

**PG AND RESEARCH DEPARTMENT OF CHEMISTRY**  
**JAMAL MOHAMED COLLEGE (Autonomous), TIRUCHIRAPPALLI – 20**  
**UG COURSE STRUCTURE FROM 2017-2018 (With Allied Botany)**

SEM	COURSE CODE	PART	COURSE	COURSE TITLE	Ins. Hrs /Week	CREDIT	MARKS		TOTAL
							CIA	ESE	
I	17U1LT1/LA1/LF1/LH1/LU1	I	Language – I		6	3	25	75	100
	17UCN1E1	II	English - I		6	3	25	75	100
	17UCH1C1	III	<b>Core – I</b>	Inorganic, Organic and Physical Chemistry-I	5	5	25	75	100
	17UCH1C2P		<b>Core – II</b>	Volumetric Analysis – Practical	3	2	20	80	100
	17UPH1A1		<b>Allied –I</b>		5	4	25	75	100
	17UPH1A2		<b>Allied –II</b>		3	2	20	80	100
	17UCN1VE	IV	Value Education	Value Education	2	2	-	100	100
<b>TOTAL</b>					<b>30</b>	<b>21</b>			<b>700</b>
II	17U2LT2/LA2/LF2/LH2/LU2	I	Language – II		6	3	25	75	100
	17UCN2E2	II	English – II		6	3	25	75	100
	17UCH2C3	III	<b>Core – III</b>	Inorganic, Organic and Physical Chemistry-II	6	5	25	75	100
	17UCH2C4P		<b>Core – IV</b>	Industrial Chemistry- Practical	3	2	20	80	100
	17UPH2A3		<b>Allied – III</b>		4	3	25	75	100
	17UPH2A4		<b>Allied –IV</b>		3	2	20	80	100
	17UCN2ES	IV	Environmental Studies	Environmental Studies	2	2	-	100	100
<b>TOTAL</b>					<b>30</b>	<b>20</b>			<b>700</b>
III	17U3LT3/LA3/LF3/LH3/LU3	I	Language– III		6	3	25	75	100
	17UCN3E3	II	English – III		6	3	25	75	100
	17UCH3C5	III	<b>Core– V</b>	Inorganic, Organic and Physical Chemistry-III	4	4	25	75	100
	17UCH3C6P		<b>Core– VI</b>	Domestic Products Preparation and Food analysis- Practical	3	2	20	80	100
	17UBO3A5		<b>Allied– V</b>		4	3	25	75	100
	17UBO3A6		<b>Allied–VI</b>		3	2	20	80	100
	17UCH3N1A/B	IV	Non Major Elective I		2	2	-	100	100
17UCN3S1	Skill Based Elective - I		Soft Skills Development	2	2	-	100	100	
<b>TOTAL</b>					<b>30</b>	<b>21</b>			<b>800</b>
IV	17U4LT4/LA4/LF4/LH4/LU4	I	Language–IV		6	3	25	75	100
	17UCN4E4	II	English– IV		6	3	25	75	100
	17UCH4C7	III	<b>Core– VII</b>	Inorganic, Organic and Physical Chemistry-IV	5	5	25	75	100
	17UCH4C8P		<b>Core - VIII</b>	Inorganic Qualitative Analysis- Practical	3	2	20	80	100
	17UBO4A7		<b>Allied– VII</b>		5	3	25	75	100
	17UBO4A8		<b>Allied–VIII</b>		3	2	20	80	100
	17UCH4N2A/B	IV	Non Major Elective - II		2	2	-	100	100
17UCN4EA	V	Extension Activities	NCC, NSS, etc.	-	1	-	-	-	
<b>TOTAL</b>					<b>30</b>	<b>21</b>			<b>700</b>
V	17UCH5C9	III	<b>Core – IX</b>	p-Block Elements, Metallurgy and Nuclear Chemistry	6	5	25	75	100
	17UCH5C10		<b>Core – X</b>	Organic compounds, reactions and Heterocyclics	5	5	25	75	100
	17UCH5C11		<b>Core – XI</b>	Thermodynamics and solutions	6	5	25	75	100
	17UCH5C12P		<b>Core - XII</b>	Gravimetric Estimation and Physical Constants Determination – Practical	5	5	20	80	100
	17UCH5M1AP/M1BP		Major Based Elective – I		4	4	20	80	100
	17UCH5S2A/B	IV	Skill Based Elective II		2	2	-	100	100
	17UCH5S3A/B		Skill Based Elective – III		2	2	-	100	100
17UCH5EC1		<b>Extra Credit Course - I</b>	Computer Applications in Chemistry	-	<b>4*</b>	--	<b>100*</b>	<b>100*</b>	
<b>TOTAL</b>					<b>30</b>	<b>28</b>			<b>700</b>
VI	17UCH6C13	III	<b>Core– XIII</b>	Transition, Inner Transition Elements and Coordination Compounds	5	5	25	75	100
	17UCH6C14		<b>Core– XIV</b>	Stereochemistry and molecular rearrangements	5	5	25	75	100
	17UCH6C15		<b>Core - XV</b>	Molecular Spectroscopy And Electrochemistry	5	5	25	75	100
	17UCH6C16P		<b>Core XVI</b>	Organic Analysis and Preparation- Practical	5	5	20	80	100
	17UCH6M2A/B		Major Based Elective II		5	4	25	75	100
	17UCH6M3AP/M3BP	Major Based Elective III		4	4	20	80	100	
	17UCN6GS	V	Gender Studies	Gender Studies	1	1	-	100	100
	17UCH6EC2		<b>Extra Credit Course - II</b>	Photochemistry and Radiation Chemistry	-	<b>4*</b>	--	<b>100*</b>	<b>100*</b>
<b>TOTAL</b>					<b>30</b>	<b>29</b>			<b>700</b>
<b>GRAND TOTAL</b>					<b>180</b>	<b>140</b>			<b>4300</b>

\* Not Considered for Grant Total and CGPA.

SEM	COURSE CODE	COURSE	COURSE TITLE
III	17UCH3N1A	Non Major Elective-I	Chemistry in Daily Life
	17UCH3N1B		Agricultural Chemistry
IV	17UCH4N2A	Non Major Elective-II	Food and Nutrition
	17UCH4N2B		Nanoscience and its Applications
V	17UCH5S2A	Skill Based Elective-II	Analytical Techniques
	17UCH5S2B		Electroanalytical Techniques
	17UCH5M1AP	Major Based Elective-I	Physical Chemistry Electrical - Practical
	17UCH5M1BP		Quantitative analysis by Photometric method - Practical
	17UCH5S3A	Skill Based Elective-III	Clinical Chemistry
17UCH5S3B		Water quality analysis	
VI	17UCH6M2A	Major Based Elective-II	Essential molecules for life
	17UCH6M2B		Essentials of Bioinorganic Chemistry
	17UCH6M3AP	Major Based Elective-III	Physical Chemistry Non Electrical -Practical
	17UCH6M3BP		Advanced Physical Chemistry- Practical

## SEMESTER-I: CORE-I

### INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY-I

Course Code : 17UCH1C1

Max. Marks : 100

Hours/ Week : 5

Internal Marks : 25

Credit : 5

External Marks : 75

#### Objectives:

- To learn the principles of quantum numbers and periodicity of elements
- To know the theoretical aspects of inorganic qualitative and quantitative analysis
- To make the students acquire knowledge about nomenclature of simple aliphatic compounds and nature of bonding.
- To learn the concept and behavior of gases.

#### UNIT – I

15 Hours

##### ATOMIC STRUCTURE AND PERIODIC PROPERTIES

- 1.1. **Quantum Numbers:** Rules for filling the orbitals with electrons – Pauli's exclusion principle, Hund's rule, Aufbau Principle – Ground state and Stability based on electronic configuration - N, O, halogens and inert gases – degeneracy of orbitals.<sup>#</sup> Periodic Table: Long form of periodic table<sup>#</sup>, Classification of elements on the basis of valence shell configuration.
- 1.2. **Periodic properties:** Ionization energy – Factors influencing ionization energy – Applications of the concept of ionization potential- metallic to non metallic along a period, relative reactivity, reducing power, basic character of elements - Electron affinity and its Periodic variations - Electronegativity –Mullikan's scale and its calculation, Periodic variations.
- 1.3. **Properties of Elements:** Atomic and ionic radii – Comparison, covalent, metallic and van der Waals radii, Ionic radii – determination of the radii of Na<sup>+</sup> and F<sup>-</sup> in NaF crystal by Pauling's method – Factors influencing magnitude of ionic radii – Periodic variations of atomic and ionic radii – Size variations of ions of same element with different oxidation states.

#### UNIT – II

15 Hours

##### QUALITATIVE AND QUANTITATIVE ANALYSIS

- 2.1. **Qualitative Analysis:** Advantages of semi-micro analysis, general reactions of common anions-carbonate, sulphide, sulphate, nitrate, chloride, iodide and interfering anions-fluoride, oxalate, borate and phosphate.
- 2.2. **General reactions of cations:** Classification of cations into groups - Precipitants of Lead, bismuth, copper, cadmium, iron, manganese, zinc, cobalt, <sup>#</sup>nickel, barium, calcium and magnesium in qualitative analysis<sup>#</sup>.

- 2.3. **Volumetric Analysis:** Preparation of standard solutions – primary and secondary standards, equivalence point, types of titrations - acid-base, redox, iodimetry, iodometry and complexometric (EDTA) titrations, theory of indicators, phenolphthalein, methyl Orange and Eriochrome Black –T. Precipitation titration, sequestering reagents.

### UNIT – III

15 Hours

#### NOMENCLATURE, BONDING AND ISOMERISM OF ORGANIC COMPOUNDS

- 3.1. **Nomenclature of organic compounds:** IUPAC naming of simple aliphatic compounds containing different functional groups (-OH, -C=O, -CHO, -COOH, -NH<sub>2</sub>) and aliphatic mono & disubstituted monocyclic compounds.
- 3.2. **Bond:** Types of bonds – homolytic and heterolytic fission of bonds, bond length, bond energy- orbital overlap – sigma and pi bonds – hybridization and geometry of molecules methane, ethane, ethylene, acetylene and benzene.
- 3.3. **Isomerism:** #Structural and geometrical isomerism#

### UNIT – IV

15 Hours

#### POLAR EFFECTS AND REACTIVE INTERMEDIATES

- 4.1 **Electron displacement effects:** Inductive, electromeric, mesomeric, resonance, hyperconjugation and steric effects.
- 4.2. **Reactive intermediates:** Generation, structure, reactivity and stability of carbocation, carbanion, free radical, carbenes and nitrenes.

### UNIT – V

15 Hours

#### GASEOUS STATE

- 5.1 **#Gas Laws-**Kinetic theory of gases, Kinetic equation of gases#, Derivation of various gas laws from Kinetic gas equation – Different types of molecular velocities, Maxwell's law of distribution of molecular velocities.
- 5.2 **Expansivity and compressibility-** Boyle temperature, Mean free path, Collision diameter, Collision number, Collision frequency, Heat capacity of gases, Determination of heat capacity ratio.
- 5.3 **Real gases and ideal gases-** Deviation of real gases from the ideal behavior, derivation of van der Waals equation for real gases, significance of van der Waals constants- critical phenomenon, Calculation of critical constants. (Simple problems using van der Waals equation)

**TEXT BOOKS:**

1. B.R. Puri and L.R. Sharma – “Principles of Inorganic Chemistry”, Shoban Lal, Nagin Chand & Co., New Delhi (2000).
2. P. L. Soni, “ Text Book of Inorganic Chemistry”, S. Chand & Co., New Delhi, (1999).
3. P. L. Soni and H. M. Chawla – “Text Book of Organic Chemistry” – 28<sup>th</sup> Edition, (1999) - Sulthan and Chand company, New Delhi.
4. B. R. Puri, L. R. Sharma and M. S. Pathania, “Principles of Physical Chemistry”, Vishal Publications, Jalandhar, 2002.

UNIT I: Text Book 1

UNIT II: Text Book 2

UNIT III: Text Book 3

UNIT IV: Text Book 3

UNIT V: Text Book 4

**REFERENCES:**

1. R. D Madan – “Modern Inorganic Chemistry”, S. Chand & Co Pvt Ltd (2009).
2. B. R. Puri, L.R.Sharma and K. C.Kalia- Principles of Inorganic chemistry, Milestone publishers and distributors, New Delhi. (2012).
3. M. K. Jain – “Organic Chemistry” – 12<sup>th</sup> Ed., (2003) Sulthan and Chand Company, New Delhi.
4. Bahl and Arun Bahl – “Advanced Organic Chemistry” – 19<sup>th</sup> Edition (2005) Sulthan and Chand Company, New Delhi.
5. R.L. Madan and G.D. Tuli, “Simplified Course in Physical Chemistry”, 5<sup>th</sup> revised and enlarged edition, S.Chand & Co., New Delhi, 2009.

## SEMESTER- II: CORE-III

### INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY-II

Course Code : 17UCH2C3

Hours/ Week : 6

Credit : 5

Max. Marks : 100

Internal Marks : 25

External Marks : 75

#### Objectives:

- To learn the concepts of bonding and Molecular orbital theory
- To know the shapes of molecules by VSEPR theory
- To understand the chemistry of alkanes and Grignard reagent
- To impart knowledge of liquid, liquid crystals and colloids.
- To study the basic idea of solid state.

#### UNIT – I

18 Hours

##### CHEMICAL BONDING-I

- 1.1 **Covalent Bond:** Valence Bond concepts – \*types of overlapping of orbitals (ss, pp, sp) # – sigma, pi –bonds: Polarity of bonds – ion polarization – degree of ionic character; Significance of dipole moment of polar molecules – Fajan’s Rules – Applications.
- 1.2 **Ionic Bond:** Electronic theory of valency, Properties of ionic compounds – Variable Electrovalence, Inert Pair effect, Lattice energy – Born Haber cycle – application, factors affecting lattice energy – solubility and solvation energy.
- 1.3 **Molecular Orbital Theory:** Bonding and anti – bonding (LCAO method) – Order of energy levels, Relationship between bond order, stability, bond length and molecular magnetic behaviour. Molecular Orbital diagrams of homonuclear ( $H_2$ ,  $He_2$ ,  $N_2$ ,  $F_2$  and  $O_2$ ) - Comparison of valence bond theory and molecular orbital theory.

#### UNIT – II

18 Hours

##### CHEMICAL BONDING-II

- 2.1. **Shapes of Covalent Molecules:** Hybridization - sp ( $BeF_2$ ,  $CO_2$ ),  $sp^2$  ( $BF_3$ ,  $NO_3^-$  ion),  $sp^3$  ( $NH_4^+$ ,  $H_2O$ ,  $SO_4^{2-}$ ),  $sp^3d$  ( $PCl_5$ ) – Salient features of hybridization – Rules – Bond Strength, energy and length. #Resonance -Canonical forms of  $CO_2$ ,  $NO_2$ ,  $CO_3^{2-}$  – Resonance energy, conditions. # VSEPR – Theory, Postulates, shapes of  $BeCl_2$ ,  $BH_3$ ,  $CH_4$ ,  $PCl_5$ ,  $SF_6$ ,  $H_2O$  and  $NH_3$ .
- 2.2. **Metallic Bond:** Electron sea theory, valence bond theory, Band theory – Properties explained by these theories.
- 2.3 **Hydrogen Bond:** Nature, types, effects on physical and chemical properties. van der Waals attraction- Significance of Intermolecular electrostatic forces.

## UNIT – III

18 Hours

### ALKANES AND GRIGNARD REAGENT

- 3.1 **Alkanes:** Preparation by Wurtz, Corey-House and Kolbe's synthesis– Mechanism of free radical substitution in alkanes – chlorination and pyrolysis (cracking).
- 3.2 **Cycloalkanes:** preparation using Wurtz reaction, Dieckmann's ring closure and reduction of aromatic hydrocarbons, substitution and ring opening reactions –Bayer strain theory.
- 3.3 **Grignard reagent:** #Preparation and uses - synthesis of alcohols, aldehydes, ketones and acids #.

## UNIT – IV

18 Hours

### LIQUIDS AND COLLOIDS

- 4.1 **Liquids:** Physical properties of liquids- Vapour pressure, Measurement of vapour pressure by isotenisopic method, Heat of vaporization, Trouton's rule - Surface tension, Measurement of surface tension by Capillary-Rise Method, Variation of surface tension with temperature and pressure. Viscosity – Variation of viscosity with temperature and pressure.
- 4.2 **Liquid crystals:** definition, classification, theory of liquid crystals, molecular viscosity – parachor, atomic parachor, structural parachor and application of parachor in deciding structures.
- 4.3. **Colloids:** Definition, differences between true solution, colloidal solution and suspension, phases of colloidal solution-Electrical properties – Electrophoresis and Electro osmosis (definition and uses only) - protection of colloids – Gold number, Theories of protection – stabilities of Sols- medicinal applications of colloids- #Emulsion and Gels- definition, types and their uses#.

