vacuum distillation, fractional distillation, solvent extraction. crystallization and sublimation.

2.3 Data Analysis - Errors in chemical analysis, classification of errors, Precision, accuracy and rejection of data questioned. Significant Figures in Scientific measurements, Mean, Mode, Median –

Mean deviation and standard deviation – t-test and Q–test – Significance of Correlation and Regression coefficients – Curve Fitting by Least Square method.

UNIT– III Analytical Techniques-I Hours 18

3.1.Thermo-analytical Methods

Principles involved in Thermo Gravimetric Analysis and Differential Thermal Analysis instrumentation. Characteristics of TGA ($CaC_2O_4.H_2O$, $CuSO_4.5H_2O$) and DTA curves ($CaC_2O_4.H_2O$) - Factors affecting TGA and DTA curves.

3.2. Analytical electrochemistry

Potentiometry (redox titration), conductometry (acid -base titration), electro – gravimetry (estimation of copper and silver).

Unit- IV Analytical Techniques-II Hours 18

4.1 Colorimetric analysis - Laws of colorimetry, principle, instrumentation, construction of standard graph and applications of colorimetry. Estimation of nickel using DMG and aluminium using oxine.

4.2 Complexometric titrations–principle and applications, sequestering agents, Structure of EDTA and its complexes.

4.3 Techniques for kinetics study

Principles and techniques used to follow the kinetics of ordinary, fast and photo chemical Reactions (Volumetry, Polarimetry, Actinometry - one example for each method) and flash photolysis.

Unit- V Chromatography Hours 18

5.1 Column chromatography – Principle, types of adsorbents, preparation of column, elution, R_f value and its significance, factors affecting R_f value, Application: separation of 2,4–dinitrophenyl hydrazones of butanone and acetophenone.

5.2 Paper chromatography – principle, selection of solvents, development of chromatogram, application – Application: separation of amino acids only.

5.3 Thin layer chromatography – principle, choice of adsorbent, preparation of plates, development and application – Application: separation of 2,4-dinitrophenylhydrazones of butanone and acetophenone only.

5.4 Ion exchange chromatography – principle, types of resins, Application: separation of lanthanides.

2B. Topics for Self-Study:

S.No	Topics	**Links**
1.	Green Chemistry	https://www.acs.org/content/acs/en/greenchemistry/principles/12-principles-of-green-chemistry.html https://cen.acs.org/articles/95/i26/Five-green-chemistry-success-stories.html
2.	Analytical Methods Protein Purification	https://www.youtube.com/watch?v=PVvpEKeOzEM https://www.youtube.com/watch?v=_CXlmtfxuzQ
3.	Analytical Techniques-I TGA DSC	https://www.youtube.com/watch?v=qaUAJ1RJqMU https://www.youtube.com/watch?v=2CU3uvjKXlk https://www.youtube.com/watch?v=aTWVCfRlMX8 https://www.youtube.com/watch?v=0QCpwgV1nfw
4.	UV Photolysis	https://www.hindawi.com/journals/ijp/2012/140605/
5.	Analytical Techniques-II Advances In Fast Ion Chromatography	https://www.europeanpharmaceuticalreview.com/article/2835/advances-in-fast-ion-

		chromatography/#:~:text=Ion%20chromatography%20(IC)%20allows%20the,possessing%20fixed%20ion%20exchange%20sites.&text=To%20identify%20and%20quantify%20counter,the%20determination%20of%20inorganic%20cations

2C. Text Books

1. R. Gopalan, P.S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand & Sons, New Delhi, 1997 **(Unit I-V)**
2. B.K. Sharma, Instrumental Methods of Chemical Analysis, Goel Publishing House, Meerut, 1999 **(Unit- II, III).**

2D. Reference Books

1. Douglas A Skoog, Donald M. West, F. James Holler, Stanely R. Crouch, Fundamentals of Analytical Chemistry, Thompson Books, Bangalore, 2014
2. H.H: Willard, D. Merrit and John A Dean, Instrumental methods of Analysis D. Van Nostrand Company, New York, 1998

3. Specific Learning Outcomes (SLO)

Unit	Course Content	Learning Outcomes	Blooms Taxonomic levels of Transaction
Unit– I	**Good Laboratory Practices (GLP)**		
1.1.	**Safety measures:** Storage and handling of corrosive, flammable, explosive, toxic, carcinogenic and poisonous chemicals	Describe the Safety measures to be taken store and handle Chemicals.	K2
	Simple first aid procedure for accidents - acid in eye, alkali in eye, acid burns, alkali burns, bromine burns, poisoning, inhalation of gases and heat burns	Choose appropriate first aid procedure for accidents.	K3

	Calibration of Glassware - Requisites for making standard Measuring flask, Pipette and Burette	Apply glassware calibration procedures.	K3
1.2.	**Green Chemistry**: Introduction and basic principles of green chemistry - green solvents - green reactions - microwave induced green synthesis.	Describe the importance of green synthetic route	K2
	Unit– II	**Analytical Methods**	
2.1.	**Organic estimations** : Principles and methods to estimate glucose, phenol, aniline, ketone, Estimation of oils and fats, Iodine value, Saponification value.	Apply the principles and methods to estimate selected organic compounds in a given sample	K3
2.2.	**Methods of purification**: Steam distillation, vacuum distillation, fractional distillation, solvent extraction. crystallization and sublimation	Identify an appropriate purification technique.	K3
2.3.	**Data Analysis:** Errors in chemical analysis, classification of errors, Precision, accuracy and rejection of data questioned. SignificantFigures in Scientific measurements, Mean, Mode, Median – Mean deviation and standard deviation – t-test and Q–test – Significance of Correlation and Regression coefficients – Curve Fitting by Least Square method	Analyze the given set of data statistically to identify errors.	K4
	UNIT– III	**Analytical Techniques-I**	
3.1.	**Thermo-analytical Methods** Principles involved in Thermo Gravimetric Analysis and Differential Thermal Analysis instrumentation. Characteristics of TGA (CaC_2O_4. H_2O, $CuSO_4.5H_2O$) and DTA curves (CaC_2O_4. H_2O) - Factors affecting TGA and DTA	Describe the thermal stability of a particular sample by using TGA and DTA process	K2

	curves		
3.2.	**Analytical electrochemistry** Potentiometry (redox titration), condutometry (acid –base titration), electro – gravimetry (estimation of copper and silver)	Explain the method of determining the amount of ions present in the sample using suitable basic electro-analytical technique.	K2
	Unit- IV	**Analytical Techniques-II**	
4.1.	**Colorimetric analysis**: Laws of colorimetry, principle, instrumentation, construction of standard graph and applications of colorimetry. Estimation of nickel using DMG and aluminium using oxine	Apply the Laws of Colorimetry in estimation of Ions**.**	K3
4.2.	**Complexometric titrations**: Principle and applications, sequestering agents, Structure of EDTA and its complexes	Apply the Principle and applications of sequestering agents	K3
4.3.	**Techniques for kinetics study:** Principles and techniques used to follow the kinetics of ordinary, fast and pho chemical Reactions (Volumetry, Polarimetry, Actinometry - one example for each method) and flash photolysis	Outline the Principles and techniques used to follow the kinetics of Reactions	K2
	Unit– V	C**hromatography**	
5.1.	**Column chromatography:** Principle, types of adsorbents, preparation of column, elution, R_f value and its significance, factors affecting R_f value, Application: separation of 2,4–dinitrophenyl hydrazones of butanone and acetophenone	Explain column chromatographic technique to separate and identify the compounds in amixture	K2

5.2.	**Paper chromatography**: Principle, selection of solvents, development of chromatogram, application – Application: separation of amino acids only	Explain the paper chromatographic technique to separate organic compounds in a mixture	K2
5.3.	**Thin layer chromatography:** Principle, choice of adsorbent, preparation of plates, development and application – Application: separation of 2,4-dinitrophenylhydrazones of butanone and acetophenone only	Explain the Thin Layer chromatographic technique to separate organic compounds in a mixture	K2
5.4.	**Ion exchange chromatography:** Principle, types of resins, Application: separation of lanthanides	Apply the principles of Ion Exchange chromatography to separate and evaluate the presence of lanthanides	K3

4. Mapping Scheme for the COs, POs and PSOs

L-Low **M-Moderate** **H- High**

ANALYTICAL CHEMISTRY										**Code: U19CH6:3**			
Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	H		H	H					H	H		H
CO2	H	H			H	H	L	H	H	H	H		H
CO3	H	H	H	H	H	H	L	H	H	H	H	H	H
CO4	H	H			H	H	L	H	H	H	H		H
CO5	H	H	H		H	H	L	H	H	H	H	H	H
CO6	H	H	H		H	H	L	H	H	H	H	H	H

5 . Course Assessment Methods

Direct

1. Continuous Assessment Test (Model Exams) I,II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Proto-type or Product Demonstration etc. (as applicable)
3. End Semester Practical Examination

Indirect

1. Course-end survey

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Core Practical - V **PHYSICAL CHEMISTRY PRACTICAL**

Semester: VI **Code:U19CH6P5**
Credits : 3 **Total Hours : 75**
Hours/Week : 5

1. Course Outcomes:

After completing the course, the students will be able to

S.No.	Course Outcomes	Level
1	Determine the rate constant and order of chemical reactions	K4
2	Determine the molecular weight and transition temperature of unknown compounds using colligative properties	K4
3	Evaluate the critical solution temperature of the given partially miscible liquid systems and the effect of impurities on their critical solution temperature	K5
4	Operate the conductometer, potentiometer and photo colorimeter estimate the strength of unknown solution	K2
5	Evaluate the efficiency of a buffer in resisting changes pH	K5
6	Apply the principles of Chromatography identify the components of the given sample	K3

2A. Syllabus

Experiments

1. Kinetics study of Acid catalysed hydrolysis of an ester.
2. Determination of Molecular Weight by Rast method.
3. Determination of Critical Solution Temperature of Phenol-water system.
4. Determination of Effect of impurity on CST.
5. Construction of Phase diagram of a Simple eutectic system.
6. Determination of transition temperature of a salt hydrate.
7. Conductometric determination of cell constant and limiting molar conductance of a strong electrolyte.
8. Conductometry – acid base titration.
9. Potentiometry – Redox titration.
10. Verification of Beer - Lamberts' law using photo colorimeter.
11. Determination of pH by potentiometry.
12. Determination of water of crystallization and the formula of salt hydrates.

