

# **THANTHAI HANS ROEVER COLLEGE**

**(Autonomous)**

*Nationally Accredited by NAAC  
UGC Recognized 2(f) and 12(B) Institution  
Affiliated to Bharathidasan University, Tiruchirapalli*

**Perambalur - 621 220, Tamil Nadu, India**



**B.Sc., CHEMISTRY**

**CHOICE BASED CREDIT SYSTEM SYLLABUS**

**SEMESTER PATTERN**

**PG & RESEARCH**

**DEPARTMENT OF CHEMISTRY**

**(2018-2019 ONWARDS)**



ROEVER COLLEGE, PERAMBALUR – 621220

(AUTONOMOUS)

B.Sc. CHEMISTRY – COURSE STRUCTURE UNDER CBCS

(For the candidates admitted from the academic year 2018-2019 onwards)



Sem	PART	Course Code	Course	Title of the Course Paper	Hours/week	Credits	Exam hours	CIA	ESE	Total
I	I	18UT1	Tamil – I	,f;fhy ,yf;fpak;> ftpij> rpWfij> ciueil> ,yf;fpa tuyhW	6	3	3	25	75	100
	II	18UE1	English – I	ProseforEffectiveCommunicationandGrammar	6	3	3	25	75	100
	III	18UCH1CC1	Core Course – I	General Chemistry – I	6	6	3	25	75	100
		18UCH1CP1	Core Practical – I	Volumetric analysis Practical	3	-	-	-	-	-
		18UPH1AC1	First Allied Course – I	Physics – I	4	4	3	25	75	100
		18UPH1AP1	First Allied Course – II	Physics (P)	3	-	-	-	-	-
	IV	18UVE	Value Education	Value Education	2	2	3	25	75	100
<b>Total</b>					<b>30</b>	<b>18</b>				<b>500</b>
II	I	18UT2	Tamil – II	,ilf;fhy ,yf;fpak;> Gjpdk;> ,yf;fpa tuyhW	6	3	3	25	75	100
	II	18UE2	English – II	PoetryforEffectiveCommunicationandGrammar	6	3	3	25	75	100
	III	18UCH2CC2	Core Course – II	General Chemistry – II	6	6	3	25	75	100
		18UCH1CP1	Core Practical – I	Volumetric analysis Practical	3	3	3	40	60	100
		18UPH1AP1	First Allied Course – II	Allied physics – II (practical)	3	3	3	40	60	100
		18UPH2AC2	First Allied Course – III	Allied Physics – III	4	2	2	25	75	100
	IV	18UES	Environmental Studies	Environmental Studies	2	2	3	25	75	100
<b>Total</b>					<b>30</b>	<b>22</b>				<b>700</b>
III	I	18UT3	Tamil – III	fhg;gpa ,yf;fpak;> ehlfk;> ,yf;fpa tuyhW	6	3	3	25	75	100
	II	18UE3	English – III	ShortStoryandEffectiveCommunication	6	3	3	25	75	100

				Skills							
		18UCH3CC3	Core Course – III	General Chemistry – III	6	6	3	25	75	100	
III		18UCH3CP2	Core Practical – II	Semimicro Analysis	3	-	-	-	-	-	
		18UBT3AC3	Allied Botany-I	Morphology, taxonomy, anatomy and embryology	4	4	3	25	75	100	
		18UBT3AP2	Allied Botany Practical	Morphology, taxonomy, anatomy and embryology	3	-	-	-	-	-	
	IV	18UCH3NME1	Non Major Elective – I	Chemistry in Every Day Life	2	2	3	25	75	100	
					<b>30</b>					<b>500</b>	
IV	I	18ULT4	Tamil – IV	பழந்தமிழ் இலக்கியம், இலக்கிய வரலாறு, பொதுக்கட்டுரை	6	3	3	25	75	100	
	II	18ULE4	English – IV	One Act Play and Effective Communication Skills	6	3	3	25	75	100	
	III		18UCH4CC4	Core Course – IV	General Chemistry – IV	5	5	3	25	75	100
			18UCH4CP2	Core Practical – II	Semi Micro Analysis Practical	3	3	3	40	60	100
			18UBT4AP2	Allied Botany Practical	Morphology, taxonomy, anatomy and embryology	3	3	3	40	60	100
			18UBT4AC4	Allied Botany-III	Thallophytes, bryophytes, pteridophytes, gymnosperms and plant physiology	3	2	3	25	75	100
	IV		18UCH4NME2	Non Major Elective - II	Health chemistry	2	2	3	25	75	100
			18UBT4SBE1	Skill Based Elective – I	Ethanomedicine	2	2	3	25	75	100
						<b>30</b>	<b>23</b>				<b>800</b>
			18UCH5CC5	Core Course – V	Inorganic Chemistry – I	5	5	3	25	75	100
		18UCH5CC6	Core Course – VI	Organic Chemistry – I	5	5	3	25	75	100	