## UNIT – V

18 hours

### SOLID STATE AND ADSORPTION

- 5.1 **Solid state:** #Classification- crystalline and amorphous solids, isotropic and anisotropic solids, space lattice, unit cell#, seven crystal systems, crystal structure of NaCl and CsCl. Packing in crystals – hcp, ccp and bcc. Bravais lattice - law of rational indices, Weiss indices and Miller indices.
- 5.2 **X- ray diffraction:** Derivation of Bragg's equation – Determination of crystal structure by Laue's powder method – Determination of Avogadro's number.(simple problems from Bragg's equation)
- 5.3. **Adsorption on solids:** Chemisorption and physisorption, postulates and mathematical form of Freundlich, Langmuir and BET adsorption isotherms.

**TEXT BOOKS:**

1. P.L. Soni – “Text book of Inorganic Chemistry”, S. Chand & Co., New Delhi (1999).
2. P.L. Soni and H.M. Chawla – “Text Book of Organic Chemistry” – 28<sup>th</sup> Ed., (1999) - Sulthan and Chand company, New Delhi.
3. B. S. Bahl, G.D. Tuli and Arun Bahl, “Essentials of Physical Chemistry”, S.Chand & Co., New Delhi, 1999.
4. B. R. Puri, L.R. Sharma and M.S. Pathania, “Principles of Physical Chemistry”, Vishal Publications, Jalandhar, 2002.

UNIT I: Text Book 1

UNIT II: Text Book 1

UNIT III: Text Book 2

UNIT IV: Text Book 3, 4

UNIT V: Text Book 3, 4

**REFERENCES:**

1. R. D. Madan – “Modern Inorganic Chemistry”, S. Chand & Co Pvt Ltd ( 2009).
2. B. R. Puri, L. R. Sharma and K. C. Kalia- Principles of Inorganic chemistry, Milestone publishers and distributors, New Delhi. (2012).
3. Bahl and Arun Bahl – “Advanced Organic Chemistry” – 19<sup>th</sup> Ed., (2005) – Sulthan and Chand company, New Delhi.
4. R. L. Madan and G.D. Tuli, “Simplified Course in Physical Chemistry”, 5<sup>th</sup> revised and enlarged edition, S.Chand & Co., New Delhi, 2009.
5. J. N. Gurtu and A. Gurtu, “Advanced Physical Chemistry”, Pragathi Prakashan, Meerut, 2007.

## SEMESTER- III: CORE-V

### INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY-III

Course Code : 17UCH3C5

Max. Marks : 100

Hours/ Week : 4

Internal Marks : 25

Credit : 4

External Marks : 75

#### Objectives:

- To understand the chemistry of alkali, alkali earth metals and zero group elements
- To understand chemistry of boron and carbon family elements
- To understand the chemistry of alkenes, dienes and alkynes
- To study the structure of molecules based on physical properties

#### UNIT – I

12 Hours

#### ALKALI, ALKALINE EARTH AND ZERO GROUP ELEMENTS

- 1.1. Alkali and alkaline earth metals:** Comparative study of metals and their compounds (oxides, hydroxides, carbonates, sulphates).
- 1.2. Zero group elements:** General properties and uses - Separation of Noble gases (Dewar's method) from liquid air – Fluoride compounds of xenon – Preparation, properties and structures of  $\text{XeF}_2$ ,  $\text{XeF}_4$ ,  $\text{XeF}_6$ ,  $\text{XeOF}_4$ , Clathrates of argon, krypton and xenon.  
#Glauber's salt, Chile saltpeter, Sodium azide#

#### UNIT – II

12Hours

#### BORON AND CARBON FAMILY

- 1.1 Boron Family:** Comparative study of boron family. Preparation, properties, structure and uses of  $\text{H}_3\text{BO}_3$ , Borax, diborane and borazole.
- 1.2 Carbon family:** Comparative study of carbon family and their compounds – hydrides, halides and oxides. Preparation and properties of carbonic acid, phosgene, carbon disulphide, cyanogens, HCN, HCNS and pseudo halogens
- 1.3 #Compounds of Aluminium:** Alumina, precious gems and alums.#

#### UNIT – III

12 Hours

#### CARBONYL COMPOUNDS, ETHERS AND LIPIDS

- 3.1. Carbonyl Compounds:** General methods of preparation of aliphatic carbonyl compounds (acetone, acetaldehyde) – by oxidation of alcohols, properties – nucleophilic addition reactions, acidity of alpha hydrogen and addition of Grignard reagents. Benzaldehyde – preparation and properties. Benzophenone and acetophenone – preparation and properties.



3.2. **Ethers:** # Simple and mixed ethers – isomerism – Williamson’s synthesis, properties - reactions involving alkyl, ethereal oxygen and C-O bonds#. Anisole, thioether and mustard gas preparation, properties and uses.

3.3. **Lipids:** Oils and fats- definition, common fatty acids present in oils and fats, rancidity, hydrogenation of oils.

#### UNIT – IV

12 Hours

#### ALKENES AND ALKYNES

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

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

4.3. **Alkynes** – preparation from dihalides, Addition reactions - hydrogen, halogens, halogen acids, water, oxidation by  $\text{KMnO}_4$ , ozonolysis, acidity of alkynes- formation of copper & silver acetylides and polymerisation.

#### UNIT –V

12 Hours

#### ELECTRICAL AND MAGNETIC PROPERTIES OF MATTER

5.1 **Electrical Properties of Matter:** #Polar and non – polar molecules, dipole moment, Stark effect#, Polarization of molecules in an electric field - electronic polarization, atomic polarization and orientation polarization- Clausius-Mosotti equation (no derivation ) and Debye equation (no derivation)- Methods to determine dipole moment – Temperature method and dilute solution method- applications of dipole moment- determining the percentage of ionic character of bonds- shapes of simple molecules ( $\text{H}_2\text{O}$ ,  $\text{CO}_2$  and  $\text{NH}_3$  ).

5.2 **Magnetic Properties of Matter:** Magnetic flux, Magnetic susceptibility, Types of magnetism- dia, para, ferro and antiferro magnetism. Determination of magnetic susceptibility by Guoy balance method. Application to solving of simple structural problems.

#### TEXT BOOKS:

1. P.L. Soni – “Text book of Inorganic Chemistry. S. Chand & Co., New Delhi (1999).
2. Bahl and Arun Bahl – “Advanced Organic Chemistry” – 19<sup>th</sup> Ed., (2005) – Sulthan and Chand company, New Delhi.
3. N. Kundu and S. K. Jain, “Physical Chemistry”, S. Chand & Company Ltd. 2000.

UNIT I: Text Book 1

UNIT II: Text Book 1

UNIT III: Text Book 2

UNIT IV: Text Book 2

UNIT V: Text Book 3

**REFERENCES:**

1. R. D. Madan – “Modern Inorganic Chemistry”, S. Chand & Co Pvt Ltd (2009).
2. B. R. Puri, L. R. Sharma and K. C. Kalia- Principles of Inorganic chemistry, Milestone publishers and distributors, New Delhi, (2012).
3. V. K. Ahluwalia “Text book of organic chemistry” Vol-I & Vol-II (2010) Ane’s Student edition, New Delhi.
4. Bahl and Arun Bahl – “Advanced Organic Chemistry” – 19<sup>th</sup> Ed., (2005) – Sulthan and Chand company, New Delhi.
4. J. N. Gurtu and A. Gurtu, “Advanced Physical Chemistry”, Pragathi Prakashan, 2007.

**SEMESTER-III**  
**NON MAJOR ELECTIVE- I**  
**CHEMISTRY IN DAILY LIFE**

**Course Code: 17UCH3N1A**  
**Hours/Week: 2**  
**Credit: 2**

**Max. Marks : 100**  
**External Marks:100**

**Objectives:**

- *To acquire knowledge on chemistry applied in day to day activities*
- *To impart knowledge about the preparation and uses of several commodities in daily life*
- *To understand the importance of fuels*

**UNIT-I**

**6 hours**

**Essential oils and Perfumes:**

- 1.1. Definition, occurrences, isolation of essential oil - steam distillation and expression method.
- 1.2. Definition, Requirements of a good perfume, composition of perfumes - vehicle, fixative, odoriferous substance, classification of perfumery materials-animals-synthetic-formulations.

**UNIT-II**

**6 hours**

**Cosmetics:**

- 2.1. Face cream, sun screen lotion, shaving cream – composition – formulation - uses and their hazards.
- 2.2. Sprayer, hand lotion, nail lacquers, nail bleaches, hair oil, hair dyes - composition-formulation - uses and their hazards.

**UNIT-III**

**6 hours**

**Dyes:**

- 3.1 Definition, requirement of a good dye, colour and constitution - theory, chromophore, chromogen and auxochrome, classification of dyes based on applications - acid, base direct, mordant, oxidation, ingrain, vat, disperse and azo dyes- physical properties, examples and uses.
- 3.2 Preparation and uses of alizarin, indigo, methyl orange, phenolphthalein and malachite green.

**UNIT-IV**

**6 hours**

**Polymers:**

- 4.1 Definition - classification of polymers - addition and condensation - Preparation and uses of PVC, PTFE, polystyrene, #terylene and nylon 6, 6 #.
- 4.2 Plastics - thermo and thermosetting plastics examples – differences – properties - uses.

## UNIT-V

6 hours

### Gaseous Fuels and Fire Extinguishers:

- 5.1 Definition, classification - solid, liquid and gaseous fuels, requirements of a good fuel - composition and uses of LPG, gobar gas and water gas.
- 5.2 **Fire Protection:** Causes of fire accidents in homes, fire fighting in homes – methods of extinguishing fire, chemical fire extinguishers - merits and demerits. #Automatic fire detection cum control, causes and fire fighting #.

#\_\_\_\_\_# Self Study

### TEXT BOOKS:

1. Thangammal Jacob, A textbook of applied chemistry, Mcmillan Company Ind. Ltd, 1979.
2. P. L. Soni and H. M. Chawla – “Text Book of Organic Chemistry” – 28<sup>th</sup> Edition, (1999) - Sulthan and Chand company, New Delhi.

UNIT I: Text Book 1

UNIT II: Text Book 1

UNIT III: Text Book 2

UNIT IV: Text Book 2

UNIT V: Text Book 1

### REFERENCES:

1. B. K.Sharma, Industrial Chemistry, Goel Publishing House, 1995.
2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, First Edition S.Chand Company Ltd – New Delhi, 2006.

**SEMESTER-III: NON MAJOR ELECTIVE - I**  
**AGRICULTURAL CHEMISTRY**

**Course Code : 17UCH3N1B**

**Hours/Week : 2**

**Credit : 2**

**Max. Marks : 100**

**External Marks : 100**

**Objectives:**

- *To understand the principles of soil and Properties of soil*
- *To make the students acquire knowledge about soil reactions and chemical fertilizers*
- *To learn the concept of pesticides.*

**UNIT – I**

**6 hours**

**SOIL CHEMISTRY**

- 1.1. Soil chemistry: introduction- classification of soil – soil profile – soil taxonomy – properties of soil- soil water- gravitation water- capillary water- hygroscopic water- water vapour – combined water.
- 1.2 Terminology used in soil water status – field capacity – wilting point-soil air – soil temperature – soil minerals – primary mineral – secondary minerals.

**UNIT – II**

**6 hours**

**COLLOIDAL PROPERTIES OF SOIL**

- 2.1. Definition – classification of soil colloids – inorganic colloids – silicate clays- oxides of Iron and aluminium- organic colloids – cation exchange capacity- methods of determination of cation exchange capacity- anion exchange capacity
- 2.2 Properties of colloids-electrical properties- dispersion – coagulation – tyndal phenomenon- Brownian movement – dialysis

**UNIT – III**

**6 hours**

**SOIL REACTIONS**

- 3.1 Soil reaction- soil acidity- causes of acidity – cropping – fertilizers- rain fall – soil alkalinity – high lime- saline soils- alkali soil – saline-sodic soil.
- 3.2 Buffering of soils –amending the soil – reclamation of acid soil – liming agent – reclamation of alkaline soil.

**UNIT – IV**

**6 hours**

**ORGANIC MANURES AND CHEMICAL FERTILIZERS**

- 4.1 Soil fertility – soil productivity – types of soil fertility – nutrients –macro nutrients – micronutrients – organic manures – farmyard manure – compost –oil cakes – bone meal – blood meal – meat meal – fish meal- green manure.
- 4.2 Chemical fertilizers – requisites of a good fertilizer – classification of fertilizers – straight fertilizers – urea – calcium ammonium nitrate – ammonium sulphate – ammonium chloride – phosphatic fertilizers – super phosphate of film – triple super phosphate – muriate of potash – pupate of potash – schoenite-complex fertilizers- #effect of excess fertilization# – eutrophication – agrochemicals.

**UNIT – V**  
**PESTICIDES**

**6 hours**

- 5.1 Insecticides – classifications – stomach poisons , contact poison- fumigants – herbicides – classifications- selective and non selective herbicide – #Fungicides#.
- 5.2 Rodenticides – nematicides – classifications – fumigants – non fumigants- land preparation of nematicides- multipurpose soil fumigants- fumigant nematicides , non – fumigant nematicides.

# # Self study

**TEXT BOOKS:**

1. K. Bagavathi Sundari– “Applied Chemistry”, MJP Publishers Chennai (2006).

UNIT I : Text Book 1

UNIT II : Text Book 1

UNIT III : Text Book 1

UNIT IV : Text Book 1

UNIT V : Text Book 1

**REFERENCES:**

1. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, First Edition S.Chand Company Ltd – New Delhi, 2006.

## SEMESTER- IV: CORE-VII

### INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY-IV

Course Code : 17UCH4C7	Max. Marks	: 100
Hours/ Week : 5	Internal Marks	: 25
Credit : 5	External Marks	: 75

#### Objectives:

- *To understand the chemistry of nitrogen family*
- *To learn the basic chemistry of alcohols and alkyl halides*
- *To know the aromaticity and mechanism of electrophilic substitution reactions.*
- *To study the importance of acids, bases and their salts*
- *To learn the basic idea about kinetics, catalysis and photo chemistry of chemical reactions.*

#### UNIT – I

15 hours

#### NITROGEN FAMILY

- 1.1 **Nitrogen group:** Comparative study of elements and their compounds, Oxides of nitrogen - nitrous oxide, nitric oxide, dinitrogen trioxide and <sup>#</sup>oxyacids - nitrous acid, nitric acid - preparation, properties and uses<sup>#</sup>
- 2.2 **Compounds of nitrogen:** Preparation, properties and uses of hydrazine, hydrazoic acid, hydroxyl amine and liquid ammonia.
- 2.3 **Phosphorous and its compounds:** – Allotropic modifications - White phosphorous – preparation and properties of P<sub>2</sub>O<sub>5</sub>, ortho and pyro phosphoric acids, Graham salt and phosphine.

#### UNIT – II

15 hours

#### ALCOHOLS AND ALKYL HALIDES

- 2.1 **Polyhydric alcohols:** Classification, isomerism, preparation and properties. <sup>#</sup>Distinction between primary, secondary and tertiary alcohols by Lucas and Victor Meyer methods<sup>#</sup>. Glycol - preparation by oxidation method. Glycerol – preparation from fats and oils and uses.
- 2.2 **Alkyl halides:** Alkyl halide, vicinal dihalides and gem dihalides -Preparation and properties. Aliphatic Nucleophilic substitution reactions - mechanism of SN<sup>1</sup>, SN<sup>2</sup> and SN<sup>i</sup> reactions. Elimination reactions - mechanisms of E<sub>1</sub> and E<sub>2</sub> reactions – Saytzeff's and Hofmann rules.

#### UNIT – III

15 hours

#### REACTIONS OF AROMATIC COMPOUNDS

- 3.1 **Aromaticity:** Huckel's rule and its application to aromaticity of benzenoid and non-benzenoid compounds.

**3.2 Aromatic Electrophilic substitution reactions:** General mechanism of electrophilic reactions – Halogenation, nitration and sulphonation. Friedel-Craft's alkylation and acylation reactions. Orientation effects of various substituents – ortho /para ratio. Nuclear and side chain halogenations of toluene.

#### UNIT –IV

**15 hours**

#### ACIDS, BASES AND THEIR SALTS

**4.1 Acids and bases** – #Arrhenius, Bronsted- Lowry and Lewis concepts of acids and bases #– Ionic Equilibria - Buffer solution – Definition, buffer action, buffer capacity, mechanism of buffer action and its uses - various measurement scales for the strength of acids and bases, pH, pOH, and pKa - calculation of pH of a buffer by Henderson's equation.

**4.2 Hydrolysis of salts** – Definition, salt of strong acid, strong base - salt of weak acid, strong base, salt of weak base - strong acid, salt of weak acid and weak base- hydrolysis constant ( $K_h$ ), relation between  $K_h$ ,  $K_a$  and  $K_w$ , Degree of hydrolysis - salt of weak acid strong base, salt of weak base - strong acid, salt of weak acid - weak base.

#### UNIT – V

**15 hours**

#### CHEMICAL KINETICS, CATALYSIS AND PHOTOCHEMISTRY

**5.1 Chemical Kinetics:** Rate and rate constant – factors affecting rate of reactions – Temperature effect on reaction rate - Arrhenius rate equation, energy of activation and its significance,. Theories of reaction rates – simple collision theory, Absolute Reaction Rate Theory (ARRT) to simple uni-molecular and bimolecular processes - Comparison of collision theory & ARRT (Solving problems using Arrhenius rate equation)

**5.2 #Catalysis:** Catalyst, types of catalysts - homogeneous and heterogeneous catalysis# – theories of catalysis- synthetic and industrial importance of catalyst.

