

**B. Sc Chemistry Programme under  
Outcome Based Education (OBE) System  
(For students who joined in June 2019 onwards)**

**SYLLABUS**



Since 1919

**DEPARTMENT OF CHEMISTRY  
(DST-FIST Sponsored Department)  
NATIONAL COLLEGE (Autonomous)  
(Nationally Accredited at 'A+' Level by NAAC with CGPA of 3.61 on 4.00 Scale)  
(College with Potential for Excellence)  
Tiruchirappalli 620 001**

## **Post Graduate and Research Department of Chemistry**

### **Vision Statement**

The Chemistry Department is dedicated

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

### **Mission Statement**

- ❖ To develop wholesome and efficient student who will cause transformation in society through a study of chemistry.
- ❖ To extend the best student support services by making them comprehensive and by evolving a curriculum relevant to student community and society at large.
- ❖ To encourage students to face IIT-JAM, CSIR-NET, GATE, SET and other competitive examinations.
- ❖ To invite scientists from National/International laboratories for lectures of global standard.
- ❖ To provide high quality education through effective teaching – learning process for their pursuing high-quality teaching, learning, research, and service.
- ❖ To provide an educational environment where students can realize their full potential in chemistry and attain quality education to face the challenges of the future.

### **GOALS**

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

## **Scope and objective of the B. Sc degree program**

- ✓ To understand the main ideas and concepts of chemistry and apply scientific information to solve problems in any situation so that they get a strong foundation in chemistry.
- ✓ Discuss and evaluate scientific information from different sources (internet, newspaper articles, television, scientific texts and publications) and assess its credibility.
- ✓ Enable students to develop scientific inquiry skills to design and carry out scientific investigations by applying the principles of organic, inorganic, physical chemistry, instrumental methods of analysis and analytical chemistry.
- ✓ Draw conclusions supported by scientific explanations and a reasoned interpretation of the analysis of the data.
- ✓ Describe and discuss ways in which science is applied and used to solve local and global problems.
- ✓ Discuss how science and its applications interact with social, economic, political, environmental, cultural and ethical factors.

## **Programme Outcomes (POs):**

1. Undergraduate students are to be passionately engaged in initial learning with an aim to think differently as agents of new knowledge, understanding and applying new ideas in order to acquire employability/self-employment.
2. Undergraduate students are trained to take up higher learning programmes.
3. Undergraduate students are made to be competent and socially responsible citizen of India.
4. Undergraduate students are to be exposed to technical, analytical and creative skills.
5. Undergraduate students are to be imparted with a broad conceptual background in the Biological sciences / Computing sciences / Languages and culture / Management studies / Physical sciences.

## **Programme Specific Outcomes (PSOs):**

1. Human and Social Values and Responsibilities in the context of learning Chemistry
2. Communicative Skills and the Creative scientific mind towards learning chemistry

3. Positive approach towards Environment and Ecology from the Chemistry perspective
4. Critical thinking and the Analytical mind, students develop for the in depth knowledge in advanced-level Chemistry
5. The relevance of extension of Chemistry in the social context for solving social issues
6. Employability Skills shall enable the students to find jobs in core chemistry and other related fields
7. Entrepreneurial Skills shall empower the students to start their own industries / business in core-chemistry fields
8. Analytical or Experimental Skills make the students capable of doing higher-level research works in the emerging fields of chemistry.

**NATIONAL COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI-620 001.**  
**NATIONALLY ACCREDITED AT 'A' LEVEL BY NAAC**  
**B.SC CHEMISTRY COURSE STRUCTURE UNDER O.B.E.S**

SEM	PART	COURSE	COURSE TITLE	INS HOURS /WEEK	CREDIT	EXAM HRS	MARKS			TOTAL
							CIA	EXTERNAL		
								W	O	
I	I	LANGUAGE- I (U19T1/H1/S1)	TAMIL/HINDI/SANSKRIT	6	3	3	25	75	-	100
	II	ENGLISH-I (U19E1)	ENGLISH	6	3	3	25	75	-	100
	III	CORE COURSE -I(U19CC-1)	GENERAL CHEMISTRY-I	5	5	3	25	75	-	100
		CORE COURSE-II-(U19CC-2)	PRACTICAL (CC-1)*	3	-	-	-	-	-	-
		FIRST ALLIED COURSE-I (U191AC-1)	ALGEBRA,CALCULUSAND DIFFERENTIAL EQUATIONS	5	3	3	25	75	-	--
		FIRST ALLIED COURSE-II-(U191AC-2)	VECTOR CALCULUS & ANALYTICAL GEOMETRY OF THREE DIMENSION	3	-	-				
	IV	ENVIRONMENTAL STUDIES - (U19ES)	ENVIRONMENTAL STUDIES	2	2	3	25	75	-	100
		<b>TOTAL</b>		<b>30</b>	<b>16</b>					<b>500</b>
II	I	LANGUAGE COURSE-II (U19T2/H2/S2)	TAMIL/HINDI/SANSKRIT	6	3	3	25	75	-	100
	II	ENGLISH -(U19E2)	ENGLISH-II	4	2	3	25	75	-	100
		ENGLISH (CEC-I)	COMMUNICATIVE ENGLISH - I	2	1	3	25	75-	-	100
	III	CORE COURSE-II (U19CC-2)	MAJOR PRACTICAL (CC-III)	3	3	3	25	75	-	100
		CORE COURSE-III (U19CC-3)	GENERAL CHEMISTRY-II	5	5	3	25	75	-	100
	IV	FIRST ALLIED COURSE-II (U191AC2)	VECTOR CALCULUS & ANALYTICAL GEOMETRY OF THREE DIMENSION	3	3	3	25	75	-	100
		FIRST ALLIED COURSE-III (U191AC3)	TRIGONOMETRY ,LAPLACE TRANSFORMS & FOURIER SERIES	5	3	3	25	75	-	100
		SKILL BASED ELECTIVE COURSE-I	OFFICE AUTOMATION	2	2	3	25	75	-	100
			<b>TOTAL</b>		<b>30</b>	<b>24</b>				
III	I	LANGUAGE- I (U19T3/H3/S3)	TAMIL/HINDI/SANSKRIT	6	3	3	25	75	-	100
	II	ENGLISH (U19E3)	ENGLISH-III	4	2	3	25	75	-	100
		COMMUNICATIVE ENGLISH COURSE-III(CEC-III)		2	1	3	25	75	-	100
	III	CORE COURSE -IV (U19CC4)	GENERAL CHEMISTRY-III	4	5	3	25	75	-	100
		CORE COURSE -V (U19CC5)	PRACTICAL -II SEMI MICRO ANALYSIS	3	-	-	-	-	-	-
		SECOND ALLIED COURSE-I	ALLIED PHYSICS -I	4	3	3	25	75	-	100
		SECOND ALLIED COURSE-II	PHYSICS ALLIED PRACTICAL	3	-	-	-	-	-	-
	IV	SKILL BASED ELECTIVE -II (U19SBE:2)	DESKTOP PUBLISHING	2	2	3	25	75	-	100
		SKILL BASED ELECTIVE -III U19SBE:3P	OFFICE AUTOMATION & DESKTOP PUBLISHING LAB	2	2	3	25	75	-	100
			<b>TOTAL</b>		<b>30</b>	<b>18</b>				

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**B.SC CHEMISTRY COURSE STRUCTURE UNDER O.B.E.S**  
**APPLICABLE TO THE CANDIDATES ADMITTED FROM THE ACADEMIC YEAR 2019-2022**

SEM	PART	COURSE	COURSE TITLE	INS HOURS /WEEK	CREDIT	EXAM HRS	MARKS			TOTAL
							CIA	EXTERNAL		
								W	O	
IV	I	LANGUAGE- I (U19T4/H4/S4)	TAMIL/HINDI/SANSKRIT	6	3	3	25	75	-	100
		ENGLISH -(U19E4)	ENGLISH-IV	4	2	3	25	75	-	100
		COMMUNICATIVE ENGLISH -II (U19CE2)	COURSE -I (CEC-II)	2	1	3	25	75	-	100
	III	CORE COURSE-V (U19CC5)	PRACTICALS (CC-VI)	3	5	3	25	75	-	100
		CORE COURSE -VI (U19CC6)	GENERAL CHEMISTRY-IV	4	4	3	25	75	-	100
		SECOND ALLIED COURSE-II(U192AC2)	ALLIED PHYSICS PRACTICAL	3	3	3	25	75	-	100
	IV	SECOND ALLIED COURSE-III(U192AC3)	ALLIED PHYSICS -II	5	3	3	25	75	-	100
		NON -MAJOR ELECTIVE -I (U19NMCH1)	AGRICULTURAL CHEMISTRY	2	2	3	25	75	-	100
		VALUE EDUCATION-U19VE	VALUE EDUCATION	1	2	3	25	75	-	100
	<b>TOTAL</b>			<b>30</b>	<b>25</b>				<b>900</b>	
V	III	CORE COURSE-V II(U19CC7)	SELECTED TOPICS IN INORGANIC CHEMISTRY-I	5	5	3	25	75	-	100
		CORE COURSE-V III)(U19CC8)	ORGANIC CHEMISTRY-I	5	5	3	25	75	-	100
		CORE COURSE-IX U19CC9E)	ANALYTICAL CHEMISTRY	5	4	3	-	-	-	100
		CORE COURSE-ELECTIVE -X U19CC10E)	PHYSICAL CHEMISTRY-I	5	4	3	-25	75	-	100
		CORE COURSE- IX (U19CC11)	PRACTICAL -III PHYSICAL CHEMISTRY	3						
		CORE COURSE- X (U19CC12)	PRACTICAL -IV - GRAVIMETRIC AND ORGANIC ANALYSIS	3						
		NON -MAJOR ELECTIVE -II (U19NMCH1)	COSMETICS CHEMISTRY	2	2	3	25	75	-	100
		SOFT SKILLS-(U19SS)		2	2	3	25	75		100
	<b>TOTAL</b>			<b>30</b>	<b>22</b>				<b>600</b>	
VI		CORE COURSE-(U19CC11)	PRACTICAL -III PHYSICAL CHEMISTRY	3	5					100
		CORE COURSE- (U19CC12)	PRACTICAL -IV - GRAVIMETRIC AND ORGANIC ANALYSIS	3	6					100
		CORE COURSE-XI (U19CC13)	SELECTED TOPICS IN INORGANIC CHEMISTRY-II	6	6	3	25	75	-	100
		CORE COURSE-XIV (U19CC14)	ORGANIC CHEMISTRY-II	6	6	3	25	75	-	100
		CORE COURSE-XV U19CC15)	PHYSICAL CHEMISTRY-II	6	6	3	25	75	-	100
		CORE COURSE ELECTIVE-XVI(U19CC16E)	FOOD CHEMISTRY	5	4	3	25	75	-	100
		GENDER STUDIES - (U19GS)	GENDER STUDIES	1	1	-	-	-	-	100
		EXTENSION ACTIVITIES -(EA)		-	1	-	-	-	-	
	<b>TOTAL</b>			<b>30</b>	<b>35</b>				<b>700</b>	
	<b>GRAND TOTAL</b>			<b>180</b>	<b>140</b>				<b>4000</b>	