Group experiments

1. Preparation of Buffer solutions and Determination of buffer capacity by pH meter.
2. Determination of distribution coefficient of metals by paper chromatography.
3. Monitoring a reaction progress using Thin Layer chromatographic technique.

2C. Text Books

1. V. Venkateswaran , R. Veeraswamy, A.R. Kulandaivelu, Basic Principles of Practical Chemistry, S. Chand & Co., New Delhi,1997.
2. R. Gopalan, P.S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand & Sons, New Delhi, 1997.
3. B.K. Sharma, Instrumental Methods of Chemical Analysis, Goel Publishing House, Meerut, 1999.

2D. Reference Books

1. Douglas A Skoog, Donald M. West, F. James Holler, Stanely R. Crouch, Fundamentals of Analytical Chemistry, Thompson Books, Bangalore, 2014
2. H.H: Willard, D. Merrit and John A Dean, Instrumental methods of Analysis D. Van Nostrand Company, New York, 1998

S.No.	Course Content	Learning Outcomes	Blooms Taxonomic levels of Transaction
1.	Kinetic study of Acid catalysed hydrolysis of an ester	Determine the rate, order and molecularity of the given reaction	K4
2.	Determination of Molecular Weight by Rast method - Determination of transition temperature of a salt hydrate	Determine the molal depression constant (K_f) of given solvent	K4
		Determine the transition temperature of given salt hydrate	K4
		Evaluate the molecularweight of unknown compounds	K5
3.	Determination of Critical Solution Temperature of Phenol-water system. Determination of Effect of	Determine the critical solution temperature (CST) of partially miscible liquid system	K4

4.	impurity on CST. Construction of Phase diagram of a Simple eutectic system	Evaluate the effect of impurities on CST	K5
5..	Conductometric determination of cell constant and limiting molar conductance of a strong electrolyte.	Determine cell constant and molar conductance of a strong electrolyte	K4
		Perform various types of conductometric titrations	K2
6	Conductometry – acid base titration.	Estimate the strength ofgiven acid or base by conductometry	K4
7..	Potentiometry – Redox titration.	Construct on electro chemical cell.	K5
8	Determination of pH by potentiometry	Determine EMF of a given cell	K4
		Perform various types of potentiometric titrations	K2
		Determine the pH of givensolution potentiometrically	K4
9.	Verification of Beer - Lamberts' law using pho colorimeter.	Verify Beer - Lamberts' law	K4
		Estimate the unknown sample	K4
10.	Determination of water of crystallization and the formula of salt hydrates.	Estimate the number of water molecules present in the give salt hydrate and determine the molecular formula	K4
11.	Preparation of Buffer solutions and Determination of buffer capacity by pH meter	Evaluate the efficiency of a buffer in resisting changes in ph.	K4

		Decide the combination of acid or base and their salts prepare buffer solutions	K4
12.	Determination of distribution coefficient of metals by paper chromatography- Monitoring a reaction progress using ThinLayer chromatographic technique.	Apply the chromatographic principles for the determination of distribution coefficient of metals.	K3
		Interpret the reaction progress using thin layer chromatographic technique	K5

4. Mapping Scheme for the PO, PSOs and COs

PHYSICAL CHEMISTRY PRACTICAL									**Code:U19CH6P5**			
Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	-	L	-	-	H	L	H	-	H	H	M	H
CO2	H	L	M	-	-	H	-	H	-	H	M	-	H
CO3	H	M	H	-	-	M	-	H	-	H	M	L	H
CO4	H	M	H	-	-	H	-	H	_	H	M	L	H
CO5	H	M	H	L	-	M	-	H	-	H	M	L	H
CO6	H	H	H	M	-	H	-	H	-	H	M	L	H

5. Course Assessment Methods Direct:

1. Continuous Internal Assessment
2. Model Exams I and II
3. End Semester Practical Examination

***

UNDER GRADUATE PROGRAMME

Allied Chemistry Syllabus

For

Botany / Zoology / Bio-Technology / Env.Science / Physics

For the students admitted in the academic year 2019 -2020

PG & RESEARCH DEPARTMENT OF CHEMISTRY
(DST-FIST Sponsored & DBT-STAR Scheme)
BISHOP HEBER COLLEGE (Autonomous) (Reaccredited with 'A' Grade (CGPA – 3.58/4.0) by the NAACRecognized by UGC as "College of Excellence" TIRUCHIRAPPALLI – 620 017

B.Sc.Physics

(For the candidates admitted from the year 2019 onwards)

Sem	Part	Course	Code	Title	Hrs/ Week	Credit	Marks		
							CIA	ESA	Total
III	III	Allied-IV	U19CHY34	Allied Chemistry-I	4	3	25	75	100
IV	III	Allied-IV	U19CHY45	Chemistry for Physicists	4	4	25	75	100
IV	III	Allied Practical-I	U19CHYP1	Volumetric and Organic Analysis	3+3	3	40	60	100

Allied Chemistry Courses – B.Sc. Botany /Zoology

(For the candidates admitted from the year 2019 onwards)

Sem	Part	Course	Code	Title	Hrs/ Week	Credit	Marks		
							CIA	ESA	Total
III	III	Allied-III	U19CHY33	Allied Chemistry-I	4	4	25	75	100
IV	III	Allied-IV	U19CHY44	Chemistry for Life Sciences	4	4	25	75	100
IV	III	Allied Practical-II	U19CHYP2	Volumetric and Organic Analysis	3+3	3	40	60	100

Allied Chemistry Courses –Bio-Technology

(For the candidates admitted from the year 2019 onwards)

Sem	Part	Course	Code	Title	Hrs/ Week	Credit	Marks		
							CIA	ESA	Total
III	III	Allied-III	U19BTC33	Allied Chemistry-I	4	4	25	75	100
IV	III	Allied-IV	U19BTC44	Chemistry for Life Sciences	4	4	25	75	100
IV	III	Allied Practical-II	U19BTCP2	Volumetric and Organic Analysis	3+3	3	40	60	100

Allied Chemistry Courses – B.Sc.Env. Science

(For the candidates admitted from the year 2019 onwards)

Sem	Part	Course	Code	Title	Hrs/ Week	Credit	Marks		
							CIA	ESA	Total
III	III	Allied-III	U19ESCY33	Allied Chemistry-I	4	4	25	75	100
IV	III	Allied-IV	U19ESCY4	Chemistry for Environmentalists	4	4	25	75	100
IV	III	Allied Practical-III	U19ESCP3	Allied Chemistry Practicals	3	3	40	60	100

PG Bio-Informatics (Integrated)

SBEC-Chemistry Course

Sem	Part	Course	Code	Title	Hrs/ Week	Credit	Marks		
							CIA	ESA	Total
IV	SBEC	I16BI2S1	General Chemistry – I	2	1	100	-		100

For B. Sc. Physics, Botany, Zoology, Env.Sciences and Biotechnology

Allied :IV/III **ALLIED CHEMISTRY-I**
Semester: III **Code : U19CHY34 /U19CHY33 / U19CHY33 /U19ESCY3 /U19BTC33**

Credits : 3 **Total Hours : 60**
Hours/Week :4

1. Course Outcomes:

After the completion of this course the students will be able to:

S.No.	Course Outcomes	Level	Unit
1	Distinguish the geometry and shape of molecules using VSEPR theory	K4	I
2	Illustrate the mechanism for different basic organic reactions	K3	II
3	Compare the different concepts of acids and bases	K2	III
4	Explain the kinetics of chemical reactions	K3	IV
5	Summarize the applications of catalytic reactions	K2	IV
6	Identify different applications of colloids in day-to-day life	K2	V

2A. Syllabus

Unit – I **Chemical Bonding** **12 Hours**

1.1 Ionic bond- Nature of Ionic bond–structure of NaCl, KCl & CsCl- Factors influencing the formation of ionic bond.
1.2. Covalent bond- nature of covalent bond–VSEPR theory - shapes of $BeCl_2$, BF_3, CH_4, PCl_5, IF_7,NH_3& H_2O.
1.3 Coordinate Bond–Nature of coordinate bond, Werner's theory and structure of some complexes - $Ni(CO)_4$, $[Co(NH_3)_6]Cl_3$, $K_4[Fe(CN)_6]$.
1.4. Hydrogen bonding-Theory of Hydrogen bonding - Inter and Intra molecularhydrogen bonding- consequences of hydrogen bonding, van der Waals and London Dispersive forces in simple molecules.

Unit- II **Types of Reactions** **12 Hours**

2.1- Types of chemical reactions,Types of intermediates- Electrophiles – nucleophiles – free radicals.
2.2 – Substitution Reactions: Nucleophilic and electrophilic substitution with mechanism (one example for each), Addition Reactions (Addition of HBr on alkenes) – Elimination Reactions (Dehalogenation of alkyl halides) – Condensation Reactions (formation of ester).
2.3 – Polymerization Reactions (Formation of Poly vinyl Chloride) – Reduction reactions (Hydrogenation of oil)- Oxidation Reactions (Conversion of benzaldehyde to benzoic acid) .

UNIT- III **Solutions** **12Hours**

3.1 Types of Solutions – Homogeneous and Heterogeneous, saturated and unsaturated, Mole Concept, Normality, Molarity, Molality and Parts per Million–**Problems.**
3.2 Primary and secondary standards and preparation of standard solutions -**Problems.**
3.3 Acids and bases: Arrhenius, Lowry- Bronsted, Lewis concepts- strong and weak acids and Bases-pH, pK_a, pK_b, buffer solutions, Derivation of Henderson – Hasselbalch equation.