**5.3 Photochemistry:** Differences between thermal and photochemical reactions- Laws of photochemistry, quantum yield – Definition, chemical actinometry.

#### TEXT BOOKS:

1. B.R. Puri, L.R.Sharma and K.C.Kalia- Principles of Inorganic chemistry, Milestone Publishers and distributors, New Delhi. (2012)
2. Bahl and Arun Bahl – “Advanced Organic Chemistry” – 19<sup>th</sup> Ed., (2005) – Sulthan and Chand company, New Delhi.
3. B. S. Bahl, G. D. Tuli and Arun Bahl, “Essentials of Physical Chemistry”, S. Chand & Co., New Delhi, 1999.
4. P. W. Atkins, “Physical Chemistry”, (7<sup>th</sup> edition) Oxford University Press, (2009).



UNIT I: Text Book 1

UNIT II: Text Book 2

UNIT III: Text Book 2

UNIT IV: Text Book 3, 4

UNIT V: Text Book 3, 4

**REFERENCES:**

1. R.D Madan – “Modern Inorganic Chemistry” , S. Chand & Co Pvt Ltd ( 2009).
2. V.K. Ahluwalia “Text book of organic chemistry” Vol-I & Vol-II (2010) Ane’s Student edition. New Delhi.
3. Dr. Jagadamba Singh – “Undergraduate Organic Chemistry” UGC Curriculum Vol. I & Vol. II, Pragati Ed., (2007) – Pragati Prakashan, Meerut.
4. R. L. Madan, G. D. Tuli, “Simplified Course in Physical Chemistry”, 5<sup>th</sup> revised and enlarged edition, S. Chand & Co., New Delhi, 2009.
5. J. N. Gurtu and A. Gurtu, “Advanced Physical Chemistry”, Pragathi Prakashan, 2007.

**SEMESTER-IV: NON MAJOR ELECTIVE-II  
FOOD AND NUTRITION**

**Course Code: 17UCH4N2A**  
**Hours/Week: 2**  
**Credit: 2**

**Max. Marks : 100**  
**External Marks: 100**

**Objectives:**

- *To learn basic knowledge on food chemistry.*
- *To know the nutritional values of food.*
- *To get awareness on the food spoilage and adulteration.*

**UNIT – I** **6 hours**  
**FOOD AND ITS CONSTITUENTS**

- 1.1 Food:** Definition - classification based on nutritional values, nutritive values of cereals, nuts oil seeds, milk and milk products.
- 1.2** Sources, biological functions, deficiency diseases and Recommended Dietary Allowance (RDA) of carbohydrates, protein and fats.

**UNIT – II** **6 hours**  
**MINERALS AND VITAMINS**

- 2.1 Minerals:** Dietary sources, Physiological functions, effects of deficiency and requirements of calcium, phosphorous, iron, fluorine, iodine, \*sodium and potassium#.
- 2.2 Vitamins:** Classification - fat and water soluble vitamins, food sources, effects of deficiency and RDA.

**UNIT – III** **6 hours**  
**MEAL PLANNING**

- 3.1** Importance of meal planning-importance of mother's milk-diets for school children - adolescents - pregnant and lactating women.
- 3.2** Diet during fever, dysentery, anemia, blood pressure, #obesity and diabetes#.

**UNIT – IV** **6 hours**  
**FOOD SPOILAGE AND PRESERVATION**

- 4.1** Food spoilage-causes of food spoilage-fermentation, rancidity, autolysis and putrefaction-food poisoning.
- 4.2 Food Preservation:** principle and importance - methods of preservation, freezing, canning, pickling, salting, smoking, bottling, sterilization, refrigeration, dehydration, heating, #radiation and preservative agents#.

**UNIT – V** **6 hours**  
**FOOD ADULTERATION**

- 5.1** Food adulteration - Definition, classification - common adulterants in food-detection and ill Effects - packing hazards - food additives.
- 5.2** Practical rules for good sanitation of food - Food laws and standards – Bureau of Indian Standards, # AGMARK and Consumer Protection act#.

# \_\_\_\_\_ # Self study

**TEXT BOOKS:**

1. Dr. M. Swaminathan – “Handbook of food and Nutrition” 5<sup>th</sup> Ed, Bangalore Printing and Publishing Co Ltd, Bangalore, 2007.
2. B. Srilaksmi – “Food Science” – 3<sup>rd</sup> Ed, New Age International (P) Ltd, New Delhi, 2005.
3. M. Raheena Begum – “A Text Book of Foods, Nutrition and Dietetics” - Sterling Publishers, Delhi, 2010.

UNIT I: Text Book 1,2

UNIT II: Text Book 1,2

UNIT III: Text Book 1,2

UNIT IV: Text Book 2

UNIT V: Text Book 2,3

**REFERENCES:**

1. Jayashree Ghose – “Fundamental Concepts of Applied Chemistry” – 1<sup>st</sup> Ed, S. Chand and Company (P) Ltd, New Delhi, 2006.
2. Morris B. Jacobs – “The Chemical Analysis of Foods and Food Products” – 3<sup>rd</sup> Ed, CBS Publishers and Distributors, New Delhi, 1993.
3. H.K.Chopra and P.S.Panesar – “Food Chemistry”, Narosa Publisher, 2010.

**SEMESTER –III: NON MAJOR ELECTIVE-II  
NANOSCIENCE AND ITS APPLICATIONS**

**Course Code: 17UCH4N2B**

**Hours/Week: 2**

**Credit: 2**

**Max.Marks :100**

**External Marks : 100**

**Objectives:**

- To introduce some of the fundamentals and current state-of-the-art in nanotechnology
- To get familiarized with the synthesis, characterization and applications of nanomaterials.

**UNIT I**

**6 hours**

**INTRODUCTION TO NANOSCIENCE**

Definition of terms-nanoscale, nanomaterials, nanoscience, nanotechnology-scale of materials-natural and manmade-nanoscience practiced during ancient and modern periods contributors to the field of nanoscience.

**UNIT II**

**6 hours**

**SYNTHESIS OF NANOMATERIALS**

Top down and bottom up approaches-synthesis of carbon nanotubes, quantum dots, gold and silver nanoparticles.

**UNIT III**

**6 hours**

**CHARACTERIZATION OF NANOMATERIALS**

Electron microscopy techniques-scanning electron microscopy, transmission electron microscopy, atomic force microscopy.

**UNIT IV**

**6 hours**

**APPLICATION OF NANOMATERIALS**

Solar cells-smart materials-molecular electronics-biosensors-drug delivery and therapydetection of cancerous cells.

**UNIT V**

**6 hours**

**NANOTECHNOLOGY IN NATURE**

The science behind the nanotechnology in lotus effect-self cleaning property of lotus -gecko foot-climbing ability of geckos-water strider-antiwetting property of water striders-spider silk-mechanical properties of the spider silk.

**TEXT BOOKS:**

1. T.Pradeep, Nano: The Essentials: Understanding Nanoscience and Nanotechnology, McGraw-Hill Professional Publishing, 2008.

UNIT I: Text Book 1  
UNIT II: Text Book 1  
UNIT III: Text Book 1  
UNIT IV: Text Book 1  
UNIT V: Text Book 1

**REFERENCE**

1. J.Dutta, H.F. Tibbals and G.L. Hornyak, Introduction to Nanoscience, CRC press, BocaRaton, 2008.

## SEMESTER- V: CORE-IX

### p-BLOCK ELEMENTS, METALLURGY AND NUCLEAR CHEMISTRY

Course Code : 17UCH5C9

Hours/ Week : 6

Credit : 5

Max. Marks : 100

Internal Marks : 25

External Marks : 75

#### Objectives:

- To understand the chemistry of oxygen and halogen family elements
- To know the compounds of silicon and polyacids
- To study metallurgy
- To know the fundamental concepts and applications of nuclear chemistry

#### UNIT – I

18 hours

##### OXYGEN AND HALOGEN FAMILY

- 1.1. **Oxygen Family:** Comparative study of elements, ozone – manufacture, properties, uses. Sulphur – Properties – Allotropic modifications, compounds of sulphur – <sup>#</sup>Oxide(SO<sub>2</sub>) Oxyacids (H<sub>2</sub>SO<sub>3</sub>), Peracid of sulphur (Caro's acid, Marshalls acid) – Preparation - Properties <sup>#</sup>
- 1.2. **Halogen Family:** Comparative study of halogens and their compounds – Oxides and Oxyacids of halogens (Structure only) Basicity of Iodine; Chemistry of Astatine. Interhalogen compounds: Preparation, properties and structures (ClF<sub>3</sub>, IF<sub>5</sub>, IF<sub>7</sub>) Polyhalides - properties, structures (ICl<sub>2</sub><sup>-</sup>, IF<sub>4</sub><sup>+</sup>).

#### UNIT- II

18 hours

##### COMPOUNDS OF SILICON AND POLYACIDS

- 2.1 **Silicon** –Occurrence, types- preparation, properties and uses, compounds of silicon-SiO<sub>2</sub>, SiH<sub>4</sub>, SiCl<sub>4</sub>, SiC – structure, properties and uses.
- 2.2 **Silicates:** Definition – Classification – Ortho, Pyro, Chain structures, sheet silicates, three – dimensional silicates – Composition, structure and uses. Silicones – Types, preparation, properties and uses. <sup>#</sup> Silicone rubbers - important uses<sup>#</sup>.
- 2.3. **Isopolyacids** – Definition, preparation of isopolyacids of chromium and tungsten.

#### UNIT – III

18 hours

##### BINARY COMPOUNDS AND METALLURGY

- 3.1 **Binary compounds:** Borides, Hydrides, Carbides, Nitrides – Classification, structure-bonding and uses.
- 3.2 **Metallurgy:** Occurrence of metals in India – Extraction of V and Ti from their ores. Concentration of ores – Froth floatation, Magnetic separation, roasting, smelting. Purification of metals - Reduction, Electrolysis, Van Arkel process, <sup>#</sup>Zone refining, Aluminothermic process.<sup>#</sup>
- 3.3 **Alloys:** Classification - Preparation and properties – role of carbon in steel – important alloys – composition – uses (Bronze, Brass, Duralamine, gun metal, stainless steel).

## UNIT – IV

18 hours

### NUCLEAR CHEMISTRY

- 4.1. **Structure of nucleus** - Composition of nucleus , nuclear forces, nuclear stability-mass defect, binding energy, BE/nucleon - n/p ratio, and magic numbers.
- 4.2. **Nuclear Models**: Nuclear shell model, liquid drop models. Nuclear Forces - Meson theory.
- 4.3. **\*Definition of isotopes, isobars, isotones and isomers\*** - whole number rule and packing fraction. Applications of radio isotopes – determination of reaction mechanism, in analytical chemistry in medicine, rock dating and carbon dating.

## UNIT – V

18 hours

### RADIOACTIVITY

- 5.1. **Radioactivity**- Definition, types of radioactivity, Properties of  $\alpha$ ,  $\beta$  and  $\gamma$  rays: Detection and measurement – Wilson cloud chamber and G.M. Counter. Modes of decay, decay constant, half life period and average life Period, Group displacement law and radioactive series.
- 5.2. **Nuclear reactions**: Nuclear Fission – Atom bomb and nuclear reactor. Nuclear Fusion – **\*Hydrogen bomb and stellar energy\***
- 5.3. **Artificial radio activity**- definition, proton, deuteron, neutron and particle induced transmutations.

**#\_\_\_\_\_# Self study**

### TEXT BOOKS:

1. P.L. Soni - “Text book of Inorganic Chemistry. S. Chand & Co., New Delhi ,1999.
2. Wahid Malik, G.D.Tuli and R.D.Madan, “Selected Topics in Inorganic Chemistry”, S.Chand & Co. Pvt Ltd ,2011.

UNIT I: Text Book 1

UNIT II: Text Book 1, 2

UNIT III: Text Book 1, 2

UNIT IV: Text Book 1, 2

UNIT V: Text Book 1, 2

### REFERENCES:

1. R.D Madan - “Modern Inorganic Chemistry”, S. Chand & Co Pvt Ltd , 2009.
2. B.R. Puri, L.R.Sharma and K.C.Kalia- Principles of Inorganic chemistry, Milestone publishers and distributors, New Delhi.,2012.

## SEMESTER- V: CORE-X

### ORGANIC COMPOUNDS, REACTIONS AND HETEROCYCLICS

Course Code : 17UCH5C10

Max. Marks : 100

Hours/ Week : 5

Internal Marks : 25

Credit : 5

External Marks : 75

#### Objectives:

- To study about the reactions of carboxylic acids.
- To know modern synthetic methods and synthetic strategies.
- To study about the reactions of heterocyclic compounds.

#### UNIT – I

15 Hours

##### CARBOXYLIC ACIDS AND THEIR DERIVATIVES

- 1.1 **Monocarboxylic acids:** Acetic acid–preparation, properties and uses. Ionization of carboxylic acids – Acidity constant – Comparison of acid strengths of substituted benzoic acids –Hammett equation.
- 1.2. **Dicarboxylic acids:** preparation and properties of oxalic, malonic, succinic, glutaric and adipic acids.
- 1.3. **Esters:** Preparation, properties and synthetic applications of acetoacetic and malonic esters. #Keto-enol tautomerism of acetoacetic ester#.

#### UNIT – II

15 Hours

##### PHENOLS

- 2.1. Phenol Nomenclature, preparation and properties. Comparative acidic strengths of alcohol & phenol and substituted phenols - resonance stabilization of phenoxide ion.
- 2.2. Reactions of phenols–Esterification, Nitration, Sulphonation, Halogenation, Benzoylation, Acylation, coupling reaction, Kolbe reaction, Gatterman reaction, Hauben - Hoesch reaction and Reimer-Tiemann reaction.
- 2.3 **Dihydric Phenols:** Catechol, resorcinol and quinol – preparation, properties – electrophilic substitution reactions of  $\alpha$  and  $\beta$ -naphthols.

#### UNIT – III

15 Hours

##### NITRO COMPOUNDS AND AMINES

- 3.1. **Nitrobenzene:** Preparation, reduction of nitrobenzene in neutral, acidic and alkaline medium - TNT – preparation and uses.
- 3.2. **Amines:** Relative basic characters of aliphatic and aromatic amines – ring substitution in aromatic amines – separation of amines by Hinsburg and Hofmann methods, diazotization and coupling, benzene diazonium chloride and its synthetic applications.
- 3.3. o-phenylene diamine, sulphanilic acid, sulphanilamide, saccharin, chloramine–T, preparation and uses.



**UNIT – IV****15 hours****REAGENTS AND NAMING REACTIONS**

4.1 **Reagents:** Synthetic applications of Lithium aluminium hydride, Sodium borohydride, Raney nickel, Wilkinson's catalyst,  $\text{KMnO}_4$ , chromyl chloride,  $\text{HIO}_4$ ,  $\text{Pb}(\text{OAc})_4$  and  $\text{SeO}_2$ .

4.2 **Naming reactions:** Aldol, Benzoin, Cannizaro, Crossed Cannizaro, Mannich, Michael addition, Perkin and Wolf Kishner reactions with mechanisms.

**UNIT – V****15 hours****HETEROCYCLIC COMPOUNDS**

5.1. Preparation, properties and uses of furan, pyrrole, thiophene, pyridine and piperidine.

Basic characters of pyrrole, pyridine and piperidine – comparative study.

5.2. Quinoline, Isoquinoline and Indole synthesis with special reference to Skraup, Fischer-indole and Bischler-Napieralski - synthesis, properties and uses.

**TEXT BOOKS:**

1. A.K. Srivastava – “Organic Chemistry” – 1<sup>st</sup> Ed.,(2002) – New Age International Publishers, New Delhi.
2. Morrison and Boyd – “Organic Chemistry” – 6<sup>th</sup> Ed., (1998) – Prentice Hall of India Pvt. Ltd., New Delhi.
3. Bahl and Arun Bahl – “Advanced Organic Chemistry” – 19<sup>th</sup> Ed., (2005) – Sulthan and Chand company, New Delhi.
4. L.A. Pacesetter, Principles of modern heterocyclic chemistry W.A. Benzamin,1968.
5. Raj, K. Bansal, Heterocyclic Chemistry, Synthesis Reactions and Mechanisms, 1990.

UNIT I: Text Book 1, 2, 3

UNIT II: Text Book 1, 2, 3

UNIT III: Text Book 1, 2, 3

UNIT IV: Text Book 1, 2, 3, 4, 5

UNIT V: Text Book 1, 2, 3, 4, 5

**REFERENCES:**

1. A.K. Srivastava – “Organic Chemistry” – 1<sup>st</sup> Ed.,(2002) – New Age International Publishers, New Delhi.
2. Morrison and Boyd – “Organic Chemistry” – 6<sup>th</sup> Ed., (1998) – Prentice Hall of India Pvt. Ltd., New Delhi.
3. Bahl and Arun Bahl – “Advanced Organic Chemistry” – 19<sup>th</sup> Ed., (2005) – Sulthan and Chand company, New Delhi.
4. Gurdeep Chatwal – “Organic Chemistry of Natural Products” – Vol. – I & Vol. II, Revised fifth ed., (2005) – Himalaya Publishing House.
5. O.P. Agarwal – “Reactions and Reagents in Organic Chemistry” – 5<sup>th</sup> Ed., (2005) – Goel Publishing House, Meerut.
6. V.K. Ahluwalia “Text book of organic chemistry” Vol.-I & Vol.-II (2010) Ane's Student edition, New Delhi.