## GENERAL CHEMISTRY – I - U19CH1

**Semester: I**

**Core Course: I**

**Instruction Hours/Week: 5**

**Credits: 5**

**Objectives:**

**The students will be able**

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

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

Quantum numbers - principal, azimuthal, magnetic and spin quantum numbers and their significance - principles governing the occupancy of electrons in various quantum levels - Pauli's exclusion principle - Aufbau principle - Hund's rule - (n+l) rule - stability of half-filled and fully-filled orbitals. Periodic properties - variation of atomic volume, atomic and ionic radii, ionization potential, electron affinity and electronegativity along periods and groups - factors affecting periodic properties Pauling's and Mulliken's scales of electronegativity.

### **UNIT II: Chemical Bonding (15 Hours)**

Ionic bond - lattice energy and Born-Haber cycle (no derivation). Covalent bond - polarity of bonds - Fajan's rules - degree of covalent character in ionic bond. VSEPR theory - shapes of simple inorganic molecules containing lone pairs and bond pairs of electrons ( $\text{BeCl}_2$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{PCl}_5$ ,  $\text{SF}_6$ ,  $\text{IF}_7$ ). Hydrogen bonding - properties, types and consequences. Intermolecular forces - London forces.

### **UNIT III: Structural Concept of Organic Molecules (15 Hours)**

Catenation and classification of organic compounds. Hybridisation and geometry of molecules - methane, ethane, ethylene and acetylene - bond length, bond angles and bond energy. Polarisation effects - inductive effect, electromeric effect, mesomeric effect, hyperconjugation and steric effects. Cleavage of bonds - homolytic and heterolytic fission of C-C bonds. Reaction intermediates - free radicals, carbocations, carbanions - structure and their stability.

**UNIT IV: Gaseous State:****(15 Hours)**

Gaseous state - The Gas constant 'R' in different units - Maxwell-Boltzmann distribution of molecular velocities- Root mean square, average and most probable velocities (no derivation) - Collision number and mean free path - Collision diameter. Deviation from ideal behavior - Van der Waal's equation for real gases. Critical Phenomena - PV isotherms of real gases, critical temperature, and continuity of state - relation between critical constants and Vander Waal's constants - Determination of critical volume - the law of corresponding states - reduced equation of state.

**UNIT V: Solutions and Macromolecules****(15 Hours)**

**Solutions** - Definition of ideal and non-ideal solutions - concentration units - molality - molarity - formality - mole fraction - normality - weight percent and volume percent. **Macromolecules** - Number average and weight average molecular weight of macromolecules - determination of molecular weight by osmometry (number average), ultra centrifuge (weight average), Viscometry and light scattering.

**Course Outcomes:****The students will be able to**

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

**Text Books:**

1. P. L. Soni, Mohan Katyal, "*Text book of Inorganic Chemistry*", 20<sup>th</sup> Revised Ed., **(2007)**, Sultan Chand & Sons, New Delhi. **(UNIT I & II)**
2. R. D. Madan, "*Modern Inorganic Chemistry*", 6<sup>th</sup> Ed., **(2008)**, S. Chand and Company Ltd., New Delhi. **(UNIT I & II)**
3. J. D. Lee, "*A New Concise Inorganic Chemistry*", Oxford Publishers, 5<sup>th</sup> Ed., **2014. (UNIT I & II)**
4. A. Bahl, B. S. Bhal, A Textbook of Organic chemistry, S. Chand and Company Ltd., New Delhi, 22<sup>nd</sup> Ed., **2016. (UNIT III)**



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

**Reference Books:**

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

## GENERAL CHEMISTRY II – U19CH3

**Semester: II**

**Core Course: III**

**Instruction Hours/Week: 5**

**Credit: 5**

### **Objectives:**

#### **The students will be able:**

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

### **UNIT I: Titrimetric Analysis (15 Hours)**

Volumetric analysis - definitions - standard solutions, equivalence point, end point, molarity, molality, normality, mole fraction, primary and secondary standards - types of titrimetric reactions - acid-base, redox, precipitation and complexometric titrations - acid-base and redox indicators. Oxidation-reduction: oxidation number and oxidation states - equivalent weights of oxidizing and reducing agents - balancing redox equations by oxidation number method and ion-electron method.

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

Metallurgy-various steps in metallurgy - grinding, pulverizing - concentration (ore dressing)-hand picking, gravity separation, froth floatation, electromagnetic separation, chemical separation - calcinations and roasting - smelting, aluminothermic process- purification of metals - zone refining, vapour phase and electrolytic refining. Position of hydrogen in the periodic table - atomic hydrogen - nascent hydrogen, occluded hydrogen, ortho-para hydrogen. General characteristics of s-block elements and their compounds - oxides, hydroxides, halides and hydrides - diagonal relationship of Li and Mg, Be and Al - extraction of Li and Be - anomalous behaviour of Li and Be

### **UNIT III: Organic Chemistry: Nomenclature, Alkanes and Alkenes (15 Hours)**

Nomenclature of organic compounds - IUPAC naming of simple and substituted aliphatic, aromatic and alicyclic compounds - priorities of functional groups in poly functional compounds, Alkanes - general methods of preparation, properties and uses. Petroleum - refining, products obtained with uses - cracking - thermal and catalytic process of cracking - synthetic gasoline - Fischer-Tropsch synthesis and Bergius method - octane number. Alkenes - general methods of preparation and

properties - addition with HBr (peroxide effect), H<sub>2</sub>SO<sub>4</sub>, H<sub>2</sub>O, hydroboration, ozonolysis hydroxylation with KMnO<sub>4</sub> - allylic substitution by NBS.

**UNIT IV: Dienes and Alkynes (15 Hours)**

Dienes - types - conjugated, isolated and cumulated. Synthesis of dienes - 1,3-butadiene, isoprene and chloroprene. Stability and chemical reactivity - 1,2 and 1,4 additions - kinetically and thermodynamically controlled reactions - Diel's-Alder reaction. Alkynes - acidity of alkynes - formation of acetylides - addition of water with HgSO<sub>4</sub> catalyst - addition of halides and halogens - oxidation and hydroboration (mechanisms not needed).

**UNIT V: Quantum Chemistry (15 Hours)**

Black body radiation and quantum theory- inadequacy of old quantum theory - atomic spectra - Bohr's model of atoms - Bohr's theory of Hydrogen atom and spectral lines. Limitations of Bohr's model. Sommerfeld's extension- photoelectric effect and Compton effect. de-Broglie's equation and verification. Heisenberg's uncertainty principle - Schrodinger wave equation - Eigen values and eigen functions- significance of  $\psi$  and  $\psi^2$  - Radial probability distribution - orbital energies in multi electron atoms - Filling of orbitals.

**Course Outcomes:**

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

**Text Books:**

1. P. L. Soni, Mohan Katyal, "*Text book of Inorganic Chemistry*", 20<sup>th</sup> Revised Ed., (2007), Sultan Chand & Sons, New Delhi. (UNIT I & II)
2. R. D. Madan, "*Modern Inorganic Chemistry*", 6<sup>th</sup> Ed., (2008), S. Chand and Company Ltd., New Delhi. (UNIT I & II)
3. J. D. Lee, "*A New Concise Inorganic Chemistry*", Oxford Publishers, 5<sup>th</sup> Ed., 2014. (UNIT I & II)
4. A. Bahl, B. S. Bhal, A Textbook of Organic chemistry, S. Chand and Company Ltd., New Delhi, 22<sup>nd</sup> Ed., 2016. (UNIT III & IV)

5. P. L. Soni, "Text book of Organic Chemistry", S. Chand and Company Ltd., New Delhi, 28<sup>th</sup> Ed., **2004. (UNIT III & IV)**
6. R. T. Morrison and R. N. Boyd., "*Organic Chemistry*", Prentice Hall of India Pvt. Ltd., New Delhi, 7<sup>th</sup> Ed., **2011. (UNIT III & IV)**
7. B. R. Puri, L.R. Sharma and M. S. Pathania, "*Principles of Physical Chemistry*", Vishal Publishing Co., 47<sup>th</sup> Ed., **2016. (UNIT V)**
8. P. L. Soni and O. P. Dharmaha, "*Text book of Physical chemistry*", S. Chand and Sons, New Delhi. **(UNIT V)**.
9. Ira N. Levine, Pearson, "*Quantum Chemistry*", London, UK, 7<sup>th</sup> Ed., **2014. (UNIT V)**.

**Reference Books:**

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

## PRACTICAL –I VOLUMETRIC ANALYSIS U19CH2P

**Semester: I & II**

**Core Course: II**

**Instruction Hours/Week: 3+3**

**Credit: 6**

### **Objectives:**

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

### **Experiments:**

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

### **Course Outcomes:**

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

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

### **Text Books:**

1. Practical Chemistry by A.O. Thomas, Scientific Book Centre, Cannanore, **2003.**

2. Basic Principles of Practical Chemistry, V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Sultan Chand & Sons, New Delhi, 2<sup>nd</sup> Ed., **2004**.