Unit- IV **Chemical Kinetics and Catalysis** **12 Hours**

4.1 Chemical kinetics: rate of reaction, order, molecularity, first order rate law, half life period and derivation of the first order rate equation.
4.2 Catalysis–homogeneous and heterogeneous catalysis, intermediate complex formation theory and adsorption theory, Positive and Negative Catalysts, Promoters and poisons, Auto catalysis, applications.
4.3 Enzyme catalysis –Mechanism and Michaelis-Menton Equation (No derivation)- Factors affecting enzyme

catalysis.

Unit- V Colloids 12 Hours

5.1 Colloids – Types with examples – classification based on affinity (Lyophilic & Lyophobic).

5.2 Optical, Kinetic and Electrical properties of colloids– Electrophoresis, Electro-osmosis, Peptization, Coagulation.

5.3 Applications of colloids- Dialysis, Desalination of water, Artificial Rain.

2B. Self Study Topics:

1. **https://ocw.mit.edu/courses/materials-science-and-engineering/3-091sc-introduction-to-solid-state-chemistry-fall-2010/syllabus/MIT3_091SCF09_aln02.pdf**
2. **https://profiles.uonbi.ac.ke/sderese/files/h-sch_102_-_types_of_organic_reactions_and_mechanisms.pdf**
3. **https://www.askiitians.com/revision-notes/chemistry/solutions/**
4. **https://www.britannica.com/science/catalysis**
5. **https://nios.ac.in/media/documents/313courseE/L10.pdf**

2C. Text Books

1. B.R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, Milestone Publishers, New Delhi, 2017 **(Unit I, II, III)**
2. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand & Co. Ltd., New Delhi, 2012 **(Unit IV)**
3. B.R. Puri, L.R. Sharma and Madan S. Pathania, Principles of Physical Chemistry Vishal Publishing Co., Jalandhar, 2017 **(Unit V)**
4. P.L.Soni, H.M. Chawla, Text Book of Organic Chemistry , Sultan Chand & Sons, New Delhi, 2004
5. R.L. Madan and G.D. Tuli, Inorganic Chemistry, S. Chand Co. Ltd., New Delhi, 2010
6. Gurdeep Raj, Advanced Physical Chemistry, Goel Publishing House, Meerut, 2016.

2D. Recommended Reference Books

1. J.D. Lee, "Concise Inorganic Chemistry", Oxford University Press, New Delhi, 2008.
2. Morrison and Boyd "Organic Chemistry" Pearson Education, 2016.
3. Peter Atkins and Julio de Paula, "Physical Chemistry" Oxford University Press, 2018.

2E.Web Links:

1. **https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Map%3A_Organic_Chemistry_(Wade)/04%3A_The_Study_of_Chemical_Reactions/5.01%3A_Introduction**

2. **https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Principles_of_Modern_Chemistry_(Oxtoby_et_al.)/Unit_5%3A_Rates_of_Chemical_and_Physical_Processes/18%3A_Chemical_Kinetics/18.7%3A_Kinetics_of_Catalysis**

3. Specific Learning Outcomes:

Unit	Course Contents	Learning Outcomes	Blooms Taxonomic levels of Transaction
Unit-1 :Chemical Bonding			
1.1	Ionic bond - Nature of ionic bond; Factors influencing the formation of ionic bond	Recall the concepts of formation	K1
		Explain the factors influencing the formation of ionic bond.	K2
1.1	Structure of NaCl, KCl and CsCl	Compare the structure of NaCl, KCl and CsCl	K2
1.2	Covalent bond; Nature of Covalent bond	Explain the concept of Covalent bond with examples	K2
1.2	VSEPR theory	Predict the shape of a given molecule based on VSEPR theory	K4
1.3	Coordinate bond; Nature of Coordinate bond	Explain the concept of Coordinate bond	K2
1.3	Werner's theory and structure of some complexes	Infer the structure of some complexes with the aid of Werner's theory	K2
1.4	Hydrogen bonding; Theory and types of hydrogen bonding; Consequence of hydrogen bonding	Compare the types of hydrogen bonding in compounds	K4
1.5	Van der Walls forces and London Dispersive forces	Identify the various forces of attraction in molecules	K3

Unit 2: Types of Reactions			
2.1	Types of intermediates – Electrophiles, Nucleophiles and Free radicals	Compare the different types of radical intermediates	K2
2.2	Substitution reactions – Electrophilic, Nucleophilic with mechanism	Explain the electrophilic and nucleophilic substitutions along with mechanism	K3
2.2	Addition reaction – Addition of HBr on alkenes	Apply the mechanistic pathway for addition reaction to alkenes	K3
2.2	Elimination reactions – Dehalogenation of alkyl halides	Apply the mechanistic pathway for Dehalogenation of alkyl halides	K3
2.2	Condensation reactions – formation of ester	Explain the condensation reaction with an example	K2
2.3	Polymerization reactions – formation of poly vinyl chloride	Describe the preparation method of PVC	K2
2.3	Reduction reactions – hydrogenation of oil	Explain the reaction of hydrogenation of oil	K2
2.3	Oxidation reactions – conversion of benzaldehyde to benzoic acid	Write the mechanism for conversion of benzaldehyde to benzoic acid	K3
Unit 3: Solutions			
3.1	Homogeneous and Heterogeneous solutions, Saturated and Unsaturated solutions	Identify the different types of solutions	K2
3.1	Mole concept – Normality, Molarity, Molality and Parts per Million – problems	Calculate strength of given solution based on mole concept	K2
3.2	Primary and secondary standard solutions and preparation	Identify the primary and secondary standard solutions	K2
3.3	Arrhenius theory	Outline the Arrhenius theory concept of acids and bases.	K2
3.3	Lowry-Bronsted theory	Explain the Lowry-Bronsted theory concept of acids and bases.	K2
3.3	Lewis acid base theory (strong and weak)	Classify strong and weak acids and bases with the aid of Lewis acid base theory	K2
3.3	Buffer solutions Henderson-Hasselbalch equation	Predict the pH of the buffer solution based on Henderson-Hasselbalch equation	K2
Unit 4 Chemical Kinetics and Catalysis			
4.1	Rate law	Explain the rate of chemical reaction	K2
4.1	Order and Molecularity of a chemical reaction	Compare the order and molecularity of chemical reaction	K2
4.1	Half life period	Illustrate the half life period of particular reactions	K2
4.1	First order rate constant equation	Develop the rate constant equation for first order reaction	K3
4.2	Homogeneous and Heterogeneous catalysis	Compare the homogeneous and heterogeneous catalysis	K2
4.2	Intermediate complex formation theory	Explain the formation of intermediate complex theory	K2
4.2	Adsorption theories of catalysis	To explain the theories of adsorption of catalysis	K2

4.2	Positive catalyst, Negative catalyst, Auto catalyst, promoters and poisons	Classify the catalyst based on their function	K2
4.2	Application of catalysis	Summarize the application of catalysis	K2
4.3	Enzyme catalysis – mechanism Michaelis – Menton Equation (no derivation)	Explain the mechanism of enzyme catalysis based on Michaelis-Menton Equation .	K2
4.3	Factors affecting the enzyme catalysis	Explain the factors which affect the enzyme catalysis	K2
Unit 5: Colloids			
5.1	Colloids and its types with examples; Lyophilic and Lyophobic colloids	Classify the types of colloids with examples	K2
5.2	Optical and Kinetic properties of colloids(electrophoresis, electro osmosis)	Compare the optical and kinetic properties of colloids	K2
5.3	Peptization and Coagulation	Differentiate the properties of peptization and coagulation	K2
5.4	Applications of colloids – Dialysis, Desalination of water and Artificial Rain	Identify different applications of colloids in day-to-day life	K2

4. Mapping of COs with POs and PSOs for B.Sc. Zoology

ALLIED CHEMISTRY-I										**U19CHY33**			
Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	-	-	-	-	-	-	-	-	-	-	-	-
CO2	H	L	L	-	-	-	-	-	L	-	L	H	L
CO3	H	-	-	H	M	H	M	-	-	-	-	H	-
CO4	H	M	M	M	M	-	-	-	H	L	L	H	L
CO5	H	H	L	-	-	-	-	L	M	-	L	M	M
CO6	H	H	H-	L	-	-	H	H	M	L	-	H	L

Mapping of COs with POs and PSOs for B.Sc. Env.Sciences

ALLIED CHEMISTRY-I										**U19ESCY3**			
Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	-	-	-	-	-	-	-	-	-	-	-	-
CO2	H	-	L	L	M	-	-	-		M	L	L	-
CO3	H	M	-	-	H	-	M	H	M	L	-	-	-

CO4	H	L	M	M	-	-	M	-	H	L	L	L	-
CO5	H	-	-	-	L	-	-	-	M	M	L	L	M
CO6	H	H	M	M	H	-	-	H	H	M	-	-	M

Mapping of COs with POs and PSOs for B.Sc.Bio-Technology

ALLIED CHEMISTRY-I										**U19BTC33**			
Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	L	H	L	-	-	-	L	-	L				
CO2	H	H	L	-	-	-	L	-	L				
CO3	M	H	M	-	L	-	L	-	L				
CO4	L	H	L	-	-	-	L	-	L				
CO5	L	H	L	-	-	-	L	-	L				
CO6	M	H	H	-	L	-	L	-	L				

Allied- V **CHEMISTRY FOR PHYSICISTS**

Semester: IV **Course Code : U19CHY45**

Credits : 4 **Total Hours : 60**

Hours/Week : 4

1. Course outcomes:

After the completion of this course the students will be able to:

S.No.	Course Outcomes	Level	Unit
1	Explain the concepts of electrochemistry and its applications	K4	I
2	Apply the principles of solid-state chemistry	K3	II
3	Categorize crystal structures and crystal defects	K4	III
4	Explain the principles of volumetric analysis and types of errors in experimental data	K3	IV
5	Analyze the composition of alloys and mixture based on phase rule	K4	V
6	Identify the significance of chemistry in day-to-day life	K2	V

2A. Syllabus

Unit – I **Electrochemistry** **12 Hours**

1.1 Introduction- specific conductance, equivalent conductance, cell constant, Arrhenius theory, Ostwald's dilution law, Determination of equivalent conductance by Kohlrausch law, conductometric titrations (strong acid vs. strong base, strong acid vs. weak base, weak acid vs. strong base, precipitation titration) - Advantages of conductometric titrations.