## SEMESTER- V: CORE-XI

### THERMODYNAMICS AND SOLUTIONS

Course Code : 17UCH5C11

Hours/ Week : 6

Credit : 5

Max. Marks : 100

Internal Marks : 25

External Marks : 75

#### Objectives:

- To understand the concepts and uses of thermodynamics and thermo chemistry
- To make the student to understand the phase rule and its applications to one and two component systems
- To study the concepts and uses of colligative properties

#### UNIT – I

18 hours

##### FIRST LAW OF THERMODYNAMICS AND THERMO CHEMISTRY

- 1.1 **Terms used in thermodynamics:** Various systems – open, closed and isolated-homogeneous and heterogeneous- #thermodynamic processes-cyclic, isothermal, isochoric, isobaric, adiabatic, reversible and irreversible#- Intensive and extensive properties, internal energy, work and heat, state function, path function, exact and inexact differentials, first law of thermodynamics-definition, heat capacity –  $C_p$  and  $C_v$ . Joule-Thomson effect, Joule Thomson co-efficient and inversion temperature- Zeroth law of thermodynamics. (problem from Joule-Thomson effect)
- 1.2. **Applications of First law:** Calculation of  $q$ ,  $W$ ,  $\Delta U$  and  $\Delta H$  for isothermal and adiabatic reversible & irreversible expansion of an ideal gas. (Problem)
- 1.3. **Thermo chemistry:** Change of internal energy and enthalpy in a chemical reaction, Enthalpy of reaction at constant volume and at constant pressure, Enthalpy of combustion, formation, neutralization, dissociation, solution, hydration, dilution, precipitation. Kirchoff equation - Hess's law and its application- Bond energy calculation

#### UNIT – II

18 hours

##### SECOND LAW OF THERMODYNAMICS AND ITS APPLICATIONS

- 2.1. **Second law:** Need for the law, #spontaneous process, different statements of second law of thermodynamics#- heat engine- Carnot's cycle and its efficiency, thermodynamic scale of temperature, entropy - Concept of entropy, entropy as a state function, entropy change in isothermal expansion of ideal gas, entropy change in reversible and irreversible processes.
- 2.2. **Entropy and free energy:** Entropy change accompanying change of phase, entropy of mixture of ideal gases, Physical significance of entropy, Free energy, work functions, variation of  $\Delta A$  and  $\Delta G$  with  $T$  and  $P$ , Gibb's- Helmholtz equations and their applications –thermodynamic equations of state- Maxwell's relations -Clausius - Clapeyron equation and its applications. (Problem).

### UNIT – III

18 hours

#### THIRD LAW OF THERMODYNAMICS AND PHASE RULE

- 3.1. **Third law:** Need for Third law of thermodynamics - Nernst heat theorem, Third law of thermodynamics, Determination of absolute entropies- Exception of third law.
- 3.2. **Phase Rule:** #Definition of the terms – Phase, components, degrees of freedom, derivation of Gibbs's phase rule#, one component system – H<sub>2</sub>O, CO<sub>2</sub> and Sulphur systems, two component system – Simple eutectic system - Pb-Ag, freezing mixture, compound formation with congruent melting points – FeCl<sub>3</sub>-H<sub>2</sub>O system, compound formation with Incongruent melting points - Na<sub>2</sub>SO<sub>4</sub> -H<sub>2</sub>O system.

### UNIT – IV

18 hours

#### SOLUTIONS OF NON-ELECTROLYTES

- 4.1. **Solution of liquids in liquids:** #Ideal and non-ideal solutions, Raoult's Law and Henry's Law#, vapour pressure of ideal solution, activity and activity co-efficients component in ideal and non-ideal solutions, chemical potential of ideal and non-ideal solution – Gibbs – Duhem - Margules equation.
- 4.2. **Vapour pressure of non-ideal solution:** deviations from Raoult's law, vapour pressure composition and boiling point - composition curves, azeotropic mixtures (HCl–H<sub>2</sub>O and ethanol–water system).
- 4.3. **Solubility of partially miscible liquids pairs:** system with upper CST - Phenol–Water, aniline–hexane, system with lower CST – Triethylamine-water and system with upper and lower CSTs - Nicotine-water, effects of impurities on CST, completely immiscible liquid pairs –Nernst distribution law and its application to solvent extraction.

### UNIT – V

18 hours

#### PROPERTIES OF DILUTE SOLUTIONS

- 5.1. **Colligative properties:** Definition, #lowering of vapour pressure, relative lowering of vapour pressure#, determination of molecular weight from lowering of vapour pressure, measurement of lowering of vapour pressure, osmosis and osmotic pressure – definitions, expression for calculating osmotic pressure, determination of molecular weight from osmotic pressure, relation between osmotic pressure and lowering of vapour pressure, experimental determination of osmotic pressure.
- 5.2. **Elevation of boiling point:** Definition, derivation of ebullioscopic constant, determination of molecular weight from elevation of boiling point, elevation of boiling point determination, depression of freezing point – definition, derivation of cryoscopic constant, determination of molecular weight from depression of freezing point, experimental determination, abnormal colligative property – Association, dissociation and Van't Hoff factor, degree of dissociation. (Problem from 5.2) ## Self Study

**TEXT BOOKS:**

1. B. R. Puri, L. R. Sharma and M. S. Pathania, "Principles of Physical Chemistry", Vishal Publications, Jalandhar, 2002.
2. K. Kuriacose and J. C. Rajaram, "Thermodynamics for Students of Chemistry", Shoban Lalnagin Chand & Co, Delhi, 2002.
3. R. L. Madan and G. D. Tuli, "Simplified Course in Physical Chemistry", 5th revised and enlarged edition, S.Chand & Co., New Delhi, 2009.

UNIT I: Text Book 1,2

UNIT II: Text Book 1,2

UNIT III: Text Book 1,2

UNIT IV: Text Book 1,3

UNIT V: Text Book 1,3

**REFERENCES:**

1. N. Kundu and S.K .Jain, Physical Chemistry, S. Chand & Co. Ltd.1998, New Delhi.
2. B. S. Bahl, G. D. Tuli and Arun Bahl, "Essentials of Physical Chemistry", S. Chand & Co.,New Delhi, 1999.
3. Samuel Glasstone, "Textbook of Physical Chemistry", 2<sup>nd</sup> Edition, MacMillan India, 1981.
4. J. N. Gurtu and A. Gurtu, "Advanced Physical Chemistry", Pragathi Prakashan, Meerut, 2007.

**SEMESTER-V: SKILL BASED ELECTIVE-II  
ANALYTICAL TECHNIQUES**

**Course Code: 17UCH5S2A**  
**Hours/Week: 2**  
**Credit: 2**

**Max. Marks : 100**  
**External Marks: 100**

**Objectives**

- *To create awareness on laboratory hygiene and safety*
- *To learn the basic analytical methods*
- *To understand the various principles in chromatography*

**UNIT – I**

**6 hours**

**LABORATORY HYGIENE AND SAFETY**

- 1.1 Storage and handling of chemicals-handling of ethers - toxic and poisonous chemicals, general precautions for avoiding accidents, first aid techniques - acid and alkali on eye - acid and alkali burn - bromine burns - cut by glasses - heat burns - Inhalation of toxic vapours.
- 1.2 Poisoning - Treatment for specific poisons - acids, alkalis, acetone, arsenic and copper compounds, cyanides – antidote – definition - universal antidotes.

**UNIT – II**

**6 hours**

**GRAVIMETRIC ANALYSIS**

- 2.1. Precipitation – Methods of obtaining the precipitate- condition of precipitate - choice of precipitants- Organic Precipitants - Types of organic precipitants - chelating and ion associating precipitants - Advantages and disadvantages of using organic precipitants.
- 2.2. Specific and selective precipitants - Theories of precipitation-process of crystal growth. Co-precipitation and post-precipitation-precipitation from homogeneous solution - digestion-filtration and washing-drying and ignition.

**UNIT – III**

**6 hours**

**THERMAL ANALYSIS**

- 3.1. Thermal analysis- definition-Thermo gravimetric Analysis (TGA)-principle-instrumentation – Techniques - Factors affecting TGA – Applications – TGA curves of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ .
- 3.2. Differential Thermal Analysis (DTA)- Principle – instrumentation – techniques– Factors affecting DTA curves – Applications- DTA curve of  $(\text{Ca} (\text{C}_2\text{O}_4)_2 \cdot \text{H}_2\text{O})$ .

**UNIT – IV**

**6 hours**

**CHROMATOGRAPHY**

- 4.1. Chromatography – definition, classification, paper chromatography – principle, types, techniques and applications. TLC - principle, plate and rate theory, techniques and applications.
- 4.2. Column chromatography- Principle, types, techniques and applications.

**UNIT – V****6 hours****SEPARATION TECHNIQUES**

- 5.1. HPLC and ion - Exchange chromatography – principle – instrumentation - techniques- applications.
- 5.2 Electrophoresis- definition-principle-techniques-applications.

**TEXT BOOKS:**

1. S.M. Khopkar, “Basic concept of Analytical Chemistry”, Wiley Eastern Ltd., 1998.
2. R. Gopalan, P.S. Subramanian, K. Rangarajan – “Elements of Analytical Chemistry”, Sultan Chand and Sons, 1995.

UNIT I : Text Book 1

UNIT II : Text Book 1

UNIT III : Text Book 1

UNIT IV : Text Book 2

UNIT V : Text Book 2

**REFERENCES:**

1. B.K. Sharma - “Instrumental methods of Analysis”, Geol Publications, 2000.
2. H. Kaur – “Instrumental methods of Chemical Analysis”, Pragathi prakasan Publications, Meerut, 1987.
3. A.K. Srivastava and P.C. Jain – “Instrumental approach to Chemical Analysis”, S.Chand Publications.

**SEMESTER-V: SKILL BASED ELECTIVE-II  
ELECTROANALYTICAL TECHNIQUES**

**Course Code: 17UCH5S2B**

**Hours/Week: 2**

**Credit: 2**

**Max. Marks: 100**

**External Marks: 100**

**Objectives**

- To learn the concepts and applications of different electro analytical techniques

**UNIT – I**

**6 hours**

**POLAROGRAPHY**

- 1.1. Polarography- Principle, Instrumentation, polarographic measurements, dropping mercury electrode-merits and demerits, polarogram (current-voltage curve), half wave potential and its significance.
- 1.2. Currents contributing to the polarographic waves- migration current. residual current, kinetic current, convection current and diffusion current. Ilkovic equation and its importance, polarographic maxima and its removal, advantages and applications of polarography- determination and separation of metals.

**UNIT – II**

**6 hours**

**POTENTIOMETRY**

- 2.1. Potentiometer- principle, electrochemical cells, indicator electrode, reference electrode, calomel electrode, instrumentation, accuracy of direct potentiometric measurements.
- 2.2. Potentiometric titrations- principle, advantages and procedure for potentiometric titrations, methods of end point location-derivative method, graphical method and direct titration to the equivalence point, Types of potentiometric titrations- redox, neutralization, precipitation and complexometric titrations.

**UNIT – III**

**6 hours**

**AMPEROMETRY**

- 3.1. Amperometry- principle, amperometric titration curves, amperometric indicators, instrumentation, procedure for amperometric titrations, advantages and applications
- 3.2. Biamperometric titrations- theory, dead stop end point method- apparatus and procedure, advantages and applications.

**UNIT –IV**

**6 hours**

**COULOMETRY**

- 4.1 Coulometry- principle, techniques and instrumentation of constant current coulometric analysis and controlled potential coulometric analysis, coulometer-water coulometer and iodine coulometer.
- 4.2 Coulometric titrations – Principle, advantages, applications and instrumentation for coulometric titrators.

**UNIT – V****6 hours****ELECTROGRAVIMETRY**

- 5.1. Electrogravimetry- theory, important terms used in electrogravimetric methods- voltaic and electrolytic cells, cathode, anode, polarized electrode, current density, current efficiency, decomposition potential and overpotential.
- 5.2 Electrogravimetric methods, instrumentation, procedure of electrolysis, internal electrolysis, advantages and applications- electrolytic separation of metals and determination of Cu, Sb, Pb and Sn in bearing metal.

**TEXT BOOKS:**

1. H. Kaur – “Instrumental methods of Chemical Analysis”, Pragathi prakasan Publications, Meerut, 1987.
2. S. M. Khopkar, “Basic Concept of Analytical Chemistry”, Wiley Eastern Ltd., 1998.
3. R. Gopalan, P. S. Subramanian, K. Rangarajan, “Elements of Analytical Chemistry”, Sultan Chand and Sons, 1995.

UNIT I : Text Book 1

UNIT II : Text Book 1,2

UNIT III : Text Book 1,3

UNIT IV : Text Book1,

UNIT V : Text Book 1,

**REFERENCES:**

1. B. K. Sharma, “Instrumental methods of Analysis”, Geol Publications, 2000.
2. A. K. Srivastava and P. C. Jain, “Instrumental approach to Chemical Analysis”, S. Chand Publications, 2007.



**SEMESTER – V: SKILL BASED ELECTIVE-III  
CLINICAL CHEMISTRY**

**Course Code: 17UCH5S3A**

**Hours/Week: 2**

**Credit: 2**

**Max. Marks : 100**

**External Marks: 100**

**Objectives**

- *To develop the basic knowledge on drugs and its applications*
- *To create the awareness about the diseases, causes and their prevention*
- *To understand the concepts of clinical chemistry*

**UNIT – I**

**6 hours**

**DRUGS TERMINOLOGY**

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

**UNIT – II**

**6 hours**

**ANTIBIOTICS**

- 2.1. Antibiotics – Definition - structure and uses of penicillin, chloramphenicol, ampicillin, streptomycin, tetracycline and erythromycin.
- 2.2. Sulpha drugs – Definition - preparation and uses of sulphadiazine, sulphapyridine, sulphathiazole and sulphafurazole.

**UNIT – III**

**6 hours**

**ANTISEPTICS AND ANAESTHETICS**

- 3.1. Antiseptics and Disinfectants – Definition - Differences between antiseptics and disinfectants - structure and uses of alkyl substituted phenols and chlorinated phenol - crystal violet - brilliant green - methylene blue - cationic surface active agent - benzalkonium chloride-cetrimide - properties and uses.
- 3.2. Anaesthetics – Definition – classification - general volatile anaesthetics - ethers, nitrous oxide, chloroform, halothane-advantages and disadvantages. Intravenous anaesthetics - thiopental sodium, methohexitone - local anaesthetics - cocaine, procaine, benzocaine - uses – advantages - disadvantages.

**UNIT – IV**

**6 hours**

**BLOOD**

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

## UNIT – V

6 hours

### ORGANIC DIAGNOSTIC AGENTS

- 5.1. Organic diagnostic agents – definition - X-ray contrast media (radio opaque) - Iodipamide, Evan's blue, histamine and xylose - advantages.
- 5.2. Qualitative test of blood samples- carbohydrates - Benedict's test- anthrone test and Fehling test. Proteins – ninhydrin and Biuret test. Fat - translucency – emulsification-iodine absorption and sudan III tests.

### TEXT BOOKS:

1. Mathew George and Lincy Joseph , Text book of pharmaceutical chemistry, 2009.
2. Jayashree Ghose – Text book of Pharmaceutical chemistry, 2<sup>nd</sup>Edn., 2003.
3. Lakshmi.S., Pharmaceutical Chemistry, III Edn., Sulthan Chand and Sons, New Delhi,2004.
4. R. S. Satoskar and S.R.Bandarkar – Pharmacology and Pharmotherapeutics, popular prakashnan.

UNIT I: Text Book 1,2,3

UNIT II: Text Book 1,2,3

UNIT III: Text Book 1,2,3

UNIT IV: Text Book 4

UNIT V: Text Book 4

### REFERENCES:

1. Aleg Gringaur, Introduction to Medicinal Chemistry, Sharma Printers, Delhi, 2011.
2. D.Sriram and P.Yogeshwari, Medicinal Chemistry, 2<sup>nd</sup> edition-2008.
3. Ashutoshkar , Medicinal chemistry, revised and expanded edition, International Publishers, 2010.
4. V.N. Rajasekaran, Vol. I and Vol.II, Pharmaceutical Chemistry, Sun publications Chennai. 4<sup>th</sup> Edn., 2003.
5. V. K.Ahluwalia and Madhu Chopra, Medicinal chemistry, Ane books private Ltd., New Delhi, 1<sup>st</sup> Edition, 2008.
6. Marlin Herbert, Pharmacology, Ashton Nany Darkson, Jones and Bartlett India Pvt.Ltd. 11thEdition, 2010.
7. J.C. Kuriacose, J.Rajaram – “Chemistry in Engineering and Technology – Vol– 2. Tata McGraw- Hill Publishing Company Limited – New Delhi – 1994.
8. P. C. Jain & Monika Jain – “Engineering Chemistry”, 15 thEd., Dhanpath Rai, Publishing Company, New Delhi, 2005.