**Reference:**

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

**Scheme of Valuation**

**Maximum Marks : 75 Marks**

Procedure writing : 10 Marks

Viva-voce : 05 Marks

Practical : 60 Marks

< 1% : 60 Marks

1-2% : 50 Marks

2-3% : 40 Marks

3-4% : 30 Marks

> 4% : 10 Marks

## GENERAL CHEMISTRY III – U19CH4

**Semester: III**

**Core Course: IV**

**Instruction Hours/Week: 4**

**Credit: 4**

### **Objectives:**

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

### **UNIT I: Oxygen Family and Qualitative Analysis (15 Hours)**

Oxygen family - Comparative study - preparation, properties, structural elucidation and uses of ozone, hydrogen peroxide, peracids of sulphur and sodium thiosulphate. Principles of qualitative analysis - solubility product - common ion effect - complexation reactions including spot tests in qualitative analysis.

### **UNIT II: Boron, Carbon and Nitrogen Family (15 Hours)**

Comparative study of boron family elements - compounds of boron - diborane, borax, boron nitride, boron carbide and borazole - structure and uses. Comparative study of carbon family elements and their compounds (hydrides, halides and oxides) – Fullerenes- intercalation compounds of Graphite with alkali metals - structure of graphite and diamond comparative study of nitrogen family elements and their compounds (hydrides, halides, oxides and oxyacids) - chemistry of hydrazine.

### **UNIT III: Cycloalkanes and Conformational Analysis Cycloalkanes:**

Nomenclature - preparation using Wurtz reaction, Dieckmann ring closure reactions and reduction of aromatic hydrocarbons - chemical properties. Substitution and ring opening reactions - relative stability of cycloalkanes (cyclopropane to cyclooctane), Baeyer's strain theory, limitations of Sasche-Mohr theory of strainless rings. Conformational Analysis: Ethane, *n*-butane, cyclohexane.

### **UNIT IV: Alcohols (15 Hours)**

Alcohols: Classification and nomenclature - monohydric alcohols - preparation by reduction of aldehydes, ketones, carboxylic acids and hydrolysis of esters - individual source of alcohols. Properties: acidic nature, H-bonding, Reactions

involving cleavage of -OH bond, C-O bond. Distinction between 1<sup>o</sup>, 2<sup>o</sup> and 3<sup>o</sup> alcohols, Dihydric alcohols: preparation, properties and uses of glycol. Trihydric alcohols: preparation - properties and uses. Reactions of polyhydric alcohols with Pb(OAc)<sub>4</sub>, HIO<sub>4</sub> and OsO<sub>4</sub>.

### **UNIT V: Chemical Kinetics**

**(15 Hours)**

Rates of reaction, rate laws, rate constants, order and molecularity of reactions. Rate equations for zero, first, second and third order reactions. Derivation of rate constants for first, second order reactions. Fractional order reactions - examples, half-life period, pseudo-first order reactions - examples. Methods of determining the order of reactions. Integration, graphical, half-life and Ostwald's isolation methods. Temperature dependence of reaction rates - Arrhenius parameters and calculations. Theories of reaction rates - simple collision theory] - Limitations - Steady state approximation - equilibrium approximation- Lindemann's hypothesis of unimolecular reactions.

#### **Course Outcomes:**

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

#### **Text Books:**

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



7. B. R. Puri, L.R. Sharma and M. S. Pathania, "*Principles of Physical Chemistry*", Vishal Publishing Co., 47<sup>th</sup> Ed., **2016**. (**UNIT V**)
8. P. L. Soni and O. P. Dharmaha, "*Text book of Physical chemistry*", S. Chand and Sons, New Delhi. (**UNIT V**).

**Reference Books:**

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

## PRACTICAL II: SEMI MICRO ANALYSIS – U19CH5P

**Semester: III & IV**

**Core Course: V**

**Instruction Hours/Week: 3**

**Credits: 5**

### **Objectives:**

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

### **Inorganic Qualitative Analysis**

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

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

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

### **Course Outcomes:**

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

### **Text Books:**

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

### **Reference:**

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

### **Scheme of Valuation**

#### **Maximum Marks: 75 Marks**

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

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

## GENERAL CHEMISTRY IV - U19CH6

**Semester: IV**

**Core Course: VI**

**Instruction Hours/Week: 4**

**Credits: 4**

### **Objectives:**

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

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

Comparative study of halogens and their compounds - oxides and oxy acids of halogens (structure only) - estimation of available chlorine in bleaching powder - basic properties of halogens. Interhalogen compounds - preparation, properties and uses - pseudo halogens - preparation, properties and uses of cyanogens and thiocyanogen - comparison with halogens. Zero group - position in the periodic table - isolation of noble gases from the atmosphere and uses - oxides and fluorides of xenon - structure and uses.

### **UNIT II: Aromaticity, Ethers, Epoxides, Organometallic Compounds**

#### **Aromaticity (12 Hours)**

Structure of benzene - stability, resonance structure, Huckel's rule of aromaticity (benzene, naphthalene and anthracene)

**Ethers:** Preparation - by dehydration of alcohols and Williamson synthesis (with mechanism)-Properties (formation of oxonium ion and hydrolysis).

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

**Organometallic compounds:** Preparation - properties - (Nucleophilic substitution and addition reaction with aldehydes, ketones, cyanides and alkylhalides).

### **UNIT III: Substitution and Elimination Reactions (12 Hours)**

Aliphatic and nucleophilic substitution reaction -  $S_N1$  &  $S_N2$  and its stereochemistry aspects. Elimination reaction and Hoffmann Saytzeff's rule. Mechanism of  $E_1$  and  $E_2$  elimination Vs substitution. Electrophilic substitution reactions with mechanism - nitration, bromination and sulphonation.

**UNIT IV: Solid State****(12 Hours)**

Properties of solids - Seven crystal systems - Bravais lattice, unit cell, law of rational indices, (Weiss indices) Miller indices, Symmetry elements in crystals (for cubic system only in detail). X - ray diffraction by crystals - derivation of Bragg's equation - Bragg method - powder method. Crystal structure of NaCl, KCl, ZnS and CsCl - radius ratio and packing in crystals.

**UNIT V: Colloids and Liquid state****(12 Hours)**

**Colloidal state:** size of colloidal particles – peptization, stability of colloids, coagulation and Protection – Reverse Osmosis and desalination of sea water - Donnan membrane equilibrium electrophoresis and separation of proteins, Gels and emulsions.

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

**Course Outcomes:**

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

**Text Books:**

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

7. B. R. Puri, L.R. Sharma and M. S. Pathania, "*Principles of Physical Chemistry*", Vishal Publishing Co., 47<sup>th</sup> Ed., **2016**. (**UNIT IV & V**)
8. P. L. Soni and O. P. Dharmaha, "*Text book of Physical chemistry*", S. Chand and Sons, New Delhi. (**UNIT IV & V**)

**Reference Books:**

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

## INORGANIC CHEMISTRY – I - U19CH7

**Semester: V**

**Core Course: VII**

**Instruction Hours/Week: 5**

**Credit: 5**

### **Objectives::**

1. To learn the group study and the metallurgy of transition and inner transition elements.
2. To study the basic concepts and application of coordination compounds.
3. To understand the chemistry of biological and carbonyl compounds.
4. To study the different concepts of acid-bases and non-aqueous solvents.

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

Group study of Titanium, Vanadium, Chromium, Manganese and Iron groups - Metallurgy of Ti, V and W. Lanthanides and Actinides - general study involving electronic configuration, Oxidation state, magnetic properties and complexation behaviour - lanthanide and actinide contraction - comparative study of lanthanides and actinides. Chemistry of Thorium and Uranium.

### **UNIT II: Coordination Chemistry - I (15 Hours)**

Double salts- complex compounds- complex ion and coordination number- Ligands and their classification- chelates and their uses - coordination number and stereochemistry of complexes - IUPAC Nomenclature of coordination compounds - Theories of coordination compounds - Werner, Sidgwick, Valence bond, Crystal field, Molecular orbital and Ligand field theory.

### **UNIT III: Coordination Chemistry – II (15 Hours)**

Isomerism - stability of complexes - factors affecting stability. Unimolecular and bimolecular nucleophilic substitution reactions in octahedral and square planar complexes - trans effect. Application of coordination compounds - separation of copper and cadmium ions - estimation of nickel using DMG and aluminium using oxine. Structure of EDTA and its complexes - complexometric titrations - principle and applications.

### **UNIT IV: Biological and Carbonyl Compounds (15 Hours)**

Biologically important coordination compounds - Chlorophyll, Hemoglobin and Vitamin B<sub>12</sub> - structure and applications (elucidation not required). Metal carbonyls - mono and polynuclear carbonyls of Ni, Fe, Cr, Co and Mn - Synthesis, reaction, structure and uses- carbonyl hydrides.

## UNIT V: Acids and Bases

(15 Hours)

Arrhenium concept - Lowry-Brønsted concept - Lux-Flood concept - The solvent system concept - The Lewis concept - Hard and Soft acids and bases - Pearson's concept HSAB principle and its application- Non-aqueous solvent- liq. ammonia and liq. HF.

### Course Outcomes:

The content given in "*Inorganic chemistry-I*" will make a student to develop the basic knowledge of coordination chemistry, chemistry of transition and inner transition elements and acid-base concepts.

### Text Books:

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

### Reference Books:

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

## ORGANIC CHEMISTRY I- U19CH8

**Semester: V**

**Core Course: VIII**

**Instruction Hours/Week: 5**

**Credit : 5**

### **Objectives:**

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

### **UNIT I: Stereochemistry**

**(15 Hours)**

Stereoisomerism - definition - classification - optical isomerism - optical activity - specific rotation- criteria for optical activity - asymmetric centre - chirality - achirality - D, L and d, l, rotations - elements of symmetry. Optical activity of lactic acid, tartaric acid, biphenyls, allenes and spiranes. Racemisation - Racemisation by substitution - resolution - methods of resolution by mechanical , conversion in to diastereo isomer and biochemical - asymmetric synthesis - partial and absolute asymmetric synthesis - Walden inversion - R, S notation of acyclic compounds with one or two asymmetric centres - Erythro and threo representations.