1.2 EMF– Standard reduction potential–electrochemical series- reference electrodes–primary(SHE) & secondary electrodes (Calomel) –Nernst equation.

1.3 Theory of Corrosion and its prevention.

Unit–II **Solid State** **12 Hours**

2.1 Crystalline vs. amorphous Solids–Elements of Symmetry–Unit cell–Bravais lattice–Seven Crystal systems- –Miller Indices –**Problems**.

2.2 Lattice energy–Born–Haber Cycle–factors affecting lattice energy- **Problems.**

2.3 Defects in crystals- stoichiometric and non- stoichiometric defects.

2.4 Properties, Importance and uses of materials–Spinels–Inverse Spinels –Pervoskites.

Unit–III **Analytical Chemistry** **12 Hours**

3.1 Error analysis: accuracy, precision, Types of errors - determinate and indeterminate errors, relative error, absolute error.

3.2. Titrimetry - principle, acid-base titrations and redox titrations with examples-End point and equivalence points. Types of indicators, Theory of Indicators - Quinonoid theory.

3.3 Photochemistry: Laws of Photochemistry, components of a colorimeter (Block diagram), application (estimation of iron).

3.4. Chromatography-introduction-principle, sampling and applications of paper, column and thin layer chromatography.

3.5. Purification methods – Steam distillation, Vacuum Distillation, Fractional Distillation, Solvent extraction, Crystallization and Sublimation.

Unit - IV **Phase Equilibria** **12 Hours**

1.1 Phase–Components–Degrees of Freedom–Gibbs Phase Rule & Reduced Gibbs rule (No Derivation)

1.2 Phase equilibria of one component system (water), Two component system- Simple Eutectic (Pb- Ag), Freezing mixture (NaCl –H_2O)

1.3 Mesomorphic State–Liquid Crystals–Types- applications.

Unit- V **Industrial Chemistry** **12 Hours**

5.1- Synthetic Polymers: Preparation, Properties and uses of Teflon, Polyester, Nylon-66, PVC, Polyethylene.

5.2 – Halogen containing compounds: Preparation and uses of Freons, CH_2Cl_2, $CHCl_3$, CCl_4, Pesticides- DDT, BHC- Preparation and uses.

5.3- Fuel gases: Water gas, Producer gas, LPG, Gobar gas, Natural Gas- Manufacture and uses.

5.4- Cosmetics: Basic ingredients, Additives and fragrances used in Soaps, Toothpaste, Lipstick, Perfumes, Deodorants and Antiperspirants. Basic tests for identification of good and bad cosmetics - pH test.

2B. Self Study Topics:

1. Chromatography :https://www.britannica.com/science/chromatography/Subsequent-developments
2. Error Analysis: http://web.iyte.edu.tr/~serifeyalcin/lectures/chem201/cn_5.pdf
3. Solid State: https://courses.edx.org/asset-v1:MITx+3.091x_5+3T2015+type@asset+block/handouts_Witt_LectureNotes_6.pdf
4. https://www.lucideon.com/testing-characterization/analytical-techniques-chemical-analysis
5. Polymer Chemistry: https://www.ch.ntu.edu.tw/~sfcheng/HTML/material94/Polymer-1.pdf
6. Analytical Techniques: https://www.lucideon.com/testing-characterization/analytical-techniques-chemical-analysis

2C. Text Books

1. Tiwari K.S., Melhotra S.N., Vishnoi N.K, *A Text book of Organic Chemistry*, Vikas Publishing House Pvt. Ltd., New Delhi, 2006 (Unit-I, V).

2. R. Gopalan, P. S. Subramanian and K. Rengarajan, *Elements of Analytical Chemistry*, Sultan Chand and Sons, New Delhi, 1997(Unit- IV).

3. Puri B.R., Sharma L. R., Kalia K.K, *Principles of Inorganic Chemistry*-23 rd edition, NewDelhi, Shoban Lal Nagin Chand & Co, 1993(Unit- I, III).

4.Puri B.R., Sharma L. R., Kalia K.K, *Principles of physical Chemistry*, 23 rd edition, New Delhi, Shoban Lal Nagin Chand & Co, 1993(Unit-II).

2D. Recommended Reference Books

1.R.T. Morrison &R.N.Boyd, *Study Guide to Organic Chemistry*, Prentice Hall, New Delhi, 2000.

2.R.L. Madan and G.D.Tuli, *Inorganic Chemistry*, S. Chand Co., Ltd., New Delhi, 2003 7.

3.Gurdeep Raj, *Advanced Physical Chemistry*, Goel Publishing House, Meerut, 2000.

2E. Web Links:

1. Electrochemistry: https://ncert.nic.in/textbook/pdf/lech103.pdf
2. Solid State :https://ocw.mit.edu/courses/materials-science-and-engineering/3-091sc-introduction-to-solid-state-chemistry-fall-2010/syllabus/MIT3_091SCF09_aln04.pdf
3. Polymer Chemistry: https://www.ch.ntu.edu.tw/~sfcheng/HTML/material94/Polymer-1.pdf
4. Analytical Chemistry: http://www.uvm.edu/~gpetrucc/courses/chem196/Textbooks/Manahan%20-%20Fundamentals%20of%20Environmental%20Chemistry/1491Ch25.pdf

3. Specific Learning Outcomes:

Unit	Course Contents	Learning Outcomes	Blooms Taxonomic levels of Transaction
Unit I Electrochemistry			
1.1	Specific and Equivalent conductance	Calculate specific and equivalent conductance of the given electrolyte.	K2
1.1	Ostwald's dilution law	Explain the principle of Ostwald's dilution law	K2
1.1	Determination of equivalent conductance by Kohlrausch law.	Apply the principle of Kohlrausch law to detect equivalent conductance	K3
1.1	Conductometric titrations and its advantages	Apply the conductometric titration principles for detecting concentration of given electrolyte.	K3
1.2	Standard reduction potential (EMF)	Find out the potential difference of redox reaction	K2
1.2	Reference electrode; primary and secondary electrodes	List out the types of electrodes with an example	K2
1.2	Nernst equation	Explain the Nernst equation for determining cell potential of a reaction.	K4
1.3	Corrosion and its prevention	Describe corrosion and its prevention techniques.	K2
Unit – 2: Solid State			
2.1	Crystalline vs Amorphous solids	Differentiate crystalline and amorphous solids	K2
2.1	Elements of Symmetry, Unit Cell, Bravais Lattice	Define unit cell.	K2
		Recollect elements of symmetry in crystal system.	K2
2.2	Lattice Energy; Born-Haber Cycle; Factors affecting lattice energy	Calculate lattice energy for NaCl from Born Haber cycle.	K3
		Recall the factors affecting lattice energy.	K1
2.3	Defects in crystals – stoichiometric and non-stoichiometric defects	Classify the crystals based on stoichiometric and non-stoichiometric defects	K4
2.4	Properties, Importance and uses of materials – Spinels- Inverse Spinels - Pervoskites	Distinguish Spinels and inverse spinels with examples.	K2
Unit – 3: Analytical chemistry			
3.1	Error analysis – accuracy, precision	Explain the differences between accuracy and precision	K3

3.2	Determinate and indeterminate errors, relative error, absolute error	Illustrate determinate & indeterminate errors, relative & absolute errors with suitable examples.	K3
3.2	Titrimetry - principle Acid – Base titrations and Redox titrationswith examples-End point and Equivalence point	Illustrate the principles behind the various kind of titrations.	K2
		Differentiate the end point and equivalence point.	K2
3.2	Theory and types of indicators	Select suitable indicators for various kind of titrations.	K2
3.2	Beer-Lambert's law	Define Beer-Lambert's law	K1
3.3	Colorimeter, components and applications (estimation of iron)	Apply the principle of colorimetric techniques for estimation of iron	K3
3.4	Chromatography – principle	Recall the principle of chromatography techniques	K1
3.4	Applications of thin layer, column and paper chromatography	Summarize the applications of TLC, column and paper chromatography techniques	K3
3.5	Purification methods – steam distillation, Vacuum distillation and Fractional distillation	Explain the principles behind various purification technique	K3
3.5	Solvent extraction	Explain Solvent extraction method for separating the desired compound from the mixture	K3
3.5	Crystallization and sublimation	Explain the crystallization and sublimation process for purifying the substance in solid phase	K3
Unit – 4 Phase Equilibria			
4.1	Phase – Components, Degrees of Freedom	Analyze the components and find out degrees of freedom using phase rule.	K4
4.1	Gibbs & Reduced Gibbs rule (No Derivation)	Compare Gibbs & Reduced Gibbs rule in phase component system	K2
4.1	Phase equilibria of one component system (water) and two component system Simple Eutectic (Pb-Ag), Freezing mixture ($NaCl-H_2O$)	Explain one component and two component systems in phase equilibria with examples.	K3
4.2	mesomorphic state	Explain the role of mesomorphic state	K2
Unit – 5 : Industrial Chemistry			
5.1	Synthetic polymers – preparation, properties and uses of Teflon, Polyester, Nylon-66, PVC & Polyethylene	Explain the preparations, properties and uses of various polymers.	K2

5.2	Preparation and uses of Freons (CH_2Cl_2, $CHCl_3$, CCl_4)	Explain the preparation and uses of alkyl derivatives of chlorine.	K2
5.2	Pesticides (DDT, BHC) – preparation and uses	Compare the properties and uses of pesticides	K2
5.3	Manufacture of Water gas, producer gas, LPG gas, Natural gas and Gobar gas	Describe the manufacturing process of various fuel gases and its usage.	K2
5.4	Cosmetics: Ingredients, Additives and fragrance used in Soaps, Toothpastes, Lipsticks, Perfumes, Deodorants and Antiperspirants	Identify the ingredients and Additives in various cosmetics available in the market.	K2
5.4	Basic tests for identification of good and bad cosmetics – pH test	Identify good and bad cosmetics using pH	K2

4. Mapping of COs with POs and PSOs of B.Sc. Physics

CHEMISTRY FOR PHYSICISTS Course Code : U19CHY45													
PO/PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	**H**	**H**	**M**	**L**	**H**	**M**	**H**	**-**	**L**	**H**	**H**	**H**	**H**
CO2	**H**	**H**	**M**	**L**	**H**	**M**	**H**	**-**	**-**	**H**	**H**	**-**	**H**
CO3	**H**	**H**	**H**	**L**	**H**	**M**	**H**	**-**	**-**	**H**	**H**	**-**	**H**
CO4	**H**	**M**	**M**	**H**	**H**	**M**	**H**	**-**	**--**	**-**	**-**	**-**	**H**
CO5	**H**	**H**	**H**	**L**	**H**	**M**	**H**	**-**	**-**	**H**	**H**	**-**	**H**
CO6	**H**	**M**	**M**	**L**	**H**	**M**	**H**	**-**	**-**	**-**	**M**	**-**	**H**

CHEMISTRY FOR LIFE SCIENCES
(For B.Sc. Bot. / Zoo. / Bio-Tech.)