**SEMESTER-V: SKILL BASED ELECTIVE-III**  
**WATER QUALITY ANALYSIS**

**Course Code: 17UCH5S3B**

**Hours/Week: 2**

**Credit: 2**

**Max. Marks : 100**

**External Marks: 100**

**Objectives**

- To give an in-depth understanding of water quality parameters, ground water and surface water pollution and its control measures.
- To learn the water treatment methods, sewage and industrial effluent treatment methods and water resources management.

**UNIT I**

**6 hours**

**WATER QUALITY PARAMETERS AND THEIR DETERMINATION**

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

**UNIT II**

**6 hours**

**GROUND WATER AND SURFACE WATER POLLUTION AND CONTROL MEASURES**

Surface water and ground water pollution - Harmful effects-pollution of major rivers - protecting ground water from pollution - ground water pollution due to Fluoride, Iron, Chromium and Arsenic ~ sources, ill effects and treatment methods.

**UNIT III**

**6 hours**

**WATER TREATMENT METHODS**

Treatment for community supply - screening, sedimentation, coagulation, filtration -removal of micro organisms - chlorination, adding bleaching powder, UV irradiation and ozonation.

**UNIT IV**

**6 hours**

**SEWAGE AND INDUSTRIAL EFFLUENT TREATMENT**

Sewage - characteristics - purpose of sewage treatment - methods of sewage treatment - primary - secondary and tertiary - Role of algae in sewage treatment. Types of industrial wastes treatment of effluents with organic and inorganic impurities.

**UNIT V**

**6 hours**

**WATER MANAGEMENT**

Water resources management - rain water harvesting methods - percolation ponds – check dams - roof top collection methods - water management in industries.

**Text book**

1. Chemical and Biological Methods for Water Pollution Studies, R.K. Trivedy and P.K. Goel, Environmental Publications, 1986.

UNIT I: Text Book 1

UNIT II: Text Book 1

UNIT III: Text Book 1

UNIT IV: Text Book 1  
UNIT V: Text Book 1

**References**

1. Engineering Chemistry, P.c. Jain and Monica Jain, Dhanpat Rai and Sons, 1993.

## SEMESTER- V: EXTRA CREDIT COURSE-I COMPUTER APPLICATIONS IN CHEMISTRY

**Course Code : 17UCH5EC1**

**Hours/Week : --**

**Credit : 4\***

**Max. Marks : 100\***

**Internal Marks : --**

**External Marks : 100\***

### **Objectives:**

- *To enable the students to learn computer basics and operating system*
- *To know the fundamentals of networks and C programming*

### **UNIT-I**

**Introduction to computer** – Characteristics of computers – organization of a computer – secondary storage devices – computer languages – low level, assembly and high level languages – software – system and application software – application of computer – algorithms and flow charts.

### **UNIT-II**

**Operating system** – MS-DOS, simple DOS commands – MS-Windows - Components of Windows – desktop, My Computer, Recycle Bin, Taskbar, My briefcase and Network Neighborhood – Windows Accessories – Calculator, games, Windows media player, Notepad and Imaging – Windows Explorer. Power point – creating a presentation – slide preparation – popular websites for data collection in chemistry.

### **UNIT-III**

**Fundamentals of Computer Networks** – Importance – Mode of Connections – Protocol – Network Topologies – Bus, Ring and Star topologies – Network Architecture – Network components – Hubs , cables, repeaters, routers and bridges.

**Internet and its application:** Internet – meaning – importance –WWW– Browsing the internet – Browsing software – URL addresses, search engines, exploring websites and downloading materials from websites, E-mail – sending, receiving and storing mail and chatting.

### **UNIT-IV**

**Fundamentals of C** – Character set – identifiers – keywords – data types – Constants –Variables – symbolic constants – operators – expressions – evaluation of expressions. Input and Output functions - get char – put char – scanf – Printf – gets and puts functions.

### **UNIT – V**

#### **Applications of C-Programming:**

- Basic Structure of C-Programming
- Conversion of temperature from Kelvin to Celsius
- Determination of molecular weight by Rast - Macro method
- Calculation of rate constant using first order rate equation
- Calculation of root mean square, average and most probable velocities of molecules
- Calculation of Bohr radius
- pH determination using Henderson equation
- Determination of half life and average life of a radioactive nucleus

- Determination of van der Waals constants
- Determination of lattice energy of a Crystal using Born-Landé equation

**TEXT BOOKS:**

1. Andrews Tenenbaum – “Computer Networks” – 4th Edition – Prentice-Hall of India Pvt.Ltd. – New Delhi -110 001.
2. E. Balagurusamy – “Programming in ANSI C” 3rd Edition – Tata McGraw-Hill- New Delhi.
3. K.V. Raman, “Computer Applications in Chemistry” Tata McGraw-Hill- NewDelhi. 2000.

UNIT I : Text Book 1

UNIT II : Text Book 1

UNIT III : Text Book 1

UNIT IV : Text Book 2

UNIT V : Text Book 2,3

**REFERENCES:**

1. Kishor Arora – “Computer Application in Chemistry” -1st Edition – Anmol Publications Pvt. Ltd.
2. Pundir Ansu Bansal – “Computers for Chemists” -9st Edition –Pragati Prakashan Publication, 2011.
3. Ramesh Kumari, “Computer and their Applications to Chemsirty”-Narosa Publishing House, New Delhi.

## SEMESTER- VI: CORE-XIII

### TRANSITION, INNER TRANSITION ELEMENTS AND COORDINATION COMPOUNDS

Course Code : 17UCH5C13

Max. Marks : 100

Hours/ Week : 5

Internal Marks : 25

Credit : 5

External Marks : 75

#### Objectives:

- To understand the chemistry of transition and inner transition elements
- To understand the theory and applications of coordination compounds

#### UNIT – I

15 hours

#### TRANSITION ELEMENTS AND THEIR PROPERTIES

- 1.1 **Transition Elements:** General characteristics of I B – VII B group metals – electronic configuration – variable oxidation states – tendency to form complexes – standard electrode potential – colour – magnetic properties and catalytic properties.
- 1.2 Preparation, properties and uses of  $\text{TiO}_2$ ,  $\text{V}_2\text{O}_5$ ,  $\text{Cr}_2\text{O}_3$ .
- 1.3 \*Preparation, properties and uses of  $\text{ZnCl}_2$  and  $\text{HgCl}_2$ .#

#### UNIT – II

15 hours

#### INNER-TRANSITION ELEMENTS AND SOME SPECIAL COMPOUNDS

- 2.1 **Lanthanides:** Properties of lanthanides - electronic configurations - oxidation states ionic radii - lanthanide contraction – colour - magnetic properties - separation of lanthanides.
- 2.2 **Actinides:** Actinide contraction – Trans-uranium elements - properties of actinides - oxidation states - colour of ions - formation of complexes - comparison with lanthanides.
- 2.3 **Some special compounds** - clathrates - examples and structures - Interstitial and non - stoichiometric compounds. Applications of phosphazenes. Beryl, asbestos, talc, mica, zeolites and ultramarines – composition, structure and uses

#### UNIT – III

15 hours

#### COORDINATION CHEMISTRY

- 3.1 **Coordination compounds:** Definition, Ligands – Classification- based on charge and denticity, IUPAC nomenclature.
- 3.2 **Theories of coordination compounds:** #Werner's theory, Sidgwick and Pauling's theory, limitations of Pauling theory#. Crystal field theory – splitting of d-orbitals in  $O_h$ ,  $T_d$  and square planar complexes – CFSE of weak and strong fields – Factors affecting  $10 Dq$ .
- 3.3 Organo metallic compounds of alkenes, alkynes and cyclopentadiene.

## UNIT – IV

15 hours

### ISOMERISM AND STABILITY OF COMPLEXES

- 4.1 **Isomerism in coordination compounds** – \*Stereoisomerism – Geometrical and optical isomerism in 4 and 6 coordination compounds – Distinction between cis and trans-isomers\*.
- 4.2 **Stability of complexes in aqueous solution** – Thermodynamic and kinetic stability, Stability and instability constants.
- 4.3 **Substitution reaction- SN<sup>1</sup> and SN<sup>2</sup> Reactions** in Oh complexes –in square planar complexes. Trans effect and its applications.
- 4.4 **Chelates** – Characteristics – Classification –Factors influencing the stability of metal chelates.

## UNIT – V

15 hours

### CARBONYLS AND NITROSYLS

- 5.1 **Metal carbonyls:** Mono and polynuclear carbonyls of Ni, Fe, Cr, Co and Mn – Preparation and properties – Application of EAN rules.
- 5.2 **Nitrosyls:** Classification, preparation and properties. Sodium nitroprusside – Preparation, properties and uses.
- 5.3 **Analytical application of coordination complexes** – Detection of K<sup>+</sup> ions – Separation of Cu<sup>2+</sup> and Cd<sup>2+</sup> ions – Estimation of Ni<sup>2+</sup> ions using DMG and Al<sup>3+</sup> using oxine -structure of EDTA and its complexes – Applications.
- 5.4 **Biologically important coordination compounds** - Chlorophyll, Haemoglobin, Vitamin B<sub>12</sub> - Structure and function.
- # \_\_\_\_\_ # Self Study

### TEXT BOOKS:

1. R.D Madan – “Modern Inorganic Chemistry” S. Chand & Co Pvt Ltd. 1987.
2. P.L. Soni – “Text book of Inorganic Chemistry. S. Chand & Co., New Delhi, 1999.

UNIT I: Text Book 1,2

UNIT II: Text Book 1,2

UNIT III: Text Book 1,2

UNIT IV: Text Book 1,2

UNIT V: Text Book 1,2

### REFERENCES:

1. B.R. Puri and L.R. Sharma – “Principles of Inorganic Chemistry” , Shoban Lal, Nagin Chand and Co., New Delhi ,2000.



## SEMESTER- VI: CORE-XIV

### STEREOCHEMISTRY AND MOLECULAR REARRANGEMENTS

**Course Code : 17UCH6C14**  
**Hours/ Week : 5**  
**Credit : 5**

**Max. Marks : 100**  
**Internal Marks : 25**  
**External Marks : 75**

#### Objectives:

- ❖ *To understand the concepts of stereochemistry and conformational analysis.*
- ❖ *To learn the various types of rearrangements and their mechanisms.*
- ❖ *To study about the reactions of polynuclear hydrocarbons and petroleum*
- ❖ *To learn the characteristics and reactions of natural products*

#### UNIT – I

**15 hours**

##### STEREOCHEMISTRY – I

- 1.1 Stereoisomerism – Definition, classification, Optical isomerism, optical activity, conditions for optical activity, asymmetric centre. Definition of Chirality and prochirality.
- 1.2 <sup>#</sup>Optical activity of lactic acid and tartaric acid<sup>#</sup> - enantiomers and diastereomers, racemic mixture – resolution – chemical and biochemical resolutions. Racemization, asymmetric synthesis and Walden inversion.
- 1.3 Optical activity of compounds containing no asymmetric carbons – Biphenyls, allenes and spiranes.

#### UNIT – II

**15 hours**

##### STEREOCHEMISTRY - II

- 2.1 D,L-Configuration, R,S-Notations – Cahn, Ingold and Prelog rule, Erythro and Threo representations. Fischer, Sawhorse and Newmann projection formulae of compounds containing two asymmetric carbon atoms.
- 2.2 Geometrical Isomerism: Cis-trans, syn-anti and E-Z notations, <sup>#</sup>Geometrical isomerisms of Maleic and Fumaric acids<sup>#</sup> and unsymmetrical ketoximes, methods of determination of the configuration of geometrical isomers.
- 2.3 Conformational analysis – Definition, conformations of ethane and n-butane and their stability. Conformations of cyclohexane and energy profile diagram.

#### UNIT – III

**15 hours**

##### MOLECULAR REARRANGEMENTS

- 3.1 Pinacole-Pinacolone, Beckmann, Benzidine, Curtius, Hofmann and Benzilic acid rearrangements with mechanisms.
- 3.2 Claisen, para-Claisen, Dienone-phenol, Fries, Favorskii and Wolff rearrangements with mechanisms.

#### UNIT – IV

15 hours

#### POLYNUCLEAR HYDROCARBONS AND PETROLEUM

- 4.1 **Polynuclear hydrocarbons:** Naphthalene, anthracene and phenanthrene – resonance structures, preparation by Haworth synthesis, properties - oxidation, reduction, sulphonation, nitration, halogenations and uses.
- 4.2 **Petroleum:** Thermal and catalytic process of cracking, synthetic petrol-Fischer Tropsch's Process, Bergius process, flash point, fire point, smoke point, knocking, octane number, cetane number, anti-knocking reagents and power alcohol.

#### UNIT – V

15 hours

#### ALKALOIDS AND TERPENOIDS

- 5.1 **Alkaloids:** Classification – General methods of isolation, Hofmann exhaustive methylation, Structural elucidation of coniine, nicotine and piperine.
- 5.2. **Terpenoids:** Classification, Isoprene rule, special isoprene rule, gem - dialkyl rule, Structural elucidation and uses of citral,  $\alpha$ -terpineol and menthol.

#### TEXT BOOKS:

- 1 Dr. Jagadamba Singh – “Undergraduate Organic Chemistry” UGC Curriculum Vol-I & Vol-II, Pragati Ed., (2007) – Pragati Prakashan, Meerut.
- 2 M.K.Jain and S.C.Sharma, “Organic Chemistry for B.Sc students of Indian universities” – Vishal Publications.
- 3 V.K. Ahluwalia “Text book of organic chemistry” Vol.-I & Vol.-II (2010) Ane's Student edition, New Delhi.
- 4 Gurdeep Chatwal- Organic chemistry of natural products-Vol –I & II, revised 5<sup>th</sup> edition (2005) Himalaya publishing house.  
UNIT I: Text Book 1,2,3  
UNIT II: Text Book 1,2,3  
UNIT III: Text Book 1,2,3  
UNIT IV: Text Book 1,2,3  
UNIT V: Text Book 4

#### REFERENCES:

1. P.S. Kalsi – “Stereochemistry conformation and mechanism” – 6<sup>th</sup> Ed., (2005), New Age International (P) Ltd., New Delhi.
2. Bahl and Arun Bahl – “Advanced Organic Chemistry” – 19<sup>th</sup> Ed., (2005) – Sulthan and Chand company, New Delhi.
3. Raj K. Bansal – “A Text Book of Organic Chemistry” – Revised 4<sup>th</sup> Ed., (2005) - New Age International Publishers, New Delhi.
4. I.L. Finar – “Stereochemistry and the Chemistry of Natural Products” – Vol. II, 5<sup>th</sup> Ed., (2006), Dorling Kindersley (India) Pvt. Ltd.

**SEMESTER- VI: CORE-XV**  
**MOLECULAR SPECTROSCOPY AND ELECTROCHEMISTRY**

**Course Code : 17UCH6C15**

**Hours/ Week : 5**

**Credit : 5**

**Max. Marks : 100**

**Internal Marks : 25**

**External Marks : 75**

**Objectives:**

- *To study the fundamentals of various spectroscopy*
- *To understand the concept and applications of electrolytic conductance and electrochemical cells*

**UNIT – I**

**15 hours**

**ATOMIC STRUCTURE AND SPECTROSCOPY**

- 1.1. de-Broglie theory of matter, #experimental proof, Heisenberg's uncertainty principle#, derivation of Schrodinger wave Equation, significance of  $\Psi$  and  $\Psi^2$ .
- 1.2. Electromagnetic radiations – Definition, regions of electromagnetic radiations, quantization of energies in molecules - Translational, rotational, vibration, and electronic energies, molecular spectra - origin of molecular spectra - Interaction of electro-magnetic radiations with molecules.
- 1.3 UV-Visible spectroscopy – Theory of electronic spectroscopy, Frank – Condon Principle, types of electronic transitions – Dissociation and Pre-dissociation spectra- Application to geometrical isomerism (maleic and fumaric acids, cis & trans stilbenes).

**UNIT – II**

**15 hours**

**ABSORPTION MOLECULAR SPECTROSCOPY**

- 2.1. Microwave spectroscopy - Molecular rotation, theory of microwave spectroscopy, selection rule, effect of isotopic substitution and calculation of moment of inertia and bond length of diatomic molecules.
- 2.2. Infrared spectroscopy – Theory of IR spectra- Harmonic oscillators-Molecular vibration – Modes of vibration of diatomic, tri-atomic linear( $\text{CO}_2$ ) and non linear ( $\text{H}_2\text{O}$ ) molecules - Stretching and bending vibrations, selection rules, expression for vibration frequency, Hook's law - calculation of force constant- Applications of IR spectra – (Group frequencies, finger print region and Hydrogen bonding only).
- 2.3. Raman spectroscopy – #Raman Effect, Rayleigh and Raman scattering#– Stokes and anti-stokes lines - Modes of vibrations and change in polarisability of  $\text{H}_2\text{O}$  and  $\text{CO}_2$ , mutual exclusion principle, comparison between Raman and IR spectroscopy.