### **UNIT II: Stereoisomerism and Heterocyclic compounds**

**(15 Hours)**

Geometrical isomerism - cis-trans, syn-anti and E-Z rotation – geometrical isomerism in maleic and fumaric acids, unsymmetrical ketoximes - methods of distinguishing geometrical isomers (Dipole moment, dehydration, heat of hydrogenation, cyclisation, melting points). Aromatic characteristics of heterocyclic compounds. Comparison of basicity of pyrrole, pyridine and amines. Preparation, Properties and uses of furan, pyrrole, thiophene, quinoline, isoquinoline and indole (Skraup synthesis and Bischler - Napieralski synthesis).

### **UNIT III: Carbonyl Compounds and Photochemistry**

**(15 Hours)**

Carbonyl polarization - acidity of  $\alpha$ -hydrogen - mechanism of aldol, perkin, koevengal, benzoin, cannizaro, claisen, reformatsky and wittig reactions. Mechanism of reduction -  $\text{NaBH}_4$ ,  $\text{LiAlH}_4$ , Wolff - Kishner and MPV reactions. Haloform, Michael addition and Oppenauer oxidation. Basics of photochemistry- Photochemistry of Carbonyl compounds - Norrish I and II types.

### **UNIT IV: Acids and Acid Derivatives**

**(15 Hours)**

Ionisation of carboxylic acids - acidity constant - comparison of acid strengths of substituted acids - acid strength of substituted benzoic acids - Hammett equations. Dicarboxylic acids - oxalic, malonic, succinic acids (preparation, properties and uses). Malonic and acetoacetic ester - characteristics of reactive methylene group - synthetic uses of these two esters. Amide and acetyl derivatives- Tautomerism – definition - keto-enol-identification, - amido-imido and nitro-acinitro tautomerism (Only interconversion).



**UNIT V: Vitamins and Terpenes:****(15 Hours)**

Vitamins - types - sources - deficiency disorders. Structure of vitamin A, B<sub>6</sub>, B<sub>12</sub> and C. Structural elucidation of riboflavins and ascorbic acid. Terpenes - classification, isoprene rule, importance. Structural elucidation of citral, geraniol and menthol.

**Course Outcomes:**

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

**Text Books:**

1. A. Bahl, B. S. Bhal, A Textbook of Organic chemistry, S. Chand and Company Ltd., New Delhi, 22<sup>nd</sup> Ed., **2016. (ALL UNITS)**
2. R.T. Morrison and R.N. Boyd, "Organic Chemistry", New York, Allyn & Bacon Ltd., 7<sup>th</sup> Ed., **2011. (ALL UNITS)**
3. K. S. Tewari and N. K. Vishnoi, "A Text book of Organic Chemistry", Vikas Publishing House Pvt. Ltd., 3<sup>rd</sup> Ed., **2006. (ALL UNITS)**
4. P. L. Soni, "Text book of Organic Chemistry", S. Chand and Company Ltd., New Delhi, 28<sup>th</sup> Ed., **2004. (ALL UNITS)**
5. M. K. Jain and S. C. Sharma, "Modern Organic Chemistry", Vishal Publications, New Delhi, 14<sup>th</sup> Ed., **2014. (ALL UNITS)**
6. I. L. Finar, Organic Chemistry, Vol 1 and 2 (6<sup>th</sup> edition) England, Addison Wesley Longman Ltd. (**2002**). (**ALL UNITS**)
7. K. Srivastava, "Organic Chemistry", 1<sup>st</sup> Ed., (**2002**)–New Age International Publishers, New Delhi. (**ALL UNITS**)
8. V. K. Ahluwalia "Text book of organic chemistry" Vol.-I & Vol.-II (**2010**) Ane's Student edition, New Delhi. (**ALL UNITS**)

**Reference Books:**

1. Advanced Organic Chemistry Part A: Structure and Mechanisms Carey, Francis A., Sundberg, Richard J., Springer, New York, 5<sup>th</sup> Ed., **2007**.
2. Stereochemistry of Organic Compounds, E.L. Eliel, Samuel H. Wilen, Wiley – India **2008**.
3. Organic Chemistry, Paula Yurkanis Bruice, Dorling Kindersley, India, 5<sup>th</sup> Ed., **2009**.
4. Strategic Applications of Named Reactions in Organic Synthesis, L. Kürti and B. Czakó, Elsevier Academic Press., London, UK., **2005**.

## ANALYTICAL CHEMISTRY – U19CH9E

**Semester: V**

**Elective Course: I**

**Instruction Hours/Week: 5**

**Credits: 4**

### **Objectives::**

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

### **UNIT I: Introduction to Analytical Chemistry (15 Hours)**

Types of analytical methods: Importance of analytical methods in qualitative and quantitative analysis - chemical and instrumental methods - Laboratory hygiene and safety: Corrosive, flammable, explosive, toxic, carcinogenic and poisonous chemicals - Waste disposal. Evaluation of analytical data: Idea of significant figures - its importance. Accuracy - methods of expressing accuracy - error analysis - types of errors-minimizing errors. Precision - methods of expressing precision - mean, median, mean deviation, standard deviation and confidence limit. Method of least squares - problems involving straight line graphs.

### **UNIT II: Quantitative Analysis (15 Hours)**

Estimations of commercial samples - determination of percentage purity of samples -pyrolusite, Iron ore, washing soda and Bleaching powder - Gravimetric analysis - principle - theories of precipitation - solubility product and precipitation - conditions of precipitations - types of precipitants - specific and selective precipitants - organic and inorganic precipitants - types of precipitation - purity of precipitates - co precipitation - post precipitation - precipitation from homogeneous solution - use of sequestering agent.

### **UNIT III: Thermo and Electroanalytical Techniques (15 Hours)**

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

### **UNIT IV: Spectro Analytical Techniques (15 Hours)**

Colorimetry and spectrophotometry - Beer-Lambert's law - principle of colorimetric analysis - visual colorimetry - standard series method - balancing method - estimation of  $\text{Ni}^{2+}$  and  $\text{Fe}^{3+}$  colorimetrically - photoelectric photometer method. Infrared spectroscopy (instrumentation only) - block diagram - source - monochromator - cell - detectors and recorders - sampling techniques - NMR spectroscopy (instrumentation only) - block diagram.

### **UNIT V: Chromatographic Techniques (15 Hours)**

Chromatography - introduction - theory - classification of chromatographic methods - development of chromatograms. Column chromatography - principle, types of adsorbents, preparation of the column, elution, recovery of substances and applications. Thin layer chromatography - principle, choice of adsorbent and

solvent, preparation of chromatoplates,  $R_f$ -values, factors affecting the  $R_f$  -values, Significance of  $R_f$  values. Paper chromatography - principle, solvents used, development of chromatogram, ascending, descending and radial paper chromatography - Gas chromatography and HPLC- principles, instrumentations and applications.

**Course Outcomes:**

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

**Text Book:**

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

**Reference Books:**

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

## PHYSICAL CHEMISTRY I - U19CH10E

**Semester: V**

**Major Based Elective Course: II**

**Instruction Hours/Week: 5**

**Credits: 4**

### **Objectives::**

1. To learn the three laws of thermodynamics, about the properties and behaviour of solutions and also about different phases.

### **UNIT I: Thermodynamics – I**

**(15 Hours)**

Thermodynamic processes - reversible and irreversible, isothermal and adiabatic processes - state and path functions - exact and inexact differentials. Work of expansion at constant pressure and free expansion. First law of thermodynamics - statement - definition of internal energy (E), enthalpy (H) and heat capacity. Relation between  $C_p$  and  $C_v$ . calculation of  $w$ ,  $q$ ,  $dE$  and  $dH$  for expansion of ideal and real gases under isothermal and adiabatic conditions of reversible and irreversible processes. Definition of Joule-Thomson coefficient - calculation of  $(\mu_{J,T})$  for ideal and real gases - Inversion temperature. Thermochemistry - relation between enthalpy of reaction at constant volume ( $q_v$ ) and at constant pressure ( $q_p$ ) - temperature dependence of heat of reaction - Kirchoff's law and its applications.

### **UNIT II: Thermodynamics – II**

**(15 Hours)**

Second law of thermo dynamics - need for the law - different statements of the law - Carnot's cycle and efficiency of heat engine - Carnot's theorem - thermodynamic scale of temperature - concept of entropy - definition and physical significance of entropy - entropy as a function of  $P$ ,  $V$  and  $T$  - entropy changes during phase changes - entropy of mixing - entropy criterion for spontaneous and equilibrium processes in isolated system - Gibb's free energy ( $G$ ) and Helmholtz free energy ( $A$ ) - variation of  $A$  and  $G$  with  $P$ ,  $V$  and  $T$  - Gibb's - Helmholtz equation and its applications - thermodynamic equation of state - Maxwell's relations only -  $\Delta A$  and  $\Delta G$  as criteria for spontaneity and equilibrium - advantages of  $\Delta G$  over entropy change.

### **UNIT III: Thermodynamics – III**

**(15 Hours)**

Equilibrium constant and free energy change - thermodynamic derivation of law of mass action - equilibrium constants in terms of pressure and concentration -  $NH_3$ ,  $PCl_5$ , - thermodynamic interpretation of Le Chatelier's principle (Concentration, temperature, pressure and addition of inert gases.) - partial molar quantities - chemical potential - Gibb's Duhem equation. van't Hoff's reaction isotherm - van't Hoff's isochore - Clapeyron equation and Clausius-Clapeyron equation - applications -Third law of thermodynamics - Nernst heat theorem statement of III law and concept of residual entropy.