Allied IV

Semester: IV **Code: U19CHY44 / U19CHY44/ U19BTC44**
Credits : 4 **Total Hours : 60**
Hours/Week : 4

1. Course Outcomes:

On Completion of this course, the students will be able to:

S.No.	Course Outcomes	Level	Unit
1	Explain the structure and properties of biomolecules	K4	I
2	Identify the types of water, quality parameters and treatment processes	K3	II
3	Distinguish various kinds of errors in data collection	K2	III
4	Explain the fundamentals of separation and purification techniques	K2	IV
5	Identify the significance of Chemistry in day-to-day life	K2	V
6	Outline the properties and applications of various polymers	K2	V

2A. Syllabus

Unit– I **Chemistry of Biomolecules** **12 Hours**

1.1 Classification of carbohydrates, glucose & fructose – preparation, properties–muta-rotation, Inter-conversion of glucose and fructose, manufacture of sucrose, test for sugars.
1.2 Amino acids – preparation and properties of glycine and alanine, peptides (elementary treatment) - proteins-classification based on physical properties and biological functions- structure of proteins – primary and secondary – Test for proteins.
1.1 Coordination compounds: biological role of hemoglobin and chlorophyll**.**

Unit–II **Chemistry of Water** **12Hours**

2.1 Water as a universal solvent–hardness of water- permanent and temporary hardness,disadvantages of hard water-DO, BOD and COD -definition, Methods of determination (any one method).
2.2 Water Softening methods - Zeolite process, Reverse Osmosis.
2.3 Preparation of De-ionized water- Distilled water–Double Distilled water–Packaged drinking water.

Unit–III **Basics of Quantitative Analysis** **12Hours**
3.1. Error analysis: accuracy, precision, determinate and indeterminate errors, relative error, absolute error.
3.2. Quantitative analysis: Titrimetry- principle, acid-base titrations and redox titrations with examples -End point and equivalence point.
3.3. Theory of Indicators- Types of indicators - Quinonoid theory**.**

Unit-IV **Analytical Techniques** **12 Hours**

4.1 Chromatography-introduction-principle, sampling and applications of paper, thin layer and column chromatography.

4.2 Photochemistry: Laws of Photochemistry, components of a colorimeter (Block diagram), application(estimation of iron).
4.3 Purification methods – Steam distillation, Vacuum Distillation, Fractional Distillation, Solvent extraction, Crystallization and Sublimation.

Unit- V **Industrial Chemistry** **12 Hours**

5.1-Synthetic Polymers: Preparation, Properties and uses of Teflon, Polyester, Nylon-66 PVC, Polyethylene.
5.2 – Halogen containing compounds: Preparation and uses of Freons, CH_2Cl_2, $CHCl_3$, CCl_4, Pesticides- DDT, BHC- Preparation and uses.
5.3- Fuel gases: Water gas, Producer gas, LPG, Gobar gas, Natural Gas- Manufacture and uses.
5.4- Cosmetics: Basic ingredients, Additives and fragrances used in Soaps, Toothpaste, Lipstick, Perfumes, Deodorants and Antiperspirants. Basic tests for identification of good and bad cosmetics-pH test.

2B. Self Study Topics:

1. Water Chemistry: https://www.cusd80.com/cms/lib/AZ01001175/Centricity/Domain/586/Lecture_Water.pdf
2. Polymer Chemistry: https://www.ch.ntu.edu.tw/~sfcheng/HTML/material94/Polymer-1.pdf
3. Analytical Techniques: https://www.lucideon.com/testing-characterization/analytical-techniques-chemical-analysis

2C. Text Books

1. Tiwari K.S., Melhotra S.N., Vishnoi N.K, *A Text book of Organic Chemistry*, Vikas Publishing House Pvt. Ltd., New Delhi, 2017. **(Unit-I, V).**
2. R. Gopalan, P. S. Subramanian and K. Rengarajan, *Elements of Analytical Chemistry*, Sultan Chand and Sons, New Delhi, 1997. **(Unit- IV).**
3. Puri B.R., Sharma L. R., Kalia K.K, *Principles of Inorganic Chemistry*, 23rd Edition, New Delhi, Shoban Lal Nagin Chand & Co, 2107. **(Unit- I, III)**
4. Puri B.R., Sharma L. R., Kalia K.K, *Principles of physical Chemistry*, 23rd Edition, New Delhi, Shoban Lal Nagin Chand & Co, 2017. **(Unit-II).**
5. B.K. Sharma, *Industrial Chemistry*, Goel Publishing Co., 1997.

2D. Recommended Reference Books

1. R.T. Morrison &R.N.Boyd, *Study Guide to Organic Chemistry*, Pearson Education, New Delhi, 2016.
2. R.L. Madan and G.D.Tuli, *Inorganic Chemistry*, S. Chand Co., Ltd., New Delhi, 2010
3. Gurdeep Raj, *Advanced Physical Chemistry*, Goel Publishing House, Meerut, 2016.

2E .Web Links :

1. Biomolecules: http://med.fau.edu/students/md_m1_orientation/Overview.pdf
2. Water Chemistry:https://dnr.mo.gov/env/wpp/vmqmp/docs/chpt-07-intro-water-chemistry-1-09.pdf
3. Analytical Chemistry: http://www.uvm.edu/~gpetrucc/courses/chem196/Textbooks/Manahan%20-%20Fundamentals%20of%20Environmental%20Chemistry/1491Ch25.pdf

3. Specific Learning Outcomes:

Unit	Course Contents	Learning Outcomes	Blooms Taxonomic levels of Transaction
Unit I: Chemistry of Biomolecules			
1.1	Classification of carbohydrates-glucose & fructose. preparation, properties.	Classify carbohydrates and explain thepreparationsand properties	K2
1.1	Muta-rotation, Inter-conversion of glucose and fructose,	Explain the dependence of optical rotation with the structure of carbohydrates under study.	K2
1.1	manufacture of sucrose	Describe the manufacturing processes of of sucrose.	K2
1.1	Test for sugars.	Identify the sugar using the standard chemical test	K2
1.2	Amino acids–preparation and properties of glycine and alanine, peptides (elementary treatment)	Recite the preparation and properties of glycine.	K1
1.2	proteins-classification based on physical properties and biological functions	Categorize proteins in to different types based on the biological functions	K4
1.2	Structure of proteins – primary and secondary.	Explain primary and secondary structures of proteins	K2
1.2	Test for proteins	Identify the protein using the standard chemical test	K3
1.3	Coordination compounds- biological role hemoglobin and chlorophyll**.**	Explain the importance of metallophorphyrine on oxygen transfer and photosynthesis	K2
Unit II: Chemistry of Water			
2.1	Water as a universal solvent.	Describe the important role of water in everyday life	K2
2.1	Hardness of water- permanent and temporary hardness, disadvantages of hard water	Discuss the impact of hardness in water.	K2
		Classify hardness of water as permanent and Temporary	K2
2.1	DO, BOD and COD - definition, Methods of determination (any one method).	Apply the BOD and COD concepts to determine the quality of water.	K3
2.2	Water Softening methods - Zeolite process, Reverse Osmosis.	Describe the Zeolite and Reverse Osmosis processes of water softening.	K2
2.3	Preparation of De-ionized water-Distilled water–Double Distilled water–Packaged drinking water	Explain the processes of water purification.	K2
Unit III :Basics of Quantitative Analysis			
3.1	Error analysis: accuracy, precision, determinate and indeterminate errors,	Identify the types of errors in the given set of data	K2

	relative error, absolute error.		
3.2	Quantitative analysis: Titrimetry-principle, acid-base titrations and redox titrations with examples -End point and equivalence point.	Illustrate the principles behind the various kind of titrations.	K2
		Identify the difference between the end point and equivalence point.	K2
3.3	Theory of Indicators- Types of indicators - Quinonoid theory**.**	Select suitable indicators for various kind of titrations..	K2
Unit IV : Analytical techniques			
4.1	Chromatography-introduction-principle, sampling and applications of paper, thin layer and column chromatography.	Outline the principles of various Chromatographic technique.	K2
4.2	Photochemistry: Laws of Photochemistry, components of a colorimeter (Block diagram), application (estimation of iron).	Describe the colorimetric procedure to find the strength of iron in a given solution.	K2
4.3	Purification methods – Steam distillation, Vacuum Distillation, Fractional Distillation, Solvent extraction, Crystallization and Sublimation.	Outline the principles behind various purification technique	K2
Unit V : Industrial chemistry			
5.1	Synthetic Polymers: Preparation, Properties and uses of Teflon, Polyester, Nylon-66 PVC, Polyethylene.	Explain the preparations, properties and uses of various polymers.	K2
5.2	Halogen containing compounds: Preparation and uses of Freons, CH_2Cl_2, $CHCl_3$, CCl_4,.	Explain the preparation and uses of alkyl derivatives of chlorine.	K2
5.2	Pesticides- DDT, BHC- Preparation and uses	Compare the properties and uses of pesticides	K2
5.3	Fuel gases: Water gas, Producer gas, LPG, Gobar gas, Natural Gas-Manufacture and uses.	Describe the manufacturing process of various fuel gases and its usage.	K2
5.4	Cosmetics: Basic ingredients, Additives and fragrances used in Soaps, Toothpaste, Lipstick, Perfumes, Deodorants and Antiperspirants.	Identify the ingredients and Additives in various cosmetics available in the market.	K2
5.4	Basic tests for identification of good and bad cosmetics - pH test.	Identify good and bad cosmetics using pH	K2