**UNIT – III**

**15 hours**

**RESONANCE AND MASS SPECTRA**

- 3.1. NMR spectroscopy - Magnetic and non-magnetic nuclei, principle of nuclear magnetic resonance - shielding mechanism, chemical shift, factors affecting chemical shifts (electro negativity and anisotropic effect) - number of signals – proton counting - Spin-spin coupling, coupling constant, NMR spectrum of ethyl alcohol.

- 3.2. ESR spectroscopy - theory of ESR spectra, hyperfine splitting, ESR spectra of hydrogen and methyl radicals – comparison of NMR and ESR.
- 3.3. Mass spectroscopy- Basic principle, <sup>#</sup>molecular ion peak, base peak, isotopic peaks, meta stable peaks<sup>#</sup>, ring rule and nitrogen rule - mass spectra of toluene and branched alkanes..

#### UNIT – IV

**15 hours**

##### **ELECTROLYTIC CONDUCTANCE AND TRANSFERENCE**

- 4.1. Ohm's law – conductance in metals and electrolytic solution – Specific conductance – equivalent conductance – Effect of temperature and dilution on conductance, Kohlrausch law and its applications – <sup>#</sup>Arrhenius theory of electrolytic dissociation and its limitations – Weak and strong electrolytes according to Arrhenius theory<sup>#</sup> - Ostwald's dilution law, its uses and its limitations- Elementary treatment of Debye -Huckel theory of strong electrolytes.
- 4.2. Ionic mobility-definition, experimental proof for migration of ions, Transport number – definition, Hittorf's rule, Determination of transport number by Hittorf's method and moving boundary method – effect of concentration on transport number.
- 4.3. Conductometric titrations- Principle, types (acid-base and precipitation only) and advantages. (Problems from 4.1)

#### UNIT – V

**15 hours**

##### **ELECTROMOTIVE FORCE OF GALVANIC CELLS**

- 5.1. Galvanic cell – Definition, <sup>#</sup>chemical cell, concentration cell, reversible cell and irreversible cell<sup>#</sup>, types of reversible electrodes – Metal-metal ion electrodes, amalgam electrodes, gas electrodes, metal-insoluble metal salt electrode and oxidation - reduction electrode, single electrode potential.
- 5.2. E.M.F. of galvanic cell and cell reaction – Cell e.m.f., sign conventions of cell e.m.f. and cell reaction, Nernst equation for cell e.m.f., reference electrode – primary and secondary reference electrode, standard electrode potential and its determination, electro chemical series, standard cell,
- 5.3. Thermodynamics of galvanic cells – Relation between E.M.F. and  $\Delta G$ ,  $\Delta H$ ,  $\Delta S$  and equilibrium constant (K), concentration cells – Electrode concentration cells – Amalgam and gas concentration cells, electrolyte concentration cells - Concentration cells without transference and its e.m.f., concentration cells with transference and its e.m.f., liquid junction potential.

(Problems from 5.2 and 5.3)

# \_\_\_\_\_ # Self study

**TEXT BOOKS:**

1. C. N. Banwell and E. M. Mccash, "Fundamentals of Molecular Spectroscopy", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2009.
2. B. R. Puri, L. R. Sharma and M. S. Pathania, "Principles of Physical Chemistry", Vishal Publications, Jalandhar. 2005.

UNIT I: Text Book 1,2

UNIT II: Text Book 1,2

UNIT III: Text Book 1,2

UNIT IV: Text Book 2

UNIT V: Text Book 2

**REFERENCES:**

1. Manas Chanda, "Structure and Chemical Bonding including Molecular spectra", Tata Mc-Graw Hill Publishing Company Ltd., New Delhi, 2000.
2. G. M. Barrow, "Introduction to Molecular Spectroscopy", Tata-McGraw- Hill Edition, 1993.
3. N. Kundu and S. K. Jain, "Physical Chemistry", S. Chand and Co. Ltd., New Delhi, 1998.
4. J. N. Gurtu and A. Gurtu, "Advanced Physical Chemistry", Pragathi Prakashan, Meerut, 2007.
5. R. L. Madan and G. D. Tuli, "Simplified Course in Physical Chemistry", 5<sup>th</sup> revised and enlarged edition, S. Chand & Co., New Delhi, 2009.

**SEMESTER –VI: MAJOR BASED ELECTIVE-II**  
**ESSENTIAL MOLECULES FOR LIFE**

**Course Code: 17UCH6M2A**  
**Hours/Week: 5**  
**Credit: 4**

**Max. Marks :100**  
**Internal Marks: 25**  
**External Marks: 75**

**Objectives:**

- *To impart the knowledge on chemistry of proteins, carbohydrates, vitamins, enzymes and nucleic acid*
- *To understand the importance of the enzymes and hormones*

**UNIT-I**

**15 hours**

**Amino acids, peptides and proteins**

- 1.1 Amino acids** - nomenclature, classification, synthesis of  $\alpha$ -amino acids, Zwitter ion, iso electric point, reactions of carboxyl group, amino group and both.
- 1.2 Peptides** - nomenclature, determination of structure-end group analysis, synthesis of peptides - Sheehan method, solid-phase method.
- 1.3 Proteins** - classification, properties, colour tests - Biuret, ninhydrin, niroprusside, Millon, Hopkins - Coke tests. Structure-primary and secondary structures, uses of proteins.

**UNIT-II**

**15 hours**

**Carbohydrates**

- 2.1 Carbohydrates** – classification - glucose- structure elucidation, cyclic structure - pyranose and furanose forms, determination of ring size, muta rotation-mechanism, reactions of open chain aldehyde form and uses.
- 2.2 Fructose** - occurrence, preparation, structure elucidation, reactions and uses. Inter conversion of aldoses to ketoses.
- 2.3 Disaccharides** - sucrose and maltose - properties, structure elucidation and uses.
- 2.4 Polysaccharides**-starch and cellulose - structure (elucidation not required) - properties and uses.

**UNIT –III**

**15 hours**

**Vitamins**

- 3.1 Vitamins** - Introduction, source, pro-vitamin, general properties of vitamins, classification, discovery, source, properties, functions and deficiency symptoms of vitamins A, D, E, K, B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub>, B<sub>5</sub>, B<sub>6</sub>, B<sub>7</sub>, B<sub>9</sub>, B<sub>12</sub>, C and H.
- 3.2** Structural elucidation of retinol, pyridoxine, niacin, ascorbic acid, biotin and phyloquinone.

## UNIT – IV

15 hours

### Enzymes and hormones

- 4.1 **Enzymes** - nomenclature - based on substrate, reaction, substrate and reaction, synthesis, discoverer, enzyme commission and E.C. Number, classification of enzymes, chemical nature, factors affecting rate of enzyme action, specificity of enzyme action, mechanisms of enzyme action-lock and key, induced fit hypothesis, biological functions of enzymes, applications of enzymes- therapeutic, analytical, industrial uses.
- 4.2 **Co-enzymes** - introduction, salient features, mechanism of co-enzyme action, classification, some common co-enzymes- NAD, FAD, CoA (structure is not required)
- 4.3 **Hormones** - introduction, properties and functions, structure and physiological functions of some hormones - Adrenaline, nor-adrenaline, thyroxine, oxytocin, insulin, vasopressin, androsterone, oestrone and progesterone.

## UNIT – V

15 hours

### Nucleic acids

- 5.1 **Nucleic Acids** - introduction carbohydrates and heterocyclic bases in nucleic acids, nucleosides, nucleotides, types of nucleic acids - Watson and Crick model of DNA, structural variation in DNA
- 5.2 **Replication of DNA** - types of replication - semi conservative, conservative and dispersive methods, enzymes involved in DNA replication – DNA polymerases, DNA ligase, functions of DNA.
- 5.3 **RNA** – Types of RNA- mRNA, tRNA and rRNA, functions of RNA, biological functions of nucleic acids - comparison of DNA and RNA.

### TEXT BOOKS:

1. P. L. Soni, H. M. Chawla, Text book of organic chemistry, Sultan Chand and Sons, New Delhi, 1997.
2. O. P. A garwal, Chemistry of organic natural products, Goel publishing house, Meerut.
3. Dulsy Fatima, L.M.Narayanan, R.P.Meyyan, K.Nallasingam,S. Prasannakumar and N.Arumugam, Biochemistry, Saras Publication, Nagercoil, 2013.

Unit I: TEXT BOOK 1

Unit II: TEXT BOOK 1

Unit III: TEXT BOOK 2,3

Unit VI: TEXT BOOK 2,3

Unit V: TEXT BOOK 2,3

### REFERENCES:

1. B. S. Bahl and Arun Bahl, Advanced organic chemistry, S. Chand & company, New Delhi, 1990.
2. M.K. Jain, S. C. Sharma, Organic Chemistry, Shoban Lal Nagin Chand & co., Jalandhar, 1998.

**SEMESTER –VI: MAJOR BASED ELECTIVE-II  
ESSENTIALS OF BIOINORGANIC CHEMISTRY**

**Course Code: 17UCH6M2B**  
**Hours/Week: 5**  
**Credit: 4**

**Max.Marks :100**  
**Internal Marks : 25**  
**External Marks : 75**

**UNIT – I** **15 hours**  
**METAL IONS IN BIOLOGICAL SYSTEM**

Essential and trace metals-classification, functions of elements basis of their action in biological system –metal storage and transport, oxygen binding metallo-biomolecules, electron carriers, non protein metal transport.

**UNIT – II** **15 hours**

**ROLE OF METAL IONS IN BIOLOGICAL PROCESS**

Division of metals in biology, role of sodium, potassium, calcium, magnesium, zinc, nickel, manganese iron, cobalt, copper, molybdenum, vanadium and chromium.

**UNIT – III** **15 hours**

**BIOENERGETICS AND ATP CYCLE**

Biological energy, ATP cycle, DNA polymerization, Watson and Crick model, replication of DNA, prokaryotic DNA polymerase-DNA polymerase(I), DNA polymerase(II), DNA polymerase(III), proof reading and DNA repair-Glucose storage- glycogenesis, glycogenolysis, Gluconeogenesis, catabolism.

**UNIT – IV** **15 hours**

**TRANSPORT AND STORAGE OF DIOXYGEN**

Haemoglobin-structure- Heme, globin. Function. myoglobin, functions. iron in hae moglobin and myoglobin, kinetics of haemoglobin and myoglobin- oxygenation, conformational changes, transport of carbondioxide, Bohr effect. Hemoglobin modeling.

**UNIT – V** **15 hours**

**ELECTRON TRANSFER IN BIOLOGY**

The electron transport system-components involved in electron transport chain-substrate dehydrogenases, flavoproteins, quinones, plastoquinones, cytochromes. Mechanism of action of cytochrome C, cytochrome P<sub>450</sub>, special functions of cytochrome in cellular electron transport. Iron-Sulphur proteins-rubredoxin, ferredoxin.



## **TEXT BOOK**

- 1) Neerja Gupta and Monal singh, Essentials of bioinorganic chemistry, Pragati Prakashan 5<sup>th</sup>edn, Meerut, 2014.

Unit I: TEXT BOOK 1

Unit II: TEXT BOOK 1

Unit III: TEXT BOOK 1

Unit VI: TEXT BOOK 1

Unit V: TEXT BOOK 1

## **References:**

- 1) James E.Huheey, Ellen A Keiter, Richard L-Keiter,  
Inorganic chemistry: Principles of structure and reactivity; 4<sup>th</sup> edn, Pearson education.
- 2) Stephen J.Lippard, Jeremy M Berg, Principles of Bioinorganic chemistry, Panimalar Publishing corporation.

**SEMESTER-VI : EXTRA CREDIT COURSE-II**  
**PHOTOCHEMISTRY AND RADIATION CHEMISTRY**

**Course Code : 17UCH6EC2**

**Hours/Week : --**

**Credit : 4\***

**Max. Marks : 100\***

**Internal Marks : --**

**External Marks : 100\***

**Objective:**

- *To understand the fundamentals of photochemistry and radiation chemistry*

**UNIT – I**

Introduction – Photochemical reaction, thermal reactions – Differences between thermal and photochemical reactions, Laws of photochemistry – Lambert law, Beer's law, Lambert – Beer's law, Grothus - Draper's law, Einstein's law of photochemical equivalence. Quantum yield – Experimental determination of quantum yield – High quantum yield reactions, low quantum yield reactions. Primary and secondary process, reasons for high and low quantum yield. Factors affecting the quantum yield.

**UNIT – II**

Jablonski diagram – Non radioactive transition, radioactive transition – Luminescence – Fluorescence, phosphorescence, Application of Fluorescence and phosphorescence. Quenching of fluorescence – Stern – Volmer equations. Factors affecting quenching of fluorescence, chemiluminescence, Bioluminescence.

**UNIT – III**

Kinetics of some important photochemical reactions – Dissociation of HI, Formation of HCl, formation of HBr, photolysis of acetaldehyde, Dimerisation of anthracene (Derivations required).

**UNIT – IV**

Photochemical reactions of transition metals – Substitution reaction, redox reactions. Photo sensitisation – Photosynthesis in plants, Excimers, Exciplexes, Atmospheric photochemistry, photochemistry formation of smog.

**UNIT – V**

Radiation chemistry – Definition – Examples - comparison of photochemistry and radiation chemistry – Source of high energy radiation with matter. Unit of Radiation energy – Curie, Rad, Gray, Rontgen, RBE. Chemical dosimeter – Fricke dosimeter, ceric sulphate dosimeter – Radiolysis of water – Ionic products – Free radical products – Hydrated electron – Properties of hydrated electron.

**TEXT BOOKS:**

1. B.R. Puri, L.R. Sharma, Madan S. Pathania, Principles of Physical Chemistry, Vishal Publications, Jalandhar, 2004.
2. N. Kundu and S.K. Jain, "Physical Chemistry", S. Chand & Company Ltd. 2000.

UNIT I : Text Book 1

UNIT II : Text Book 1,2

UNIT III : Text Book 1,2

UNIT IV : Text Book 1,2

UNIT V : Text Book 1,2

**REFERENCES:**

1. Gurdeep Raj "Photochemistry", Goel Publishing House, Meerut, 2009.
2. B.S. Bahl, G.D. Tuli and Arun Bahl, "Essentials of Physical Chemistry", S.Chand & Co., New Delhi, 1999.

**SEMESTER- I: ALLIED -I (For B.Sc., Physics)**  
**INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY – I**

**Course Code : 17UCH1A1:1**  
**Hours/ Week : 5**  
**Credit : 4**

**Max. Marks : 100**  
**Internal Marks : 25**  
**External Marks : 75**

**Objectives:**

- *To understand the concept of periodic properties and molecular orbital theory.*
- *To know the chemistry of biomolecules.*
- *To study the concept of stereochemistry electrochemistry and photochemistry.*
- *To learn the principles of separation techniques.*

**UNIT – I**

**15 hours**

**PERIODIC PROPERTIES, MOLECULAR ORBITAL THEORY AND INDUSTRIAL CHEMISTRY**

- 1.1. **Periodic properties-** Ionization potential, electron affinity and electro negativity-Definition, factors affecting and variation in the periodic table.
- 1.2. **Molecular Orbital Theory:** LCAO, Bonding, anti-bonding orbital and bond order. MO diagrams of H<sub>2</sub>, He<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub> and F<sub>2</sub> molecules
- 1.3. **Industrial Chemistry:** Fuel gases – Water gas, Producer gas, LPG, Gobar gas and Natural gas. Fertilizers – NPK and mixed fertilizers. Soap and detergents – An elementary idea of soap and detergent, Cleansing action of soap and detergents<sup>#</sup>.

**UNIT – II**

**15 hours**

**CARBOHYDRATES, PROTEINS AND NUCLEIC ACIDS**

- 2.1. **Carbohydrates:** Classification. Glucose and fructose – Preparation and properties. Sucrose – Manufacture and properties. Starch and cellulose – Structure and uses.
- 2.2. **Amino Acids and Proteins:** Amino acids – Definition, classification, preparation and Properties - Peptides (Elementary treatment) – Proteins – Classification based on physical properties and biological functions.
- 2.3. **Nucleic acids:** DNA and RNA – functions - **#Structure of DNA and RNA#.**

**UNIT – III**

**15 hours**

**POLYMERS, HETEROCYCLIC COMPOUNDS AND STEREOISOMERISM**

- 3.1. **Polymers** – Definition, classifications of polymers – Natural and synthetic polymers, Inorganic and organic polymers, Thermo and thermosetting plastics. Addition and condensation polymerization. Preparation, properties and uses of polyethylene, PVC, Teflon, polyester, nylon 6, 6, and Bakelite.
- 3.2. **Heterocyclic compounds** – Furan, thiophene, and pyridine – Preparation, properties and uses.
- 3.3. **Stereoisomerism:** Optical isomerism – lactic and tartaric acid, Racemic mixture and resolution, Geometrical isomerism – maleic and fumaric acid, methods of determining geometrical isomerism.

**UNIT – IV****15 hours****CHROMATOGRAPHY, PHOTOCHEMISTRY AND PHASE RULE**

- 4.1 **Chromatography** – Definition, classification- Adsorption, Partition and Thin layer principles chromatography - Principle.
- 4.2 **Photochemistry**: Differences between thermal and Photochemical reactions, photochemical laws – Grothus-Draper’s law, Einstein’s law of photo chemical equivalence, Quantum efficiency, Lambert’s law, Beer’s law – derivation,
- 4.3 **Phase Rule**: Phase, Component, Degree of freedom, Phase Rule – definition, one component system –Water system.