### **UNIT IV: Solutions**

**(15 Hours)**

Completely miscible liquid systems - benzene and toluene. Raoult's law and Henry's law. deviation from Raoult's law and Henry's law. Duhem-Margules equation - theory of fractional distillation - azeotropes - HCl-water and ethanol-water systems - partially miscible liquid systems - phenol-water, triethanolamine - water and nicotine-water systems - lower and upper CSTs - effect of impurities on CST - completely immiscible liquids - principle and applications of steam distillation. Nernst distribution law derivation - applications - Dilute solutions:

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

**UNIT V: Thermodynamics of Phase Changes (15 Hours)**

Definition of terms in the phase rule - derivation and application to one component systems -Water, carbondioxide and sulphur - two component systems - solid liquid equilibria, simple eutectic (lead-silver, Bi-Cd), desilverisation of lead - compound formation with congruent melting point (Mg-Zn) and incongruent melting point (Na-K) - solid solutions - fractional crystallization - freezing mixtures - FeCl<sub>3</sub> - H<sub>2</sub>O systems, CuSO<sub>4</sub>-H<sub>2</sub>O system.

**Course Outcomes:**

Students are expected to apply the knowledge gained during research and also in industries.

**Text books:**

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

**Reference Books:**

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

## **PRACTICAL –III PHYSICAL CHEMISTRY PRACTICAL –U19CH11P**

**Semester: V & VI**

**Core Course : IX**

**Instruction Hours/Week : 3**

**Credit : 5**

### **Objectives:**

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

### **List of Experiments:**

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

### **Demonstration Experiments:**

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

### **Course Learning Outcomes**

#### **The students are able to**

1. By carrying out both electrical and non-electrical physical practicals.
2. Find out CST of phenol-water system, Transition temperature of any hydrated salt and molecular weight of any substance.
3. Measure eutectic temperature and follow kinetics of reaction.
4. Perform conductometric and potentiometric titrations for calculating concentration and the amount present in the given solution.
5. Determine cell constant and equivalent conductance.

### **Text Books:**

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

### **Reference Books:**

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

### **Scheme of Valuation**

#### **Maximum Marks: 75 Marks**

Procedure Writing	: 10 Marks		
Viva-voce	: 05 Marks	Practical	: 60 Marks

## **PRACTICAL IV (GRAVIMETRIC AND ORGANIC ANALYSIS) - U19CH12P**

**Semester : V & VI**

**Core Course : X**

**Instruction Hours/Week : 3+3**

**Credit : 5**

### **Objectives:**

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

### **Gravimetric Analysis:**

1. Estimation of Lead as lead chromate.
2. Estimation of Barium as barium chromate.
3. Estimation of Nickel as Nickel - DMG complex.
4. Estimation of Copper as copper (I) thiocyanate
5. Estimation of Magnesium as magnesium oxinate
6. Estimation Calcium as calcium oxalate monohydrate
7. Estimation of Barium as barium sulphate.
8. Estimation of Iron as Iron (III) oxide.

### **Organic Qualitative Analysis:**

Analysis of Simple Organic compounds (a) characterization of functional groups (b) confirmation by preparation of solid derivatives / characteristic colour reactions. Note: Mono-functional compounds are given for analysis. In case of bi-functional compounds, students are required to report any one of the functional groups.

### **Organic Preparation:**

Preparation of Organic Compounds involving the following chemical conversions

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

### **Determination of Physical Constants**

Determination of boiling point and melting point by semi micro method.

### **Course Outcomes:**

1. Knowledge on the technique of organic qualitative analysis
2. Knowledge about the method of organic compound preparation
3. Learning physical constant of solid and liquid organic compounds
4. Understand by the principles of gravimetric estimation and develop practical skill in it.

### **Text Books:**

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

### **Reference Books:**

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

### **Scheme of Valuation Maximum Marks: 75 Marks**

Physical constant	: 10 Marks
Viva-Voce	: 05 Marks
Gravimetric	: 30 Marks
Organic Preparation	: 10 Marks
Organic Analysis	: 20 Marks

### **Split up mark for Organic Analysis as follows:**

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

## INORGANIC CHEMISTRY – II – U19CH13

Semester: VI

Core Course: XIII

Instruction Hours/Week: 6

Credit : 6

### Objectives:

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

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

Structure of crystal lattice- examples- NaCl, CsCl, Zinc blende, Wurtzite and fluorite. Layer structure compounds - examples CdI<sub>2</sub> and NiAs. Organometallic compounds of alkenes, alkynes and cyclopentadiene.

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

Clathrates - examples and structures - interstitial compounds. Silicones - composition, raw materials, manufacture, structure, properties and uses. Boron-Phosphorous compounds- coordination polymers and phosphonitrilic polymers. Silicates - classification into discrete anions- one, two, and three dimensional structures with typical examples - composition, properties and uses of beryl, asbestos, talc, mica, zeolites and ultramarines.

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

Packing of atoms in metals (bcc, ccp and hcp) - theories of metallic bonding - Electron gas, Pauling and Band theories. Structure of alloys substitutional and interstitial solid solutions - Hume-Rothery ratios - crystal defects in stoichiometric and non-stoichiometric compounds. Semiconductors - extrinsic and intrinsic-n-type and p-type - composition, structure and uses in electronic industry

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

Introduction - composition of nucleus and nuclear forces. Nuclear stability n/p ratio - mass defect, binding energy, packing fraction and magic numbers - nuclear shell and liquid drop models. Isotopes - detection and separation - isotopic constitution of elements - Whole number rule - Isobars, Isotones and nuclear isomers. Nuclear fission and fusion - nuclear reactor.

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

Radioactivity - discovery, detection and measurement (Wilson Cloud Chamber) - radioactive emission - disintegration theory - modes of decay - rate of disintegration - half-life- average life - radioactive series .Nuclear transformations - projectiles - particle accelerators- cyclotron- nuclear reactions - Q values of nuclear reactions- applications of radioisotopes - carbon dating - radioactive waste disposal.

### Course Outcomes:

The content given in "*Inorganic chemistry-II*" will make a student to develop the basic knowledge of ionic and organometallic compounds, the structural studies of polymeric inorganic compounds, theoretical concepts, applications of metallic state and industrial chemistry as well as nuclear chemistry.



**Text Books:**

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

**Reference Books:**

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

## ORGANIC CHEMISTRY II – U19CH14

**Semester: VI**

**Core Course : XIV**

**Instruction Hours/Week: 6**

**Credit: 6**

### **Objectives::**

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

### **UNIT I: Chemistry of Nitrogen Compounds**

**(18 Hours)**

Preparation of nitro benzene to *o*, *p* and *m* - dinitrobenzene, TNT – reduction of aromatic nitro compounds in neutral, acidic and alkaline media. Relative basic characters of aliphatic and aromatic amines ring substitution in aromatic amines - diazotization and its mechanism - synthetic applications of diazonium salts. Phenylene diamines - sulphanilic acids - sulphanilamide, saccharin, chloramine-T

### **UNIT II: Amino acids, Proteins and Nucleic acids**

**(18 Hours)**

Amino acids - introduction - classification, preparation, properties and reaction of amino acids. Zwitter ion, isoelectric point. Peptides - polypeptides – use of protective groups in the synthesis of polypeptides.- synthesis and end group analysis. Proteins - classification based on physical, chemical properties and physiological functions. Primary, secondary and tertiary structures of protein. Nucleic acids - nucleotides, nucleosides, heterocyclic bases and sugars. DNA and RNA, biological functions.

### **UNIT III: Carbohydrates**

**(18 Hours)**

Carbohydrates - classification - preparation and reactions of glucose and fructose, structural elucidation of glucose only. Mutarotation and its mechanism, epimerization. ascending and descending of sugar series - interconversions. Disaccharides - preparation, reactions and structures of maltose, lactose and sucrose. Polysaccharides - starch and cellulose. Properties, structures and uses. (Structural elucidation NOT necessary).

### **UNIT IV: Phenols, Dyes and Polymers**

**(18 Hours)**

Acidic character of phenols - electrophilic substitution reactions of phenols - coupling with diazonium salts, Reimer-Tiemann reaction, Houben-Hoesch acylation, Gattermann's reaction, Kolbe's reaction. Cresols, Nitro and amino phenols, di and trihydric phenols,  $\alpha$  and  $\beta$ -naphthols preparation and properties. Dyes - theory of color and constitution. Classification according to structure and application. Preparation and uses of the following dyes.

(i) Azodyes - methyl orange and Bismark Brown. (ii) Triphenyl methane dyes - Malachite green. (iii) Phthalein dyes - Phenolphthalein and flourescein. (iv) Vat dye – Indigo. (v) Anthraquinone dye – Alizarin.

**Polymers:** Definition, types of polymers, difference between thermosetting and thermoplastic polymers. preparation of caprolactam, nylon 66, polyester and epoxy resins.

## UNIT V: Molecular Rearrangement and Alkaloids

(18 Hours)

Molecular Rearrangements - classification and mechanism. Pinacol pinacolone - Beckmann rearrangement. Hoffmann, Curtius, Benzidine, Cope and Claisen, Fries and Benzil-Benzilic acid rearrangements. Alkaloids - general methods of isolation - importance - structure elucidation of coniine, piperine and nicotine.- Importance of alkaloids.