4. Mapping COs with POs and PSOs of B.Sc.Botany

CHEMISTRY FOR LIFE SCIENCES Code: U19CHY44

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	-	M	H	-	-	-	-	M	M	-	-	-	-
CO2	-	H	H	-	H	H	-	H	M	-	-	-	-
CO3	-	H	M	-	-	-	-	M	M	-	-	-	-
CO4	-	M	H	-	-	-	-	H	M	-	-	-	-
CO5	--	H	H	-	H	H	-	H	M	-	-	-	-
CO6	-	H	H	-	H	H	-	H	M	-	-	-	-

Mapping of COs with POs and PSOs of B.Sc. Bio-Technology

CHEMISTRY FOR LIFE SCIENCES Code: U19BTC44

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	H	M	L	L	M	M				
CO2	H	H	H	H	M	L	L	M	M				
CO3	H	H	H	H	H	L	L	M	M				
CO4	H	H	H	H	M	L	L	M	M				
CO5	H	H	H	H	M	L	L	M	M				
CO6	H	H	H	H	M	L	L	M	M				

Mapping COs with POs and PSOs of B.Sc.Zoology

CHEMISTRY FOR LIFE SCIENCES Code: U19CHY44

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	-	M	H	-	-	-	-	M	M	-	-	-	-
CO2	-	H	H	-	H	H	-	H	M	-	-	-	-
CO3	-	H	M	-	-	-	-	M	M	-	-	-	-
CO4	-	M	H	-	-	-	-	H	M	-	-	-	-
CO5	--	H	H	-	H	H	-	H	M	-	-	-	-
CO6	-	H	H	-	H	H	-	H	M	-	-	-	-

Allied – IV **CHEMISTRY FOR ENVIRONMENTALISTS**

Semester: IV **Code: U19ESCY4**

Credits: 3 **Total Hours : 60**

Hours/Week : 4

1. Course outcomes:

On completion of the course the student will be able to:

S.No.	Course Outcomes	Level	Unit
1	Analyze the constituents of atmosphere and chemistry of various atmospheric reactions	K4	I
2	Apply the concepts of water quality parameters and treatment processes	K3	II
3	Identify the types of errors in experimental data	K2	III
4	Apply the principles of volumetric estimation	K3	IV
5	Explain principles of chromatographic and colorimetric techniques	K2	IV
6	Illustrate the mechanism of organic reactions	K3	V

2A. Syllabus

Unit– I **Chemistry of Atmosphere** **12Hours**

2.1-Chemical constituents of the atmosphere; oxygen in the atmosphere-atomic oxygen, molecular oxygen and ozone and their chemical reactions in atmosphere, Ozone-oxygen cycle in stratosphere-photochemical reactions in ozone layer.

2.2-Nitrogen and its compound in atmosphere - their sources and reactions, Photochemical reaction, O_3 in troposphere, Inorganic carbon compounds- CO, CO_2 and their sources and reactions, Hydrocarbons in Atmosphere, Water vapor – hydroxyl radical formation and their reactions.

Unit–II **Chemistry of Water** **12Hours**

2.1 Water as a universal solvent–hardness of water- permanent and temporary hardness, disadvantages of hard water-DO, BOD and COD -definition, Methods of determination (any one method).

2.2 Water Softening methods - Zeolite process, Reverse Osmosis.

2.3 Preparation of De-ionized water- Distilled water–Double Distilled water–Packaged drinking water.

Unit–III **Basics of Quantitative Analysis** **12Hours**

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

3.2. Quantitative analysis: Titrimetry- principle, acid-base titrations and redox titrations with examples -End point and equivalence point.

3.3. Theory of Indicators- Types of indicators - Quinonoid theory**.**

Unit-IV **Analytical Techniques** **12Hours**

4.1 Chromatography-introduction-principle, sampling and applications of paper, thin layer and column chromatography.

4.2 Photochemistry: Laws of Photochemistry, components of a colorimeter (Block diagram), application(estimation of iron).

4.3 Purification methods – Steam distillation, Vacuum Distillation, Fractional Distillation, Solvent extraction,

Crystallization and Sublimation.

Unit- V Industrial Chemistry 12Hours

5.1-Synthetic Polymers: Preparation, Properties and uses of Teflon, Polyester, Nylon-66 PVC, Polyethylene.
5.2 – Halogen containing compounds: Preparation and uses of Freons, CH_2Cl_2, $CHCl_3$, CCl_4, Pesticides- DDT, BHC- Preparation and uses.
5.3- Fuel gases: Water gas, Producer gas, LPG, Gobar gas, Natural Gas- Manufacture and uses.
5.4- Cosmetics: Basic ingredients, Additives and fragrances used in Soaps, Toothpaste, Lipstick, Perfumes, Deodorants and Antiperspirants. Basic tests for identification of good and bad cosmetics-pH test.

2B. Self StudyToipcs:

1. Atmosphere: http://www.uvm.edu/~gpetrucc/courses/chem196/lectures/Chemistry%20of%20the%20Atmosphere.pdf
2. Water Chemistry: https://www.cusd80.com/cms/lib/AZ01001175/Centricity/Domain/586/Lecture_Water.pdf
3. Polymer Chemistry: https://www.ch.ntu.edu.tw/~sfcheng/HTML/material94/Polymer-1.pdf
4. Analytical Techniques: https://www.lucideon.com/testing-characterization/analytical-techniques-chemical-analysis

2C. Text Books :

1. Tiwari K.S., Melhotra S.N., Vishnoi N.K, *A Text book of Organic Chemistry*, Vikas Publishing House Pvt. Ltd., New Delhi, 2006 (Unit-I, V).
2. R. Gopalan, P. S. Subramanian and K. Rengarajan, *Elements of Analytical Chemistry*, Sultan Chand and Sons, New Delhi, 1997(Unit- IV).
3. Puri B.R., Sharma L. R., Kalia K.K, *Principles of Inorganic Chemistry*-23 rd edition, New Delhi, Shoban Lal Nagin Chand & Co, 1993(Unit- I, III).
4. Puri B.R., Sharma L. R., Kalia K.K, *Principles of physical Chemistry*, 23 rd edition, New Delhi, Shoban Lal Nagin Chand & Co, 1993(Unit-II).

2D. Recommended Reference Books:

1.R.T. Morrison &R.N.Boyd, *Study Guide to Organic Chemistry*, Prentice Hall, New Delhi, 2000.
2.R.L. Madan and G.D.Tuli, *Inorganic Chemistry*, S. Chand Co., Ltd., New Delhi, 2003 7.
3.Gurdeep Raj, *Advanced Physical Chemistry*, Goel Publishing House, Meerut, 2000.

2E. Web Links:

1. Atmosphere: https://www2.acom.ucar.edu/sites/default/files/ua/lecture1.pdf
2. Water Chemistry:https://dnr.mo.gov/env/wpp/vmqmp/docs/chpt-07-intro-water-chemistry-1-09.pdf
3. Analytical Chemistry: http://www.uvm.edu/~gpetrucc/courses/chem196/Textbooks/Manahan%20-%20Fundamentals%20of%20Environmental%20Chemistry/1491Ch25.pdf

3 . Specific Learning Outcomes:

Unit	Course Contents	Learning Outcomes	Blooms Taxonomic levels of Transaction
Unit I - Chemistry of Atmosphere			
1.1	Chemical constituents of atmosphere.	Discuss the chemical constituents of atmosphere	K2
1.1	Oxygen in the atmosphere Atomic oxygen, molecular oxygen & ozone and their reactions in atmosphere Ozone- oxygen cycle in the stratosphere Photochemical reactions in ozone layer	Explain the oxygen content and its reactions in atmosphere, ozone layer cycle and its photochemical reactions	K4
1.2	Nitrogen and its compound in atmosphere-Sources & reactions of N and its compound in atmosphere. Photochemical reactions Ozone in troposphere	Summarize the nitrogenous compounds in atmosphere, and its Photochemical reaction in troposphere.	K2
1.3	Inorganic compounds – CO & CO_2 sources and their reactions Hydrocarbons in atmosphere Water vapour – Hydroxy radical formations and their reactions	Discuss about the inorganic compounds, hydrocarbons, formation and reaction of water vapourand hydroxy radical, in atmosphere.	K2
Unit II - Chemistry of Water			
2.1	Water as a universal solvent.	Describe the importance of water in everyday life	K2
2.1	Hardness of water – permanent & temporary Disadvantage of hard water Definition & determination of DO, BOD and COD	Explain the hardness, DO, BOD and COD in water.	K3
2.2	Water softening method – zeolite process and reverse osmosis	Explain the various water softening methods.	K3
2.3	Preparation of De-ionized water, Distilled water, Double distilled water and Packaged drinking water .	Describe the methods preparation of de-ionized, distilled and double distilled water.	K2
Unit–III - Basics of Quantitative Analysis			
3.1	Accuracy and precision of error analysis, Determinate and indeterminate errors, Relative and absolute error	Interpret the various types of errors with reasons in an experimental data.	K2