**UNIT – V****15 hours****CONDUCTANCE, CORROSION, pH AND BUFFER**

- 5.1. **Conductance**: Ionic conductance, electrolytic conductance, specific and equivalent conductance – their determination, Effect of dilution on conductivities, An elementary idea about ionic theory, Ostwald’s dilution law and Kohlrausch’s law, conductometric titrations- Principle, applications (Strong acid vs Strong base and Weak acid and Weak base) and advantages.
- 5.2. **Corrosion**: Definition, types, wet and dry corrosion and preventive of corrosion.
- 5.3. **pH and Buffer**:  
#pH, buffer solution#, Henderson-Hasselbalch equation and its importance (no derivation)- Biological importance of pH and Buffer solutions in living system.

# \_\_\_\_\_ # Self study

**Text books**

1. P.L. Soni – “Text book of Inorganic Chemistry. S. Chand & Co., New Delhi (1999).
2. P.L. Soni and H.M. Chawla – “Text Book of Organic Chemistry” – 28<sup>th</sup> Edition, (1999) - Sulthan and Chand company, New Delhi.
3. B.R. Puri, L.R. Sharma and M.S. Pathania, “Principles of Physical Chemistry”, Vishal Publications, Jalandhar, 2002.

UNIT I: Text Book 1

UNIT II: Text Book 2

UNIT III: Text Book 2

UNIT IV: Text Book 3

UNIT V: Text Book 3

**References:**

1. Bahl and Arun Bahl – “Advanced Organic Chemistry” – 19<sup>th</sup> Edition., (2005) – Sulthan and Chand company, New Delhi.
2. M.K. Jain – “Organic Chemistry” – 12<sup>th</sup> Ed., (2003) Sulthan and Chand Company, New Delhi.
3. R.L. Madan, G.D. Tuli, “Simplified Course in Physical Chemistry”, 5<sup>th</sup> revised and enlarged edition, S.Chand & Co., New Delhi, 2009.

**SEMESTER- II: ALLIED -III (For B.Sc., Physics)**  
**INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY – III**

<b>Course Code : 17UCH2A3:1</b>	<b>Max. Marks : 100</b>
<b>Hours/ Week : 4</b>	<b>Internal Marks : 25</b>
<b>Credit : 3</b>	<b>External Marks : 75</b>

**Objectives:**

- *To study the chemistry of coordination compounds and metallic bond.*
- *To have knowledge of types for organic reaction and chemotherapy.*
- *To study the importance of colloids.*
- *To know the concept of chemical equilibrium and catalysis.*

**UNIT – I**

**12 hours**

**COORDINATION CHEMISTRY AND METALLIC BOND**

**1.1. Coordination Chemistry:**

Nomenclature of mononuclear complexes – Werner, Sidgwick and Pauling's Theory.  
Biological role of Haemoglobin and Chlorophyll.

**1.2. Metallic Bond:**

Electron gas, Pauling and Band Theories. Semiconductors – Intrinsic and Extrinsic, n and p-type super conductors.

**UNIT – II**

**12 hours**

**ELECTRON DISPLACEMENT EFFECTS, AROMATICITY AND SUBSTITUTION REACTIONS**

**2.1. Electron Displacement Effects-** Inductive effect – relative strengths of aliphatic acid and alkyl amines, resonance – condition for resonance, consequences of resonance, hyper conjugation – definition and examples- steric effect.

**2.2. Aromaticity** – Conditions – Huckel's rule - aromaticity of benzene, furan, thiophene, pyrrole and pyridine.

**2.3. Substitution reactions-** mechanism of nitration, halogenation, sulfonation, # Friedel Crafts alkylation and acylation of benzene#.

**UNIT – III**

**12 hours**

**CHLORO COMPOUNDS, CHEMOTHERAPY AND NAME REACTIONS**

**3.1. Chloro compounds:** Preparation and uses of Dichloromethane, Chloroform, Carbon tetrachloride, Freons, DDT and BHC.

- 3.2. **Chemotherapy:** Sulpha drugs-structure, preparation and uses of sulphapyridine, sulphathiazole and sulphadiazine, Antibiotics –Structure and uses of penicillin–G and **#Chloromycetin#**.
- 3.3. **Name reactions:** Benzoin, Perkin, Cannizaro, Reimer-Tiemann and Kolbe’s reactions. (Mechanism not necessary)

#### UNIT – IV

12 hours

##### SOLID STATE AND COLLOIDS

- 4.1 **Solid State:** Types of solids- crystalline and amorphous, unit cell, simple, body centered and face centered cubes, symmetry elements, seven crystal systems, Bragg’s equation, Weiss indices and Miller indices,
- 4.2. **Colloids:** Definition, differences between true solution, colloidal solution and suspension, principle, applications -Electrical properties – Electrophoresis and Electro osmosis (definition and uses only) - protection of colloids – Gold number- medicinal applications of colloids.
- 4.3. **Emulsion and Gels:** definition, types, preparation, and applications.

#### UNIT – V

12 hours

##### CHEMICAL KINETICS, CHEMICAL EQUILIBRIUM AND CATALYSIS

- 5.1 **Chemical Kinetics:** Order, rate, molecularity of the reaction and rate constant, determination of order of the reaction, activation energy, effect of temperature on reaction rate.
- 5.2 **Chemical Equilibrium:** Criteria of homogeneous and heterogeneous equilibria. Decomposition of HI and  $\text{PCl}_5$
- 5.3 **Catalysis:** Catalysis – Importance of catalysis. Types of catalysis - Homogeneous and heterogeneous catalysis, factors affecting catalysis. Definitions of catalytic promoter, catalytic inhibitor, catalytic poison. Theory of catalysis - Intermediate compound theory. Acid-base and enzyme catalysis- definition and examples.

**#\_\_\_\_\_#** Self study

##### Text books:

1. P.L. Soni – “Text book of Inorganic Chemistry. S. Chand & Co., New Delhi (1999).
2. P.L. Soni and H.M. Chawla – “Text Book of Organic Chemistry” – 28<sup>th</sup> Ed., (1999) - Sulthan and Chand company, New Delhi.
3. B.R. Puri, L.R. Sharma and S. Pathania – Principles of Physical Chemistry: Shoban Lal Nagin Chand and Co., New Delhi

UNIT I: Text Book 1

UNIT II: Text Book 2

UNIT III: Text Book 2

UNIT IV: Text Book 3

UNIT V: Text Book 3

**References:**

1. R. D Madan – “Modern Inorganic Chemistry” (1987), S. Chand & Co Pvt Ltd.
2. A .K. Srivastava – “Organic Chemistry” – 1<sup>st</sup> Ed.,(2002) – New Age International Publishers, New Delhi.
3. B. R. Puri and L.R. Sharma – Principles of Inorganic Chemistry: Shoban Lal Nagin Chand and Co., New Delhi (2000).
4. R.L. Madan, G.D. Tuli, “Simplified Course in Physical Chemistry”, 5<sup>th</sup> revised and enlarged edition, S.Chand & Co., New Delhi, 2009.



**SEMESTER- I: ALLIED -I (For B.Sc., Botany & Zoology)**  
**INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY – I**

**Course Code : 17UCH1A1:2**  
**Hours/ Week : 5**  
**Credit : 4**

**Max. Marks : 100**  
**Internal Marks : 25**  
**External Marks : 75**

**Objectives:**

- *To understand the periodicity of elements and MO theory*
- *To know the important biomolecules*
- *To understand the chemistry of polymers and heterocycles*
- *To know the separation techniques*
- *To study the concepts of acids, bases and catalysis.*

**UNIT – I** **15 hours**  
**PERIODIC PROPERTIES, MOLECULAR ORBITAL THEORY AND INDUSTRIAL CHEMISTRY**

- 1.1 **Periodic properties-** Ionization potential, electron affinity and electro negativity-Definition, factors affecting and variation in the periodic table.
- 1.2 **Molecular Orbital Theory:** LCAO, Bonding, anti-bonding orbital and bond order – application of MO theory to H<sub>2</sub>, He<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub> and F<sub>2</sub> molecules
- 1.3 **Industrial Chemistry:** Fuel gases – Water gas, Producer gas, LPG, Gobar gas and Natural gas. Fertilizers – NPK and mixed fertilizers. Soap and detergents – An elementary idea of soap and detergent, cleansing action of soap and detergents.

**UNIT – II** **15 hours**  
**CARBOHYDRATES, PROTEINS AND NUCLEIC ACIDS**

- 2.1 **Carbohydrates:** Classification, glucose and fructose – preparation, open chain structure and properties - sucrose –manufacture and properties – starch and cellulose – properties and uses.
- 2.2 **Amino Acids and Proteins:** Amino acids – classification, preparation and properties- peptides (Elementary treatment) – proteins –<sup>#</sup> classification based on physical properties and biological functions<sup>#</sup>.
- 2.3 **Nucleic acids:** Types of nucleic acids, primary building blocks of nucleic acids (Chemical composition – DNA and RNA) primary structure of DNA and its double helix.

**UNIT –III** **15 hours**  
**POLYMERS, HETEROCYCLIC COMPOUNDS AND STEREOISOMERISM**

- 3.1. **Polymers** – Definition, Classifications of polymers, Polymerization - Addition and condensation, synthetic polymers- preparation, properties and uses of polyethylene, PVC, Teflon, nylon 6, 6 and polyester.
- 3.2 **Heterocyclic compounds** – Furan, thiophene, and pyridine – Preparation and properties.

3.3 **Stereoisomerism:** Optical isomerism – lactic and tartaric acid, Racemic mixture and resolution, Geometrical isomerism – maleic and fumaric acid, methods of determining geometrical isomerism.

#### UNIT – IV

15 hours

#### SEPARATION AND PURIFICATION TECHNIQUES AND PHOTOCHEMISTRY

- 4.1 **Separation Techniques:** Distillation-steam, fractional and azeotropic distillation, crystallization, – principles, working techniques and applications.
- 4.2 **Chromatography** – principles, experimental techniques and applications of paper, thin layer and column chromatography.
- 4.3 **Photochemistry:** Differences between thermal and photochemical reactions, photochemical laws – Grothus-Draper's law, Einstein's law of photo chemical equivalence, Quantum efficiency, Lambert's law, Beer's law – derivation.

#### UNIT – V

15 hours

#### ACIDS, BASES AND CATALYSIS

- 5.1. **Acids-Bases:** Arrhenius, Lowry-Bronsted and Lewis concepts of acids and bases-pH, buffer solution, Henderson-Hasselbalch equation and its importance (no derivation) -Biological importance of pH and buffer solutions in living system- Determination of pH by colorimetric method.
- 5.2 **Catalysis:** Catalysis – Importance of catalysis. Types of catalysis - Homogeneous and heterogeneous catalysis, factors affecting catalysis. Definitions of catalytic promoter, catalytic inhibitor, catalytic poison. Theory of catalysis - Intermediate compound theory. Definitions of acid-base and enzyme catalysis.

# \_\_\_\_\_ # Self study

#### TEXT BOOKS:

1. P.L. Soni – “Text book of Inorganic Chemistry. S. Chand & Co., New Delhi (1999).
2. P.L. Soni and H.M. Chawla – “Text Book of Organic Chemistry” – 28<sup>th</sup> Edition, (1999) - Sulthan and Chand company, New Delhi.
3. B.R. Puri, L.R. Sharma and M.S. Pathania, “Principles of Physical Chemistry”, Vishal Publications, Jalandhar, 2002.

UNIT I: Text Book 1

UNIT II: Text Book 2

UNIT III: Text Book 2

UNIT IV: Text Book 3

UNIT V: Text Book 3

#### REFERENCES:

1. Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, 23<sup>rd</sup> edition, New Delhi, Shoban Lal, Nagin Chand & Co.,(1993)
2. Jain. M. K. Organic Chemistry 12<sup>th</sup> edition, Sulthan and Chand company, New Delhi.(2003)

**SEMESTER- II: ALLIED -III (For B.Sc., Botany/ Zoology)**  
**INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY – II**

**Course Code : 17UCH2A3:2**

**Hours/ Week : 5**

**Credit : 3**

**Max. Marks : 100**

**Internal Marks : 25**

**External Marks : 75**

**Objectives:**

- *To understand the coordination chemistry*
- *To study about nuclear chemistry, vitamins and chemotherapy*
- *To understand the concepts of enzymes, hormones and colloids*

**UNIT – I**

**12 hours**

**COORDINATION CHEMISTRY**

- 1.1 **Co-ordination compound:** central metal ion, ligand, coordination number, types of ligands, Nomenclature of mononuclear complexes, Werner, Sidgwick and Pauling's Theory, Application of complexes in qualitative and quantitative analysis – detection of potassium ions, separation of mixture of copper and cadmium ions, estimation of nickel and aluminium.
- 1.2 **Biologically important co-ordination compounds:** Haemoglobin and Chlorophyll- structure and biological role.

**UNIT – II**

**12 hours**

**NUCLEAR CHEMISTRY**

- 2.1 **Structure of nucleus** - Composition of nucleus, nuclear forces, nuclear stability-mass defect, binding energy, n/p ratio, and magic numbers, \*Definition of isotopes, isobars, isotones and isomers#
- 2.2 **Radioactivity**- Definition, types of radioactivity, Properties of  $\alpha$ ,  $\beta$  and  $\gamma$  rays: Detection and measurement – Wilson cloud chamber and G.M. Counter, nuclear fusion and fission reactions, applications of radio isotopes – in analytical chemistry, in medicine, rock dating and carbon dating.

**UNIT –III**

**12 hours**

**VITAMINS AND CHEMOTHERAPY**

- 3.1 **Vitamins** – Definition, classification. Sources, functions and deficiency disorders of vitamins A, D, E, K, B<sub>6</sub>, B<sub>12</sub> and C.
- 3.2 **Chemotherapy:** Definition, sulpham drugs - structure, preparation and uses of sulphapyridine, sulphathiazole and sulphadiazine, Antibiotics – Definition, structure and uses of penicillin-G and Chloromycetin.

## UNIT – IV

12 hours

### ENZYMES AND HORMONES

- 4.1 **Enzymes**- Nomenclature- based on substrate, reaction, substrate and reaction, synthesis, discoverer, enzyme commission and E.C. Number, classification of enzymes, chemical nature, factors affecting rate of enzyme action, specificity of enzyme action, mechanisms of enzyme action – lock and key, induced fit hypothesis, biological functions of enzymes, applications of enzymes- therapeutic, analytical, industrial uses.
- 4.2. **Hormones**- introduction, properties and functions, structure and physiological functions of some hormones-Adrenaline, nor-adrenaline, thyroxine, oxytocin, insulin and vasopressin.

## UNIT – V

12 hours

### COLLOIDS

- 5.1. **Colloids**: Definition, differences between true solution, colloidal solution and suspension, phases of colloidal solution-Electrical properties – Electrophoresis and Electro osmosis (definition and uses only) - protection of colloids – Gold number- medicinal applications of colloids.
- 5.2 **Emulsion**: definition, types, preparation, and applications-Emulsifying agents and their importance.
- 5.3. **Gels**: definition, types, preparation, properties and applications.

#\_\_\_\_\_# Self study

### TEXT BOOKS:

1. Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, 23<sup>rd</sup> edition, New Delhi, Shoban Lal, Nagin Chand & Co.,(1993)
2. Dulsy Fatima, L. M. Narayanan, R. P. Meyyan, K. Nallasingham, S. Prasannakumar and N. Arumugam, “Biochemistry”, Saras Publications, Nagercoil, 2013.
3. Puri B.R., Sharma L.R., Pathania M.S., Principle of Physical Chemistry, (23<sup>rd</sup> edition) New Delhi, Shoban Lal, Nagin Chand & Co., (1993)

UNIT I: Text Book 1

UNIT II: Text Book 1

UNIT III: Text Book 2

UNIT IV: Text Book 2

UNIT V: Text Book 3

### REFERENCES:

1. R. D Madan – “Modern Inorganic Chemistry” (1987), S. Chand & Co Pvt Ltd.
2. A .K. Srivastava – “Organic Chemistry” – 1<sup>st</sup> Ed.,(2002) – New Age International Publishers, New Delhi.
3. R. L. Madan and G. D. Tuli, “Simplified Course in Physical Chemistry”, 5th revised and enlarged edition, S.Chand & Co., New Delhi, 2009.

**SEMESTER – I: CORE –II**  
**VOLUMETRIC ANALYSIS - PRACTICAL**

**Course Code :17UCH1C2P**  
**Hours/Week : 3**  
**Credit : 2**

**Max. Marks : 100**  
**Internal Marks : 20**  
**External Marks :80**

**Objectives:**

- *To know the basic principles of volumetric analysis*
- *To understand the concepts of indicators and equivalent weight*

**Titrimetric Quantitative Analysis**

1. Estimation of HCl by NaOH using a standard oxalic acid solution.
2. Estimation of Na<sub>2</sub>CO<sub>3</sub> by HCl using a standard Na<sub>2</sub>CO<sub>3</sub> solution.
3. Estimation of oxalic acid by KMnO<sub>4</sub> using a standard oxalic acid solution.
4. Estimation of Iron (II) sulphate by KMnO<sub>4</sub> using a standard Mohr's salt solution.
5. Estimation of Fe (III) by K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> using a standard Mohr's salt solution (internal and external indicators).
6. Estimation of copper (II) sulphate by Na<sub>2</sub>S<sub>2</sub>O<sub>4</sub>.
7. Estimation of Mg (II) by EDTA.
8. Estimation of Ca (II) by EDTA.