### Course Outcomes:

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

### Text Books:

1. A. Bahl, B. S. Bhal, A Textbook of Organic chemistry, S. Chand and Company Ltd., New Delhi, 22<sup>nd</sup> Ed., **2016. (ALL UNITS)**
2. R.T. Morrison and R.N. Boyd, "*Organic Chemistry*", New York, Allyn & Bacon Ltd., 7<sup>th</sup> Ed., **2011. (ALL UNITS)**
3. K. S. Tewari and N. K. Vishnoi, "A Text book of Organic Chemistry", Vikas Publishing House Pvt. Ltd., 3<sup>rd</sup> Ed., **2006. (ALL UNITS)**
4. P. L. Soni, "Text book of Organic Chemistry", S. Chand and Company Ltd., New Delhi, 28<sup>th</sup> Ed., **2004. (ALL UNITS)**
5. M. K. Jain and S. C. Sharma, "Modern Organic Chemistry", Vishal Publications, New Delhi, 14<sup>th</sup> Ed., **2014. (ALL UNITS)**
6. I. L. Finar, Organic Chemistry, Vol 1 and 2 (6<sup>th</sup> edition) England, Addison Wesley Longman Ltd. (**2002**). (**ALL UNITS**)
7. K. Srivastava, "Organic Chemistry", 1<sup>st</sup> Ed., (**2002**)-New Age International Publishers, New Delhi. (**ALL UNITS**)
8. V. K. Ahluwalia "Text book of organic chemistry" Vol.-I & Vol.-II (**2010**) Ane's Student edition, New Delhi. (**ALL UNITS**)

### Reference Books:

1. Advanced Organic Chemistry Part A: Structure and Mechanisms Carey, Francis A., Sundberg, Richard J., Springer, New York, 5<sup>th</sup> Ed., **2007**.
2. Stereochemistry of Organic Compounds, E.L. Eliel, Samuel H. Wilen, Wiley - India, **2008**.
3. Organic Chemistry, Paula Yurkanis Bruice, Dorling Kindersley, India, 5<sup>th</sup> Ed., **2009**.
4. Strategic Applications of Named Reactions in Organic Synthesis, L. Kürti and B. Czakó, Elsevier Academic Press., London, UK., **2005**.

## PHYSICAL CHEMISTRY II Code: U19CH15

Semester : VI

Core Course : XV

Instruction Hours/Week : 6

Credits : 6

### Objectives::

1. To learn in detail about reactions taking place in electrolytic cells.
2. To learn in detail about reactions taking place in electrochemical cells.
3. To learn in detail about the nature of light and its interaction with matter.

### UNIT I: Electrical Conductance (18 Hours)

Electrical transport and conductance in metal and in electrolytic solution - specific conductance and equivalent conductance - measurement of equivalent conductance. Arrhenius theory of electrolytic dissociation and its limitation - Arrhenius theory of strong and weak electrolytes. Ostwald's dilution law - applications and limitation - variation of equivalent conductance with concentration. Transport number and Hittorf's rule - determination by Hittorf's method and moving boundary method Kohlrausch's law and its applications. The elementary treatment of the Debye-Huckel-Onsager equation for strong electrolytes - application of conductance measurements - determination of the concentrations of strong electrolytes and acids. Determination of  $K_a$  of acids - determination of solubility product of a sparingly soluble salt - common ion effect - conductometric titrations.

### UNIT II: Electrochemical Cells (18 Hours)

Electrolytic and galvanic cells - reversible and irreversible cells - conventional representation of electrochemical cells - electromotive force of a cell and its measurement - calculation of thermodynamic quantities of cell reactions ( $\Delta G$ ,  $\Delta H$ ,  $\Delta S$  and  $K$ ) - application of Gibbs-Helmholtz equation - concentration and EMF - Nernst equation - types of reversible electrodes - gas/metal ion - metal/metal ion; metal/insoluble salt/anion and redox electrodes - electrode reactions derivation of cell - EMF and single electrode potential - standard hydrogen electrode - reference electrodes - standard electrode potentials - sign convention - electrochemical series and its significance - concentration cell with and without transport - liquid junction potential - application of EMF of concentration cells - valency of ion- solubility product and activity coefficient - potentiometric titrations - determination of pH using hydrogen and quinhydrone electrodes - determination of  $pK_a$  of acids by potentiometric method.

### UNIT III: Photochemistry (18 Hours)

Light absorption - Jablonski diagram - radiative and non-radiative transitions - laws of photochemistry - Lambert-Beer, Grothus - Draper and Stark-Einstein's

law of photochemical equivalence. quantum efficiency - photochemical reactions - rate law - kinetics of  $H_2-Cl_2$  and  $H_2-Br_2$  reactions-comparison of their quantum yields.- comparison between thermal and photochemical chain reactions - photo sensitization and quenching - Fluorescence, phosphorescence and chemiluminescence.

#### **UNIT IV: Spectroscopy – I (18 Hours)**

Electromagnetic spectrum - the regions of various types of spectra. **Microwave spectroscopy:** Rotational spectra of diatomic molecules- treatment as rigid rotator - condition for a molecule to be active in microwave region - rotational constants - and selection rules for rotational transition. Frequency of spectral lines, calculation of inter - nuclear distance in diatomic molecules.

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

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

#### **UNIT V: Spectroscopy – II (18 Hours)**

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

**NMR spectroscopy:** Nuclear spin and conditions for a molecule to give rise to NMR spectrum - theory of NMR spectra - number of NMR signals - equivalent and non-equivalent protons - position of NMR signals - shielding, deshielding, chemical shift,  $\delta$  scale - peak area and number of protons - splitting of NMR signals - spin-spin coupling- NMR spectra of simple compounds like acetone, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, toluene, isomers of dimethylcyclopropane(1,1-dimethylcyclopropane, cis-1,2-dimethylcyclopropane and trans-1,2-dimethylcyclopropane), 1,1-dichloroethane, 1,1,2-trichloroethane, 1,1,2,2-tetrachloroethane, 1-bromo-2-chloroethane, 2-methylpropene and 1-chloro-2,2-dimethylpropane.

**Course Outcomes:**

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

**Text books:**

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

**Reference Books:**

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

## FOOD CHEMISTRY- U19CH16E

**Semester: VI**

**Elective Course: III**

**Instruction Hours/Week: 5**

**Credits: 4**

### **Objectives:**

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

### **UNIT I: Nutrition and Balanced Diet (15 Hours)**

Nutrition and balanced diet - calorific value of food stuff - energy requirements of individuals. Diseases associated with protein malnutrition, vitamin deficiency. Nutritional importance of carbohydrates, fibers and lipids.

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

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

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

### **UNIT III: Food Additives (15 Hours)**

Food additives - artificial sweeteners - saccharin - cyclamate and aspartate, food flavours esters aldehydes and heterocyclic compound. Food colours - restricted use of spurious colors - emulsifying agents - leavening agents, baking powder, yeast - taste makers - MSG, vinegar.

### **UNIT IV: Beverages (15 Hours)**

Beverages - Soft drinks addition - soda - fruit juices -alcoholic beverages examples. Carbonation -Addition to alcohol - cirrhosis of liver and social problems.

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

**Food preservation** - Methods - preservation by low temperature, high temperature - preservatives. **Quality control:** specifications and standards. PFA, FPO, FDA, Drug license, WHO standards, ISI specifications packing and label requirements, essential commodities Act, commune protection Act, AGMARK - basic concepts.

### **Course Outcomes:**

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

### **Text Books:**

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

### **Reference Books:**

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



# ALLIED CHEMISTRY FOR BOTANY, GEOLOGY, ZOOLOGY AND PHYSICS

## ALLIED CHEMISTRY- I - U19ACH1

**Semester: I/III**

**Allied course: I**

**Instruction hours/week: 5**

**Credit: 4**

### **Objective:**

1. To learn about standard solutions and types of titrimetric reactions.
2. To know various types of bonds and their properties.
3. To learn knowledge on chemotherapy, drugs and their mode of action.
4. To impart the knowledge of acids, bases and colloids.
5. To instruct the different types of catalysis and gas laws.

### **UNIT I Volumetric analysis**

**(15 Hours)**

Definitions - standard solutions, equivalence point, end point, equivalent weights of oxidizing and reducing agents, molarity, molality, normality, mole fraction, primary and secondary standards - types of titrimetric reactions - acid-base and redox titrations.

### **UNIT - II Chemical Bonding**

**(15 Hours)**

Ionic bond - general properties of ionic compounds - polarizing power - polarizability - Fajan's rule - Covalent bond - definition - Valence bond theory.

**Metallic State:** Metallic bond- Electron gas theory- Pauling's theory- Band theory- Semiconductors - types.

### **UNIT - III Chemotherapy**

**(15 Hours)**

Definition of chemotherapy- examples each for (i) Analgesics, (ii) antibacterial, (iii) anti-inflammatory, (iv) antipyretic, (v) antibiotic, (vi) antitubercular, (vii) antiviral, (viii) antitussive, (ix) antiallergic, (x) antidiabetics, (xi) antihypertensive, (xii) anaesthetics (local and general) Structure not necessary.

### **UNIT - IV Colloids**

**(15 Hours)**

Definition - classification of colloidal solutions - preparation, purification, properties - osmotic pressure, Tyndall effect, electrical charge, electrophoresis.

**Acids & Base:** Arrhenius, Bronsted-Lowry and Lewis theories - pH - Determination of pH by colorimetric method - Buffers - Mechanism of buffer action.

### **UNIT - V Catalysis**

**(15 Hours)**

Homogeneous and heterogeneous catalysis - Theories of homogeneous and heterogeneous catalysis - catalytic promoters - catalytic poisons - Enzyme catalysis - Factors affecting enzyme catalysis.

**Gaseous State:** Gas laws: Boyle's law, Charles's law - Avogadro's law - ideal gas equation - deviation from ideal behaviour - kinetic theory of gases.

**Course Outcomes:**

1. Students are able to understand volumetric principle and to prepare standard solutions.
2. Students are able to recognize various types of bond.
3. Students gain knowledge on drugs and their mode of action.
4. Able to identify acids and bases and to acquire knowledge about pH and buffer.
5. Able to categorize the kinds of catalysis and gas laws.