3.2	Quantitative analysis using titrimetry and its principle Acid base titration, Redox titrations – example End points and equivalent points	Illustrate the principles behind the various kind of titrations.	K3
3.3	Theory of indicators Types of indicators Quinanoid theory	Select indicators based on Quinonoid theory	K2
Unit - IV - Analytical Techniques			
4.1	Chromatography – principle, procedure, sampling	Outline the principles involved in chromatographic separations.	K2
4.1	Thin Layer, paper and column Chromatography – principle, procedure & applications	Explain the methodology of TLC, PC and Colum chromatography	K2
4.2	Colorimeter – Principle – Beer Lambert's law Components of colorimeter Applications of colorimeter – Iron estimation	Describe the colorimetric procedure to find the strength of iron in a given solution.	K2
Unit- V - Industrial Chemistry			
5.1	Types of chemical reactions Substitution reaction – Nucleophilic & Electrophilic	Explain the electrophilic and nucleophilic substitutions along with mechanism	K3
5.1	Addition of HBr on Alkenes	Apply the mechanistic pathway for addition reaction to alkenes	K3
5.1	Elimination reaction – Dehalogenation of Alkyl Halides	Apply the mechanistic pathway for Dehalogenation of alkyl halides	K3
5.1	Condensation – Formation of Ester	Explain the condensation reaction with an example	K2
5.1	Polymerization – Formation of poly vinyl chloride	Describe the preparation method of PVC	K2
5.1	Reduction – Hydrogenation of oil Oxidation- $KMnO_4$ for conversion of benzaldehyde to benzoic acid	Write the mechanism of oxidation and reduction reactions.	K2
5.2	Types of intermediates – Electrophiles, Nucleophiles and Free radicals	Classify the reaction intermediates and their role in reaction mechanisms.	K2

4.Mapping of COs with POs and PSOs of B.Sc. Env.Sciences

	CHEMISTRY FOR ENVIRONMENTALISTS									**Code: U19ESCY4**			
PO/PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	**H**	**M**	**H**	**L**	**M**	**L**	**M**	**-**	**H**	**H**	**H**	**-**	**-**
CO2	**H**	**M**	**H**	**M**	**H**	**M**	**M**	**M**	**M**	**H**	**H**	**H**	**H**
CO3	**L**	**L**	**L**	**M**	**L**	**M**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

CO4	**M**	**M**	**H**	**H**	**H**	**H**	**M**	**-**	**-**	**M**	**H**	**M**	**-**
CO5	**M**	**-**	**M**	**M**	**L**	**L**	**-**	**-**	**L**	**M**	**M**	**-**	**-**
CO6	**L**	**L**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Allied Chemistry Practical-I /II

VOLUMETRIC AND ORGANIC ANALYSIS

(For B.Sc. Physics / Botany /Zoology / Bio-Tech)

Semester: IV **Code: U19CHYP1, U19CHYP2,U19BTCP2**
Credits: 3 **Total Hours : 90**
Hours/Week : 6

1. Course Outcomes:

After the completion of the course the students will be able to:

S.No.	Course Outcomes	Level
CO1	Relate the basic principles and types of volumetric analysis**.**	**K2**
CO2	Infer the redox reaction concept.	**K3**
CO3	Estimate the strength of the given solution.	**K3**
CO4	Apply complexationconcept to check water quality	**K3**
CO5	**I**dentify organic compounds and quantifying.	**K5**
CO6	Classify the primary standard solutions and to prepare standard solutions in different concentration units.	**K3**

2A. Syllabus

I. Preparation of standard solution (Molar, ppm & Normal) & basic principles oforganic analysis

II. Volumetric Analysis

1. Estimation of hydrochloric acid (Acidimetry and Alkalimetry)
2. Estimation of sodium hydroxide (Acidimetry and Alkalimetry)
3. Estimation of oxalic acid using $KMnO_4$ (Permanganometry)
4. Estimation of ferrous sulphate $KMnO_4$ (Permanganometry)

III. Organic Analysis: Analysis of organic compounds **(Carbohydrate, Diamide, Aldehyde, Ketone and Carboxylic Acid)**with the following tests for,

a. Aromatic/ Aliphatic nature,
b. Saturation / unsaturation
c. Solubility in common solvents and
d. Presence of nitrogen

2B. Text Book

Venkateswaran, R. Veerasamy, A.R. Kulandaivelu, Basic Principles of Practical, Chemistry, Sultan Chand & Sons, New Delhi, 1997

2C. Self Study Topics:

1. https://www.aplustopper.com/prepare-standard-solution/
2. http://wwwchem.uwimona.edu.jm/lab_manuals/c10expt25.html

2D. Web link:

1. http://www.ecs.umass.edu/cee/reckhow/courses/572/572bk16/572BK16.html
2. https://www.csub.edu/chemistry/organic/manual/Lab14_QualitativeAnalysis.pdf
3.
4.

5. 3. Specific Learning Outcomes:

S.No.	Course Content	Learning Out Comes	Blooms Taxonomic levels of Transaction
Volumetric Analysis			
1	Preparation of standard solution (Molar, ppm& Normal)	To relate the basic principles and types of volumetric analysis. To classify primary standard substances To prepare standard solutions in different concentration units.	**K2** **K3** **K3**
2.	Estimation of Hydrochloric acid	To estimate the acid base neutralization reaction. To select indicators for acid base titration with different pH value.	**K3**
3	Estimation of Sodium Hydroxide	To estimate the acid base neutralization reaction. To select indicators for acid base titration with different pH value.	**K3**
4	Estimation of oxalic acid using $KMnO_4$	To infer the redox reaction concept.	**K3**
5	Estimation of ferrous sulphate using $KMnO_4$	To estimate the strength of the given Oxalic acid/$FeSO_4$ solution.	**K3**
Organic Analysis			
6	Analysis of organic compounds(**Carbohydrate, Diamide, Aldehyde, Ketone and Carboxylic Acid)**with the following tests for (i)Aromatic/ Aliphatic nature, (ii)Saturation/ unsaturation (iii)Solubility in common solvents (iv)Presence of nitrogen	To infer aromatic substitution reaction To relate addition reaction to saturation test. To analyse unknown samples systematically and report the same	**K3** **K3** **K5**

4. Mapping of COs with POs and PSOs

Mapping		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PS04
CO1		H	----	M	----	M	M	L	M	-----	H	H	H	H
CO2		M	-----	M	-----	M	M	L	M	------	H	M	M	M
CO3		M	------	M	----	M	M	L	M	-----	H	H	H	M
CO4		H	M	M	L	M	L	L	M	------	H	H	H	---
CO5		M	-----	M	------	H	M	L	------	-----	H	H	----	H
CO6		M	-----	M	-----	----	L	L	M	-----	H	H	H	M

5. COURSE ASSESSMENT

METHODS DIRECT:

1. Continuous Internal Assessment
2. Model Exams I and II
3. End Semester Practical Examination

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Allied Chemistry Practical
(For Env. Sciences)

Semester: IV **Course Code : U19ESCY4**
Credits: 3 **Total Hours : 90**
Hours/Weeks : 4

1. Course Outcomes:

After the completion of the course the students will be able to:

S.No.	Course Outcomes	Level
CO1	Relate the basic principles and types of volumetric analysis**.**	**K2**
CO2	Infer the redox reaction concept.	**K3**
CO3	Estimate the strength of the given solution.	**K3**
CO4	Apply complexationconcept to check water quality	**K3**
CO5	**I**dentify organic compounds and quantifying.	**K5**
CO6	Classify the primary standard solutions and to prepare standard solutions in different concentration units.	**K3**

2A. Syllabus

IV. Preparation of standard solution (Molar, ppm & Normal) & basic principles oforganic analysis

V. Volumetric Analysis

5. Estimation of hydrochloric acid (Acidimetry and Alkalimetry)
6. Estimation of sodium hydroxide (Acidimetry and Alkalimetry)
7. Estimation of oxalic acid using $KMnO_4$ (Permanganometry)
8. Estimation of ferrous sulphate $KMnO_4$ (Permanganometry)

VI. Organic Analysis: Analysis of organic compounds **(Carbohydrate, Diamide, Aldehyde, Ketone and Carboxylic Acid)**with the following tests for,

a. Aromatic/ Aliphatic nature,
b. Saturation / unsaturation
c. Solubility in common solvents and
d. Presence of nitrogen

2B. Text Book

Venkateswaran, R. Veerasamy, A.R. Kulandaivelu, Basic Principles of Practical, Chemistry, Sultan Chand & Sons, New Delhi, 1997

2C. Self Study Topics:

3. https://www.aplustopper.com/prepare-standard-solution/
4. http://wwwchem.uwimona.edu.jm/lab_manuals/c10expt25.html

2D. Web link:

1. http://www.ecs.umass.edu/cee/reckhow/courses/572/572bk16/572BK16.html
2. https://www.csub.edu/chemistry/organic/manual/Lab14_QualitativeAnalysis.pdf

3. Specific Learning Outcomes:

S.No.	Course Content	Learning Out Comes	Blooms Taxonomic levels of Transaction
	Volumetric Analysis		
1	Preparation of standard solution (Molar, ppm & Normal)	To relate the basic principles and types of volumetric analysis. To classify primary standard substances To prepare standard solutions in different concentration units.	**K2** **K3** **K3**
2.	Estimation of Hydrochloric acid	To estimate the acid base neutralization reaction. To select indicators for acid base titration with different pH value.	**K3**
3	Estimation of Sodium Hydroxide	To estimate the acid base neutralization reaction. To select indicators for acid base titration with different pH value.	**K3**
4	Estimation of oxalic acid using $KMnO_4$	To infer the redox reaction concept.	**K3**
5	Estimation of ferrous sulphate using $KMnO_4$	To estimate the strength of the given Oxalic acid/$FeSO_4$ solution.	**K3**
	Organic Analysis		
6	Analysis of organic compounds(**Carbohydrate, Diamide, Aldehyde, Ketone and Carboxylic Acid)**with the following tests for (i)Aromatic/ Aliphatic nature, (ii)Saturation/ unsaturation (iii)Solubility in common solvents (iv)Presence of nitrogen	To infer aromatic substitution reaction To relate addition reaction to saturation test. To analyse unknown samples systematically and report the same	**K3** **K3** **K5**