**Scheme of valuation**

Record	-	10 marks
Procedure writing	-	10 marks
Experiment	-	60 marks
1-2%	-	60 marks
2-3%	-	50 marks
3-4%	-	40 marks
>4%	-	30 marks

**Reference:**

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2<sup>nd</sup> edition, New Delhi, Sultan Chand & sons (1997).

**SEMESTER- II: CORE - IV**  
**INDUSTRIAL CHEMISTRY - PRACTICAL**

**Course Code :17UCH2C4P**  
**Hours/Week : 3**  
**Credit : 2**

**Max. Marks : 100**  
**Internal Marks : 20**  
**External Marks :80**

**Objectives:**

- *To compare the experimental and standard values of certain commercial substances*
- *To check the purity of some samples.*

1. Estimation of total hardness of water using EDTA
2. Determination of Iodine value of oil by Hanus method.
3. Determination of saponification value of an oil
4. Estimation of ascorbic acid (Vitamin – C)
5. Determination of percentage purity of washing soda
6. Estimation of available chlorine in bleaching powder
7. Determination of percentage of calcium in lime stone
8. Determination of acid value of an edible oil

**Scheme of valuation**

Record	-	10 marks
Procedure writing	-	10 marks
Experiment	-	60 marks
1-2%	-	60 marks
2-3%	-	50 marks
3-4%	-	40 marks
>4%	-	30 marks

**Reference:**

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2<sup>nd</sup> edition, New Delhi, Sultan Chand & sons(1997).

**SEMESTER- III: CORE - VI**  
**DOMESTIC PRODUCTS PREPARATION AND**  
**FOOD ANALYSIS- PRACTICAL**

**Course Code : 17UCH3C6P**  
**Hours/Week : 3**  
**Credit : 2**

**Max. Marks : 100**  
**Internal Marks :20**  
**External Marks :80**

**Objectives:**

- *To develop self employment skills*
- *To become entrepreneur*

**Preparation of domestic products**

1. Preparation of detergent washing powder
2. Preparation of utensils cleaning powder
3. Preparation of normal shampoo
4. Preparation of room freshener
5. Preparation of liquid blue
6. Preparation of pain relieving balm
7. Preparation of jasmine perfume liquid

**Food analysis**

1. Qualitative analysis for carbohydrates in food samples.
  - a) Disaccharide – Lactose (milk), Sucrose (table sugar)
  - b) Polysaccharide – Starch (rice)
2. Qualitative analysis for protein in given food samples- Casein (milk)
3. Qualitative analysis for minerals in given food samples- Iron (red rice flakes)
4. Estimation of Moisture content in the given sample. (Hot air oven method)
5. Estimation of ascorbic acid in amla and lemon
6. Demonstration of Iron in drumstick leaves.

**Scheme of valuation**

Record : 10 marks  
Procedure writing : 10 marks  
Preparation of Domestic Product : 30 marks

Food Analysis : 30 marks

**Reference:**

1. Hilda Butler, Pouchers- Perfumes, Cosmetics and Soaps, 10<sup>th</sup> Edition, Springer, New Delhi, 2007.

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**SEMESTER- IV: CORE - VIII**  
**INORGANIC QUALITATIVE ANALYSIS – PRACTICAL**

**Course Code : 17UCH4C8P**  
**Hours/Week : 3**  
**Credit : 2**

**Max. Marks : 100**  
**Internal Marks : 20**  
**External Marks : 80**

**Objectives:**

- *To understand the basic concepts of qualitative analysis*
- *To study the applications of solubility product, common ion effect in group separation*
- *To distinguish interfering and non interfering radicals*

**Semi micro 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 analyzed:** lead, copper, bismuth, cadmium, tin, iron, zinc, manganese, cobalt, nickel, barium, calcium, strontium, magnesium and ammonium.

**Anions to be analysed:** carbonate, sulphide, sulphate, nitrate, chloride, bromide, fluoride, borate, oxalate and phosphate.

**Scheme of valuation**

Record : 10 marks  
Procedure : 10 marks

Experiment : 60 marks

4 radicals correct with suitable tests: 60 marks

3 radicals correct with suitable tests: 50 marks

2 radicals correct with suitable tests: 40 marks

1 radical correct with suitable tests: 20 marks

Spotting: 5 marks

**Reference:**

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2<sup>nd</sup> edition, New Delhi, Sultan Chand & sons (1997).

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**SEMESTER- V: CORE - XII**  
**GRAVIMETRIC ESTIMATION AND PHYSICAL**  
**CONSTANTS DETERMINATION - PRACTICAL**

**Course Code : 17UCH5C12P**  
**Hours/Week : 5**  
**Credit : 5**

**Max. Marks : 100**  
**Internal Marks : 20**  
**External Marks : 80**

**Objectives:**

- *To learn the complex preparation*
- *To study the reagent for separation of metal ions*
- *To know the stoichiometry of the complexes*
- *To study physical constants of solids and liquid organic compounds*

**Gravimetric Estimation:**

**Sintered Crucible**

1. Ni as nickel dimethyl glyoxime
2. Zn as zinc oxinate.
3. Pb as lead chromate.
4. Ba as barium chromate.
5. Ca as calcium oxalate monohydrate

**Silica Crucible**

1. Ca as calcium sulphate.
2. Pb as lead sulphate.
3. SO<sub>4</sub> as barium sulphate

**Determination of physical constants**

Determination of boiling / melting point of given organic compound

**Melting Points:**

1. Acetamide 2. m-dinitrobenzene 3. Benzoic acid 4. Benzamide 5. Urea and 6. Cinnamic acid

**Boiling Points:** 1. Water 2. EMK 3. Ester 4. Toluene and 5. CCl<sub>4</sub>

**Scheme of valuation**

Record	-	10 marks
Procedure writing		10 marks
Gravimetric estimation	-	50 Marks
Physical constant	-	10 marks
<1%	-	50 marks
1-2%	-	40 marks
2-3%	-	30 marks
3-4%	-	20 marks

**Reference:**

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2<sup>nd</sup> edition, New Delhi, Sultan Chand & sons(1997).

## SEMESTER- V: MAJOR BASED ELECTIVE - I

### PHYSICAL CHEMISTRY ELECTRICAL - PRACTICAL

Course Code : 17UCH5M1AP  
Hours/Week : 4  
Credit : 4

Max. Marks : 100  
Internal Marks : 20  
External Marks : 80

#### Objectives:

- To understand the conductometric and potentiometric principles
- To know different types of chemical reaction
- To study electrode potential of single electrodes, EMF

1. Determination of equivalent conductance of a strong electrolyte.
2. Determination of strength of strong acid (HCl) by conductometry using NaOH.
3. Determination of strength of a weak base by conductometry.
4. Determination of strength of  $K_2SO_4$  by conductometry.
5. Determination of strength of a strong acid by potentiometry.
6. Determination of strength of weak acid by potentiometry.
7. Determination of pH of a buffer solution by potentiometry.
8. Determination of strength of Fe (II) ion by potentiometry.

#### Scheme of valuation

Record	-	10 marks
Procedure with formula	-	10 marks
Experiment	-	60 marks
<1%	-	60 marks
1-2%	-	50 marks
2-3%	-	40 marks
3-4%	-	30 marks
>4%	-	20 marks

#### Reference:

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2<sup>nd</sup> edition, New Delhi, Sultan Chand & sons(1997).
2. Daniels et al., Experimental Physical Chemistry, (7<sup>th</sup> edition), New York, McGraw Hill,(1970).
3. Findlay, A., Practical Physical Chemistry, (7<sup>th</sup> edition), London, Longman (1959)

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## SEMESTER- V: MAJOR BASED ELECTIVE - I

### QUANTITATIVE ANALYSIS BY PHOTOMETRIC METHOD - PRACTICAL

Course Code : 17UCH5M1BP  
Hours/Week : 4  
Credit : 4

Max. Marks : 100  
Internal Marks : 20  
External Marks : 80

#### Objectives

- To verify experimentally Beer's law
  - To examine the metal ligand ratio in complex by Job's method
  - To estimate metal ions by colorimetry
- 1) Verification of Beer's law for  $\text{KMnO}_4$  solution.
  - 2) Verification of Beer's law for acidified  $\text{K}_2\text{Cr}_2\text{O}_7$  solution.
  - 3) Verification of Beer's law for ammoniacal solution of  $\text{CuSO}_4$ .
  - 4) Verification of Beer's law for  $\text{FeCl}_3$  solution using  $\text{NH}_4\text{SCN}$ .
  - 5) Determination of Metal-Ligand ratio of  $[\text{Fe}(\text{o-phenanthroline})_3]^{2+}$  complex by Job's method.
  - 6) Determination of Metal-Ligand ratio of ferric-salicyclic acid complex by Job's method.
  - 7) Estimation of Cu by colorimetry.
  - 8) Estimation of Ni by colorimetry.
  - 9) Estimation of Fe by colorimetry.

#### Scheme of valuation

Record	-	10 marks
Procedure with formula	-	10 marks
Experiment	-	60 marks
<1%	-	60 marks
1-2%	-	50 marks
2-3%	-	40 marks
3-4%	-	30 marks
>4%	-	20 marks

#### Reference books:

- 1) A text book on Chemistry Practical by Bidhan Chandra Ray and Satyanarayan Das, New central book agency pvt ltd, Kolkata, 2014.

**SEMESTER- VI: CORE - XVI**  
**ORGANIC ANALYSIS AND PREPARATION - PRACTICAL**

**Course Code : 17UCH6C16P**  
**Hours/Week : 5**  
**Credit : 5**

**Max. Marks : 100**  
**Internal Marks : 20**  
**External Marks : 80**

**Objectives:**

- *To learn the techniques of organic qualitative analysis*
- *To learn the methods of organic compound preparation*

**Organic Qualitative Analysis and Organic Preparation:**

**Organic 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 (Benzoic acid from benzaldehyde)
2. Hydrolysis (Benzoic acid from ethyl benzoate)
3. Nitration (*m*-Dinitrobenzene from nitrobenzene)
4. Bromination(*p*-Bromoacetanilide from acetanilide, Tri-bromoaniline from aniline)
5. Diazotization (Methylorange from aniline)

**Scheme of valuation**

Record	- 10 marks
Procedure	- 10 marks
Organic analysis	- 45 marks
Organic preparation	- 15 marks
Special elements present / absent	- 05 marks
Aromatic/ aliphatic	- 05 marks
Saturated/ unsaturated	- 05 marks
Functional group present	- 15 marks
Derivative	- 15 marks

**Reference:**

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2<sup>nd</sup> edition, New Delhi, Sultan Chand & sons(1997).

**SEMESTER- VI : MAJOR BASED ELECTIVE-III  
PHYSICAL CHEMISTRY NON-ELECTRICAL - PRACTICAL**

**Course Code** 17UCH6M3AP  
**Hours/Week** : 4  
**Credit** : 4

**Max. Marks** : 100  
**Internal Marks** :20  
**External Marks** :80

**Objectives:**

- *To study colligative properties of organic compounds*
- *To understand the concept of chemical equilibrium*
- *To study phase rule and its applications*

**List of Experiments:**

1. Critical Solution Temperature of Phenol –Water system.
2. Effect of impurity (NaCl) on Critical solution Temperature of Phenol –Water system.
3. Determination of Transition Temperature of a salt hydrate.
4. Determination of molecular weight by Rast’s macro method.
5. Determination of  $k_f$  by Rast’s macro method.
6. Phase diagram(Simple eutectic system)
7. Determination of rate constant of acid catalyst hydrolysis of an ester
8. Determination of Partition co-efficient of iodine between water and carbon tetrachloride

**Scheme of valuation**

Record	-	10 marks
Procedure with formula	-	10 marks
Experiment	-	60 marks
Up to 10%	-	60 marks
10-15%	-	45 marks
15-20%	-	35 marks
>20%	-	25 marks

**Reference:**

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R.,Basic principles of Practical Chemistry, 2<sup>nd</sup> edition, New Delhi, Sultan Chand & sons(1997).
2. Daniels et al., Experimental Physical Chemistry, (7<sup>th</sup>edition), New York, McGraw Hill,(1970).
3. Findlay, A., Practical Physical Chemistry, (7<sup>th</sup> edition), London, Longman (1959).

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**SEMESTER- VI : MAJOR BASED ELECTIVE-III  
ADVANCED PHYSICAL CHEMISTRY- PRACTICAL**

**Course Code** 17UCH6M3BP  
**Hours/Week** : 4  
**Credit** : 4

**Max. Marks** :100  
**Internal Marks** :20  
**External Marks** :80

**Objectives:**

- *To gain the advance experimental knowledge in chemical kinetics and adsorption chemistry*
  1. Heat of neutralization of sodium hydroxide and hydrochloric acid by calorimetry.
  2. Determining the order of Saponification of ethyl acetate with sodium hydroxide.
  3. Finding the order of reaction and velocity constant for the inversion of cane sugar by acids.
  4. Determination of the equilibrium constant of the esterification reaction between acetic acid and ethanol.
  5. Determination of equilibrium constant of the keto-enol tautomerism of ethylacetoacetate.
  6. Experimental verification of Freundlich's adsorption isotherm.
  7. Experimental verification of Langmuir adsorption isotherm

**Scheme of valuation**

Record	-	10 marks
Procedure with formula	-	10 marks
Experiment	-	60 marks
Up to 10%	-	60 marks
10-15%	-	45 marks
15-20%	-	35 marks
>20%	-	25 marks

**Reference:**

1. Gurtu-Gurtu, Advanced Physical Chemistry Experiments, 3<sup>rd</sup> Edition, 2007, Pragathi Prakashan Publications, Meerut.

**SEMESTER-I**  
**ALLIED CHEMISTRY II**  
**VOLUMETRIC ANALYSIS PRACTICAL**

**Course Code :17UCH1A2P**  
**Hours/Week : 3**  
**Credit : 2**

**Max. Marks :100**  
**Internal Marks :20**  
**External Marks :80**

**Objectives:**

- *To know the basic principles of volumetric analysis*
- *To understand the concepts of indicators and equivalent weight*

1. Estimation of Sodium Hydroxide	(Na <sub>2</sub> CO <sub>3</sub> X HCl X NaOH)
2. Estimation of Hydrochloric Acid	(H <sub>2</sub> C <sub>2</sub> O <sub>4</sub> X NaOH X HCl)
3. Estimation of Oxalic Acid	(FeSO <sub>4</sub> X KMnO <sub>4</sub> X H <sub>2</sub> C <sub>2</sub> O <sub>4</sub> )
4. Estimation of Ferrous Sulphate	(H <sub>2</sub> C <sub>2</sub> O <sub>4</sub> X KMnO <sub>4</sub> X FeSO <sub>4</sub> )
5. Estimation of KMnO <sub>4</sub>	(K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> X FAS X KMnO <sub>4</sub> )
6. Estimation of Zn by EDTA	(MgSO <sub>4</sub> X EDTA X ZnSO <sub>4</sub> )
7. Estimation of Mg by EDTA	
8. Estimation of Cu by iodometry	(K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> X thio X CuSO <sub>4</sub> )
9. Estimation of Iodine	(K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> X thio X I <sub>2</sub> )

**Scheme of valuation**

Record	-	10 marks
Procedure writing	-	10 marks
Experiment	-	60 marks
1-2%	-	60 marks
2-3%	-	50 marks
3-4%	-	40 marks
>4%	-	30 marks

**Reference:**

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2<sup>nd</sup> edition, New Delhi, Sultan Chand & sons, 1997.

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**SEMESTER-II  
ALLIED CHEMISTRY - IV  
ORGANIC ANALYSIS-PRACTICAL**

**Course Code :17UCH2A4P**  
**Hours/Week : 3**  
**Credit : 2**

**Max. Marks :100**  
**Internal Marks :20**  
**External Marks :80**

**Objectives:**

- *To learn the techniques of organic qualitative analysis*
- *To learn the Nitrogen containing compounds.*

A study of reactions of the following organic compounds:

1. Carbohydrate
2. Amide
3. Aldehyde
4. Ketone
5. Monocarboxylic acid
6. Dicarboxylic acid
7. Amine
8. Monohydric phenol
9. Ester
10. Nitro

**Scheme of valuation**

Record	-	10 marks
Procedure Writing	-	10 marks
Organic analysis	-	60 marks
Special elements present / absent	-	20 marks
Aromatic/ aliphatic	-	10 marks
Saturated/ unsaturated	-	10 marks
Functional group present	-	20 marks

**Reference:**

1. Venkateswaran V. Veerasamy R. Kulandaivelu A. R., Basic principles of Practical Chemistry, 2<sup>nd</sup> edition, New Delhi, Sultan Chand & sons, 1997.

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