**Text books:**

1. P.L. Soni, "*Text book of Inorganic Chemistry*", Sultan Chand & Sons, New Delhi, 20<sup>th</sup> Ed., **2000**.
2. Malik, Tuli, Madan, "*Selected Topics in Inorganic Chemistry*", S. Chand & Co., New Delhi, **2010**.
3. B. S. Bahl, A. Bhal, "*Textbook of Organic chemistry*", S. Chand and Company Ltd., New Delhi, 22<sup>nd</sup> Ed., **2016**.
4. P. L. Soni, "*Text book of Organic Chemistry*", S. Chand and Company Ltd., New Delhi, 28<sup>th</sup> Ed., **2004**.
5. M. K. Jain and S. C. Sharma, "*Modern Organic Chemistry*", Vishal Publications, New Delhi, 14<sup>th</sup> Ed., **2014**.
6. B. S. Bahl, G. D. Tuli and Arun Bahl, "*Essentials of Physical Chemistry*", S. Chand & Company Ltd, New Delhi, 12<sup>th</sup> Ed., **2011**.
7. B.R. Puri, L.R. Sharma and M.S. Pathania, "*Principles of Physical Chemistry*", Vishal Publishing Co., 47<sup>th</sup> Ed., **2016**.
8. Jain, P.C. and Monica Jain, "*Engineering Chemistry*", Dhanphatrai and Sons, New Delhi, 15<sup>th</sup> Ed., **2006**.

**Reference Books:**

1. R.T. Morrison and R.N. Boyd, "*Organic Chemistry*", New York, Allyn & Bacon Ltd., 7<sup>th</sup> Ed., **2011**.
2. Sharma B.K, "*Industrial Chemistry*", Goel Publishing house, Meerut, UP. **2011**.
3. Peter Atkins, Julio de Paula, and James Keeler, "*Atkins' Physical Chemistry*", Oxford University Press, UK 11<sup>th</sup> Ed., **2017**.

## **ALLIED CHEMISTRY FOR BOTANY, GEOLOGY, ZOOLOGY AND PHYSICS**

### **ALLIED CHEMISTRY PRACTICAL - U19ACH2P**

**Semester: I & II/III & IV**

**Allied Course: II/IV**

**Instruction Hours/ Week: 3**

**Credits: 4**

#### **Objectives:**

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

#### **I VOLUMETRIC ANALYSIS**

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

#### **II ORGANIC ANALYSIS**

Qualitative analysis of the following organic compounds

1. Carboxylic acid
2. Amide
3. Primary aromatic amine
4. Aromatic aldehyde
5. Aromatic ketone
6. Carbohydrate

#### **Course Outcomes:**

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

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

#### **Text Books:**

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

#### **Reference Book:**

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

# ALLIED CHEMISTRY FOR BOTANY, GEOLOGY, ZOOLOGY AND PHYSICS

## ALLIED CHEMISTRY- II - U19ACH3

**Semester: II/IV**

**Allied course: III**

**Instruction hours/week: 5**

**Credit: 4**

### **Objectives:**

1. To learn about complexes and industrial applications of fuel gases.
2. To understand the nature of amino acids and proteins.
3. To understand the basic concepts of organic reactions and polymers.
4. To impart the knowledge and classifications of dyes, fats and oils.
5. To study the importance's of electrochemistry and phase rule.

### **UNIT I Coordination Chemistry (15 Hours)**

Classification of complexes - IUPAC Nomenclature of mononuclear complexes. Chelation and its industrial importance with particular reference to EDTA - biological role of haemoglobin and chlorophyll - applications of complexes in qualitative and quantitative analytical analysis. **Industrial Chemistry:** Fuel gases - Water gas, producer gas, L.P.G. gas, gobar gas and natural gas. Fertilizers - NPK and mixed fertilizers, micronutrients and their role in plant life and biofertilizers.

### **UNIT II Amino Acids and Proteins: (15 Hours)**

Amino Acids and Proteins: Amino acids - classification based on structure - essential and non-essential amino acids - proteins - classification based on physical properties and biological functions, structure of proteins- primary, secondary and tertiary (elementary treatment).

### **UNIT - III Organic reactions and synthetic polymers: (15 Hours)**

**Organic reactions:** Osazone test, biuret test, condensation reactions for aldehydes and ketones, Esterification reaction, Diazotization followed by coupling and phthalein fusion test. **Synthetic polymers:** Definition - Teflon, alkyd and epoxy resins, polyesters - general treatment only.

### **UNIT - IV Dyes, Fats and oils (15 Hours)**

**Dyes: Definition** - classification of dyes based on structure and method of application (two examples for each classification). **Fats and oils:** Definition of fats and oils - distinction between fats and oils - chemical properties - analysis of fats and oils - saponification value and iodine value.

### **UNIT V Electrochemistry (15 Hours)**

Specific and equivalent conductivities - their determinations- effect of dilution on conductivity - an elementary idea about basic theory - Ostwald's dilution law, Kohlraush law - conductometric titrations. **Phase rule:** Definition of phase, component and degree of freedom. Explanation of one - component system (Water and sulphur).

**Course Outcomes:**

1. Students are able to understand complexes and their industrial importance.
2. Students are able to recognize radioactivity and applications of radio isotopes.
3. Students are able to identify different types of organic reactions and polymers.
4. Students are able to classify dyes and acquire knowledge on fats and oils.
5. Students are able to categorize conductance and phase.

**Text books:**

1. P.L. Soni, "*Text book of Inorganic Chemistry*", Sultan Chand & Sons, New Delhi, 20<sup>th</sup> Ed., **2000**.
2. Malik, Tuli, Madan, "*Selected Topics in Inorganic Chemistry*", S. Chand & Co., New Delhi, **2010**.
3. B. S. Bahl, A. Bhal, "*Textbook of Organic chemistry*", S. Chand and Company Ltd., New Delhi, 22<sup>nd</sup> Ed., **2016**.
4. P. L. Soni, "*Text book of Organic Chemistry*", S. Chand and Company Ltd., New Delhi, 28<sup>th</sup> Ed., **2004**.
5. M. K. Jain and S. C. Sharma, "*Modern Organic Chemistry*", Vishal Publications, New Delhi, 14<sup>th</sup> Ed., **2014**.
6. B. S. Bahl, G. D. Tuli and Arun Bahl, "*Essentials of Physical Chemistry*", S. Chand & Company Ltd, New Delhi, 12<sup>th</sup> Ed., **2011**.
7. B.R. Puri, L.R. Sharma and M.S. Pathania, "*Principles of Physical Chemistry*", Vishal Publishing Co., 47<sup>th</sup> Ed., **2016**.
8. Jain, P.C. and Monica Jain, "*Engineering Chemistry*", Dhanphatrai and Sons, New Delhi, 15<sup>th</sup> Ed., **2006**.

**Reference Books:**

1. R.T. Morrison and R.N. Boyd, "*Organic Chemistry*", New York, Allyn & Bacon Ltd., 7<sup>th</sup> Ed., **2011**.
2. Sharma B.K, "*Industrial Chemistry*", Goel Publishing house, Meerut, UP. **2011**.
3. Peter Atkins, Julio de Paula, and James Keeler, "*Atkins' Physical Chemistry*", Oxford University Press, UK 11<sup>th</sup> Ed., **2017**.

## AGRICULTURAL CHEMISTRY - U19NMCH1

**Semester: IV**

**Non-Major Elective: 1**

**Instruction Hours/Week: 2**

**Credits: 2**

### **Objectives::**

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

### **UNIT I: Plant Nutrients-I**

**(6 Hours)**

Plant nutrients – macro and micro nutrients – their role in plant growth Sources –forms of nutrients absorbed by plants.

### **UNIT II: Plant Nutrients-II**

**(6 Hours)**

Factors affecting nutrients absorption – requirement of crops – availability, fixation and release of nutrients- deficiency symptoms in plants.

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

### **UNIT III: Fertilizers**

**(6 Hours)**

**Fertilizers** - classification of NPK fertilizers - sources – natural and synthetic – complex – liquid fertilizers, their properties – use and relative efficiency secondary and micro nutrients fertilizers - mixed fertilizers - Vermi composting – handling and storage.

### **UNIT IV: Pesticides and Insectides**

**(6 Hours)**

**Pesticides:** Definition - classification - organic and Inorganic pesticides – Mechanism of action – characteristics safe handling of pesticides - impact of pesticides on soil, plants and environment. **Insectides** - Definition- plant products- nicotine, pyrethrin.

### **UNIT V: Fungicides and Herbicides**

**(6 Hours)**

Definition - classification - mechanism of action – sulphur, copper, mercury compounds, dithanes, dithiocarbamate. **Herbicides** – Acaricides - rodenticides - attractants- repellants.

### **Course Outcomes:**

1. Knowledge about the need of macro and micro nutrients for plants.
2. Insight into the influence of fertilizers and manures and their types.
3. Characteristics of pesticides, insecticides, fungicides and herbicides and their impact.

**Text Book:**

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

**Reference Books:**

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

## COSMETICS CHEMISTRY - U19NMCH2

**Semester: V**

**Non-Major Elective: II**

**Instruction Hours/Week: 2**

**Credits: 2**

### **Objectives:**

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

### **UNIT I: Soaps**

**(6 Hours)**

Manufacture of Soaps, formulation of toilet soaps –different ingredients used - soft soaps and shaving soaps.

### **UNIT II: Detergents**

**(6 Hours)**

Anionic detergents – manufacture and applications –Cationic detergents – manufactures and applications

### **UNIT III: Cosmetics**

**(6 Hours)**

Cosmetics - Introduction about raw materials in cosmetics - (oil, waxes, color, preservative and fragrance). Shampoo -different kinds shampoo – anti-dandruff, anti-lice, herbal and baby shampoo hair dye – manufacture of conditioners (raw materials and uses only)

### **UNIT IV: Skin Products**

**(6 Hours)**

Preparation of cosmetics - skin and hair - skin lighteners, sun screen lotions - skin toners anti wrinkling creams. Lip care - lip gloss – lipsticks - lip liners, moisturizers - crack creams, Sun cream and UV rays protecting cream.