4. Mapping of COs with POs and PSOs

Allied Chemistry Practical (For Env. Sciences)									**Course Code : U19ESCY4**			
Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	----	M	----	M	M	L	M	-----	H	H	H	H
CO2	M	-----	M	-----	M	M	L	M	------	H	M	M	M
CO3	M	------	M	----	M	M	L	M	-----	H	H	H	M
CO4	H	M	M	L	M	L	L	M	------	H	H	H	---
CO5	M	-----	M	------	H	M	L	------	-----	H	H	----	H
CO6	M	-----	M	-----	----	L	L	M	-----	H	H	H	M

5. COURSE

ASSESSMENT

METHODS

DIRECT:

1. Continuous Internal Assessment
2. Model Exams I and II
3. End Semester Practical Examination

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UG - Non Major Elective Courses (NMEC)
(Offered to Students of other Disciplines)
(For the students admitted in the Academic year 2019 -20)

Sem	Course	Code	Title	Hrs/ Week	Credit	Marks		
						CIA	ESA	Total
III	NMEC I	U16CH3E1	Food and Nutrition	2	2	25	75	100
IV	NMEC II	U16CH3E2	Principles of Medicinal Chemistry	2	2	25	75	100

NMEC I: FOOD AND NUTRITION

Semester: III **Course Code : U16CH3E1**
Credits : 2 **Total Hrs. : 30**
Hours / week:2

1.General Objectives

1. To know the basic techniques of food processing.
2. To gain basic knowledge about minerals in diet.
3. To appreciate the importance of vitamins in diet
4. To identify adultrants in food

2.Syllabus

Unit-I Food **6 Hours**

Introduction , classification, sources of food – (animal and plant sources), functions and uses of food. Food metabolism: anabolism and catabolism. Basic food groups-proteins- amino acids -peptides, functions of proteins in the body and deficiency diseases. Carbohydrates - classification, functions and deficiency diseases. Lipids - classification, rancidity of fats - function, storage of fats and deficiency diseases.

Unit-II Vitamins **6 Hours**

Introduction, classification of vitamins -Fat soluble vitamins: Vitamin A, D,E &K. Occurrence, functions, requirement, effects of deficiency. Water soluble vitamins: Vitamin B complex (Vit B 1,B2,B6,&B12) & Vitamin C. occurrence, functions, requirement, effects of deficiency.

Unit- III Minerals **6 Hours**

Classification of minerals, sources, functions, bio-availability and deficiency of the following mineral: Calcium, magnesium, sodium, potassium, iron, fluorine, iodine, chlorine, sulphur, phosphorous, vanadium, cobalt and manganese.

Unit-IV Food Preservation and Processing **6 Hours**

Types of food spoilage and deterioration. Methods of food preservation and processing (heating, sterilization, Deep freezing and pasteurization). Objectives of cooking and different modes of cooking fruits and vegetables. Food additives-Artificial sweeteners-saccharin, cyclamate, aspartame. Food flavours-esters, aldehydes and heterocyclic compounds. Taste enhancers - MSG, vinegar.

Unit-V Food Poisoning and Adulteration **6 Hours**

Food Poisoning - Reasons, Diagonsis and Treatment. Diseases due to contaminated food stuffs (Acidity, Gastric ulcer, Diarrhoea, Constipation) Adulterants- Common adulterants in different foods-milk and milk products, vegetable oils and fat, spices, cereals, pulses, sweetening agents, and beverages. Contamination with toxic chemicals - pesticides and insecticides. Detection of common food adulterants.

3.Reference Books

1. Seema Yadav, Food Chemistry, Anmol Publishing (P) Ltd., New Delhi, 1997**(Unit I-III, V)**
2. Sri lakshmi B.,Food Processing and Preservation,New age international Pvt.Ltd.Publishers,III ed, 2003 **(Unit- IV)**
3. Carl H, Synder, The Extraordinary chemistry for ordinary things, John Wiley & Sons Inc., NewYork, 1992
4. Alex .V.Ramani, Food chemistry, MJP Publishers, Chennai.2009
5. Swaminathan M,Text book on Food chemistry, Printing and Publishing Co.,Ltd., Bangalore,1993

NMEC II : PRINCIPLES OF MEDICINAL CHEMISTRY

Semester : IV **Course Code: U16CH3E2**
Credits : 2 **Total Hrs : 30**
Hours / week:2

1.General Objectives

1. To know about the basics of drugs.
2. To learn the various modes of actions of drugs.
3. To understand the common diseases and their remedies.

2A.Syllabus

Unit –I Introduction **6 Hours**

Common diseases – infective diseases – insect-borne, air-borne and water-borne-hereditary diseases (3 examples for each) –Definition – drug, pharmacology, antimetabolites, and therapeutic index. Receptor and drug action – Receptor concept, Receptor proteins and drug receptor interactions. Mechanism of drug action: agonism and antagonism (Basic concepts only).

Unit –II Drugs **6 Hours**

Various sources of drugs, pharmacologically active constituents in plants, Indian medicinal plants – tulsi, neem, keezhanelli, aloe vera – their importance. Manufacture of drugs (e.g. quinine, reserpine, atopsine and d – tubocurarine) from Indian medicinal plants. Drug metabolism – Oxidative reactions, Reductive reactions and conjugation reactions. Factors affecting metabolism of drugs (Basic Concepts only).

Unit –III Chemotherapy **6 Hours**

Drugs based on physiological action, definition and two examples for Anesthetics - General and local – Analgesics (2 examples) – Narcotic analgesics (only morphine compounds) – Antipyretic analgesics (acetyl salicyclic acid, p-aminophenol derivatives). Muscle relaxants. i. Acting at neuromuscular junction (d–tubocurarine chloride). ii. Acting at spinal cord alone (glyceryl guaiacolate, diazepam) and Antibiotics – Penicillin, streptomycin, Antivirals (2 examples). AIDS, Cancer – symptoms, prevention and treatment (structure not required).

Unit –IV Common Body Ailments **6 Hours**

Diabetes – Causes, hyper and hypoglycemic drugs – Blood pressure - Systolic & Diastolic Hypertensive drugs – Cardiovascular drugs –nitrates, beta blockers (propanalol and atinelol) and calcium channel blockers. Depressants (special reference to sedatives and hypnotics) – Lipid profile - HDL, LDL, Cholesterol, lipid lowering drugs (structure not required)

Unit –V Health Promoting Drugs **6 Hours**

Medicinally important inorganic compounds of Al, P, As, Hg and Fe - examples and applications. Agents for kidney function (Aminohippuric acid) Agents for liver function (Sulfo bromophthalein), antioxidants, treatment of ulcer and skin diseases: Eczema, psoriasis and Acne (structure not required).

3.Reference Books

1. S. Lakshmi, Pharmaceutical Chemistry, S.Chand & Sons, New Delhi,2004 **(Unit I-V)**
2. V.K. Ahluwalia and Madhu Chopra, Medicinal Chemistry, Ane Books, New Delhi, 2008 **(Unit II-V)**
3. P. Parimoo, A Text Book of Medicinal Chemistry, CBS Publishers, New Delhi, 2006
4. Satoshkar, Medicinal Chemistry, Wiley Eastern Ltd., New Delhi, 1993
5. Romas Nogrady, Medicinal Chemistry, Oxford University Press, **1988**

UG – Skill Based Courses (SBC)

(For the students Admitted in the Academic year 2019 -20)

Sem.	Course	Code	Title	Hrs.	Credits	Marks		
						CIA	ESA	TOTAL
IV	SBC– I	U16LFS41	Life Skills	2	1	100	-	100

LIFE SKILLS

Semester IV **Course code: U16LFS41**
Total Hrs. : 30 **Credit : 1**
Hours / week: 2

1.General Objectives

1. To acquire skills and abilities for adaptive and positive behavior that helps to deal effectivelywith the demands and challenges of everyday life.
2. To develop creative, communicative and critical thinking skills necessary for employability

2.Syllabus

Unit I Basics of Communication skills & Effective Communication 6 Hours

Features of Communication – Process of Communication Verbal, nonverbal, Body Language – Postures & Etiquette –Listening& speaking Skills- Communication Barriers – Listening & speaking Skills.

Unit II Personal Effectiveness 6 Hours

Maslow's theory – Self-esteem- Role Conflict – Intra & Inter personal Skills – Efficiency Vs effectiveness – Team Building – Emotional Intelligence & Quotient

Unit III Interview Skills 6 Hours

Types of Interviews – Resume Formats & preparation - Cover letters – Simple rules to face interviews – Dos &Don'ts in a an Interview – Telephonic Interview and Etiquette - Group Discussions – Types – Methods – Ingredients and Tips for a Successful Group Discussion.

Unit IV Test of Reasoning & Numerical Ability 6 Hours

A. Numerical Ability: Problems related to Average – Percentage – Profit /Loss – Simple & CompoundInterest-Time & Work – Boats & Streams etc.
B. Logical reasoning: Logical Detection – Nonverbal reasoning – Problems related to seatingarrangements – Relationship model – Assertion & Reasoning etc.
C. Online Tests: Aptitude – Logical Reasoning – Problem Solving –Time management in Onlinetests- Online tests on Language skills- Aptitude and technical rounds

Unit V Outbound Learning 6 Hours

Physical, Mental, and emotional exercises

3.Texts for Reference:

1. Barun.K.Mitra, Personality Development and Soft Skills, 6th edition, Oxford University pressNoida 2012.
2. M.Sarada, The complete Guide to Resume Writing, Sterling Publishers Pvt Ltd, New Delhi2012.
3. Gloria J.Galances& Katherine Adams,Effective Group Disscussions,Theory & practice,12th Edition, Tata McGrawHillpvt Ltd 2012.
4. Francis Soundararaj, Basics of Communication in English, SoftSkills for Listening Speaking, Reading& Writing, Macmillan Publishers India Ltd. 2013.

4.Scheme of Evaluation

1.	EQ test	10 Marks
2.	Resume	10 Marks
3.	Numerical Ability Test	10 Marks
4.	Online test 1(aptitude)	10 Marks
5.	Group Discussion	10 Marks
6.	Team Work	10 Marks
7.	OBL Observation / Work book	40 Marks
	Total	**100 Marks**