### **UNIT V: Toxicity**

**(6 Hours)**

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

### **Course Outcomes:**

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

### **Text Books:**

1. *Industrial chemistry* by B. K. Sharma, Goel publishing house, **1995**.
2. Thangamma Jacob, Text Books of Applied chemistry for home science and Allied Science, Macmillan, 1<sup>st</sup> Ed., **1990**.
3. Modern Technology of Cosmetics, NIIR Board, Asia Pacific Business Press Inc., New Delhi, **2004**.
4. Jayashree Ghose, "Fundamental Concepts of Applied Chemistry", S. Chand and Company (P) Ltd, New Delhi, 1<sup>st</sup> Ed, **2006**



5. *Hilda Butler, Pouchers- Perfumes, Cosmetics and Soaps*, 10<sup>th</sup> Edns., Springer, New Delhi, **2007**.
6. Krishnamurthy N., Jayasubramanian K and Vallinayagam, "*Applied Chemistry*", Prentice Hall of India, New Delhi, **1990**.

**Reference:**

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

**SEMESTER – I COURSE    CODE: U19ES**  
**PART – IV: ENVIRONMENTAL STUDIES**

**HOURS: 2**

**CREDITS: 2**

**UNIT I:**

Environment and Natural Resources: Definition, scope, importance of Environmental Studies - Need for public awareness. Natural resources — classification - Associated problems

- a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- b) Water resources: Use and overutilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies).
- f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - Role of an individual in conservation of natural resources - Equitable use of resources for sustainable lifestyles.

**UNIT II:**

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

**UNIT III:**

Biodiversity and its conservation - Introduction — Definition: genetic, species and ecosystem diversity - Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels - India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity:

habitat loss, poaching of wildlife, man-wildlife conflicts - Endangered and endemic species of India - Conservation of biodiversity In-situ and Ex-situ conservation of biodiversity

#### **UNIT IV:**

Environmental Pollution Definition - Cause, effects and control measures of a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards - Solid waste Management : Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster management floods, earthquake, cyclone and landslides.

#### **UNIT V:**

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

#### **TEXTBOOKS**

1. Ekambaranatha Ayyar.M. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol. 1 [Invertebrata], parts I and II.S. Viswanathan (Printers and Publishers) Pvt. Ltd; Madras.
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Pubi. Ltd. Bikaner.
3. Sharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad.
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.
5. Clark R.S., Marine Pollution, Clarendon Press Oxford (TB)
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico PubI. House, Mumbai,
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment (R)
9. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press.

10. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
11. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press
12. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi.
13. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition.
14. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
15. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
16. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA.
17. Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Pubi. Co. Pvt. Ltd.
18. Sharma B.K., 2001. Environmental Chemistry. Geol Pubi. House, Meerut
19. Survey of the Environment, The Hindu (M)
20. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
21. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
22. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA (M) Magazine (R) Reference (TB) Textbook

**SEMESTER – II COURSE CODE: U19SBE1**

**PART – IV: COMPUTER APPLICATIONS – I - OFFICE AUTOMATION**

**HOURS: 2**

**CREDITS: 2**

**UNIT I:**

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

**UNIT II:**

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

**UNIT III:**

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

**UNIT IV:**

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

**UNIT V:**

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

**TEXTBOOKS**

1. Jill Murphy, Microsoft Office Word- Comprehensive Course, Labyrinth Publications, 2003.
2. McGraw-Hill/Irwin-Deborah Hinkle, Microsoft Office 2003 PowerPoint: A Professional Approach, Comprehensive w/ Student CD, New Delhi, 2003.
3. Nellai Kannan, C., MS-Office, Nels Publications, Tamil Nadu, 2002. 67

## **SEMESTER – III COURSE CODE: U19SBE2**

### **PART – IV: COMPUTER APPLICATIONS - II - DESKTOP PUBLISHING**

**HOURS: 2**

**CREDITS: 2**

#### **UNIT I:**

Photoshop Tools : Move, Type, Marquee, Lasso, Crop, Shapes, Healing, Brush, Patch, Cloning Stamp, Eraser, Gradient, Blur, Smudge, Dodge, Pen, Eye Dropper, Patch selection and Zoom tool. Layer: New layer, Layer set, Duplicate layer, Rasterize and Merge down Layer Styles: Drop shadow, inner shadow, outer glow & inner glow, Bevel and Emboss, Gradient overlay, Stroke. Text formatting

#### **UNIT II:**

File: Save, File formats, Page set up. Edit: Check spelling, Copy merged, Fill, Transform, Define pattern. Image: Motion blur, Twirl, lens flare, Glowing edges, lighting effects, solarize, water paper, Stained glass, Mosaic Tiles. Window: Character and Paragraph settings.

#### **UNIT III: COREL DRAW:**

Drawing Tools: Pick, Shape, Knife, eraser, Smudge, Roughen brush, free transform, Zoom, hand, Free hand, Bezier, Artistic, Pen, Poly line, Point, Interactive connective, Spiral tool. Colour Tool: Paint Bucket Tool, Eye Dropper, Fill Tools. Fill Options, Stroke Options.

#### **UNIT IV:**

Special Effects: 3D effects, Add perspective, Blend, Contour, Artistic media, lens, and Power clip. Shaping Options: Weld, trim, Intersect. Text Effects: Format text, bullet, and fit text to path, align and straighten, spell check.

File Menu: Save, Save as, Import, Page set Up.

#### **UNIT V: PAGE MAKER:**

Page Maker Tools: Pointer, Rotate, Line, Rectangle, Ellipse, Polygon, Hand, Text, Crop, Rectangle frame tools. Text layout, Style and Objects: Alignments, Styles, fill, frame options, Stroke, Group, Lock, unlock, mask, polygon settings character and paragraph settings. Text Editing: Edit story: Undo, Redo, Cut, Copy, Paste, paste Special, Spelling check and Find. File: Page set up, save, Save as.

#### **TEXTBOOKS**

2. CorelDraw IN Simple Steps – Shalini Gupta Corel DRAW Bible - DEBORAH MILLER
3. Teach Yourself Adobe Photoshop – Rose Carla Adobe Photoshop Cs Classroom in a Book by Adobe Press, 68
4. Using Microsoft Word - Asmita Bhatt Pagemaker In Easy Steps - Scott Basham Ctoa Material By Genesis.

**SEMESTER – III COURSE CODE: U19SBE3P**

**PART – IV: COMPUTER APPLICATIONS – II PRACTICAL (DTP LAB)**

**HOURS: 2**

**CREDITS: 2**

**OFFICE AUTOMATION & DESKTOP PUBLISHING LAB**

**UNIT I:**

**Office Automation**

1. MS – Word: Text Formatting, Mail Merge
2. MS – Excel: Implement the Statistical & Mathematical Function ( Using Min, Max, Median, Average, Standard Deviation, Correlation, Logical 'if' Condition ) for the given data, Prepare a Chart for a given Data using Pie diagram / Histogram

**UNIT II:**

**Photoshop**

3. Design a College Broacher / Birthday Card.
4. Cropping, rotating and Overlapping the image.
5. Create a single image from Multiple image.
6. Creating an image with multilayer's.

**UNIT III:**

**Corel Draw**

7. Design a Visiting Card \ Greeting Card using Draw & Text tools.
8. Create a logo for a Company \ College.

**UNIT IV:**

**Page Maker**

9. Type and format a letter using text tool.
10. Prepare a Invitation for College Day /Sports Day.

**SEMESTER – IV COURSE CODE: U19VE**  
**PART – IV: VALUE EDUCATION**

**HOURS: 1**

**CREDITS: 2**

**UNIT I:**

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

**UNIT II:**

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

**UNIT III:**

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

**UNIT IV:**

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

**UNIT V:**

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

**TEXTBOOKS**

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



## **SEMESTER – V COURSE CODE: U19SS**

### **PART – IV: SOFT SKILLS**

**HOURS: 2**

**CREDITS: 2**

#### **UNIT I:**

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

#### **UNIT II:**

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

#### **UNIT III:**

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

#### **UNIT IV:**

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

#### **UNIT V:**

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

#### **TEXT BOOKS**

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

#### **REFERENCE BOOKS**

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

**SEMESTER – VI COURSE CODE: U19GS**

**PART – V: GENDER STUDIES**

**HOURS: 1**

**CREDITS: 1**

**UNIT I:**

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

**UNIT II:**

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

**UNIT III:**

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

**UNIT IV:**

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

**UNIT V:**

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

**TEXTBOOKS**

1. Bhasin Kamala, Understanding Gender: Gender Basics, New Delhi: Women Unlimited 2004
2. Bhasin Kamala, Exploring Masculinity: Gender Basics, New Delhi: Women Unlimited, 2004
3. Bhasin Kamala, What is Patriarchy? : Gender Basics, New Delhi: Women Unlimited, 1993
4. Pernau Margrit Ahmad Imtiaz, Reifeld Hermut (ed.,) Family and Gender: Changing Values in Germany and India, New Delhi: Sage Publications, 2003
5. Agarwal Bina, Humphries Jane and Robeyns Ingrid (ed.,)

6. Capabilities, Freedom, and Equality: Amartya Sen's Work from a Gender Perspective, New Delhi: Oxford University Press, 2006
7. Rajadurai.S.V, Geetha.V, Themes in Caste Gender and Religion, Tiruchirappalli: Bharathidasan University, 2007 Misra Geetanjali, Chandiramani Radhika (ed.,)
8. Sexuality, Gender and Rights: Exploring Theory and Practice in South and Southeast Asia, New Delhi: Sage Publication, 2005 Rao Anupama (ed.,)
9. Gender &Caste: Issues in Contemporary Indian Feminism, New Delhi: Kali for Women, 2003
10. Saha Chandana, Gender Equity and Gender Equality: Study of Girl Child in Rajasthan, Jaipur: Rawat Publications, 2003
11. Krishna Sumi,(ed.,) Livelihood and Gender Equity in Community Resource Management New Delhi: Sage Publication, 2004
12. Wharton .S Amy, The Sociology of Gender: An Introduction to Theory and Research, USA: Blackwell Publishing, 2005.
13. Mohanty Manoranjan (ed.,) Class, Caste, Gender: Readings in Indian Government and Politics- 5, New Delhi: Sage Publications, 2004.
14. Arya Sadhna, Women, Gender Equality and the State, New Delhi: Deep & Deep Publications, 2000.