V	III	18UCH5CC7	Core Course – VII	Physical Chemistry – I	6	5	3	25	75	100
		18UCH5CP3	Core Practical – III	Physical Chemistry (P)	3	3	3	40	60	100
		18UCH5MBE1	Major Based Elective - I	Analytical Chemistry	5	5	3	25	75	100
	IV	18UBT5SBE2	Skill Based Elective – II	Pharmacognosy	2	2	3	25	75	100
		18UBT5SBE3	Skill Based Elective – III	Herbs and drug action	2	2	3	25	75	100
		18USSD	Soft Skills Development	Soft Skills Development	2	2	3	25	75	100
		<b>Total</b>		<b>30</b>	<b>29</b>				<b>800</b>	
VI	III	18UCH6CC8	Core Course – VIII	Organic Chemistry – II	6	6	3	25	75	100
		18UCH6CC9	Core Course – IX	Physical Chemistry – II	6	6	3	25	75	100
		18UCH6CP4	Core Practical – IV	Gravimetric & Organic Analysis (P)	6	5	6	40	60	100
		18UCH6MBE2:1	Major Based Elective - II	Nuclear and industrial chemistry	6	6	3	25	75	100
		18UCH6MBE2:2		/ Agricultural Chemistry						
		18UCH6MBE3:1	Major Based	Food Chemistry /	5	5	3	25	75	100
		18UCH6MBE3:2	Elective - III	Polymer Chemistry						
	V		Extension Activities	Extension Activities	-	1	-	-	-	-
		18UGS	Gender Studies	Gender Studies	1	1	3	40	60	100
		<b>Total</b>		<b>30</b>	<b>30</b>				<b>600</b>	
		<b>Overall Total</b>		<b>180</b>	<b>140</b>				<b>3900</b>	

<b>List of allied Courses</b>	
<b>Allied Course - I</b>	<b>Allied Course II</b>
Physics	Botany
❖ Language Part - I	- 4
❖ Language Part - II	- 4
❖ Core Paper	- 9
❖ Core Practical	- 4
❖ Allied Paper	- 4
❖ Allied Practical	- 2
❖ Non-Major Elective	- 2
❖ Skill Based Elective	- 3
❖ Major Based Elective	- 4
❖ Environmental Studies	- 1
❖ Value Education	- 1
❖ Soft Skill Development	- 1
❖ Gender Studies	- 1
❖ Extension Activities	- 1 (Credit only)

\* for those who studied Tamil upto 10th +2 (Regular Stream)

+ Syllabus for other Languages should be on par with Tamil at degree level

# those who studied Tamil upto 10th +2 but opt for other languages in degree level under Part I should study special Tamil in Part IV

\*\* Extension Activities shall be out side instruction hours

Non Major Elective I & II - for those who studied Tamil under Part I

a) Basic Tamil I & II for other language students

b) Special Tamil I & II for those who studied Tamil upto 10th or +2 but opt for other languages in degree programme

**Note:  
Marks**

**Internal Marks**

**External**

1.Theory	25	75
2.Practical	40	60
3. Separate passing minimum is prescribed for Internal and External marks		

#### FOR THEORY

The passing minimum for CIA shall be 40% out of 25 marks [i.e. 10 marks] The passing minimum for University Examinations shall be 40% out of 75 marks [i.e. 30 marks]

## FOR PRACTICAL

The passing minimum for CIA shall be 40% out of 40 marks [i.e. 16 marks] The passing minimum for University Examinations shall be 40% out of 60 marks [i.e. 24 marks]

### 1. Mark distribution for Practical:

Aim, Apparatus required, Tabulation - 15 + Experimental work - 15 + Calculation - 15 + Result with accuracy - 05 + Record - 10 + Internal assessment - 25 (Lab Attendance - 10 + Assignment - 05 + Observation Note - 05 + Model Exam - 20)

2. Every student shall undertake an industrial visit as a part of the curriculum once in the course period, to industrial units and R and D centres, to give a stress on the applied aspects. Extension and extracurricular activities should also be carried outside the class hours.

## SEMESTER - I

### GENERAL CHEMISTRY-I

<b>Core course:</b>	<b>I</b>	<b>Hours</b>	<b>: 6</b>
<b>Course code:</b>	<b>18UCH1CC1</b>	<b>Credits</b>	<b>: 6</b>
		<b>Max.Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

#### Objectives:

- 1. To learn the structure of atoms*
- 2. To understand the bonding in chemical compounds*
- 3. To understand the nomenclature of organic molecules*

#### UNIT I: Electronic Structure and Periodic Properties

Quantum numbers, principal, azimuthal, magnetic and spin quantum numbers and their significance, principles governing the occupancy of electrons in various quantum levels, Pauli exclusion principle Aufbau principle, Hund's rule, (n+1) rule, stability of half-filled and fully-filled orbitals-Periodic properties-variation of atomic volume, atomic and ionic radii- ionization potential, electron affinity-**metallic character**- electronegativity along periods and groups - Pauling's and Mulliken's scales of electronegativity.

#### UNIT II: Chemical Bonding

Ionic bond, lattice energy and Born-Haber cycle, Covalent bond, Fajans' rules, VSEPR theory - shapes of simple inorganic molecules containing lone pairs and bond pairs of electrons ( $\text{BeCl}_2$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{PCl}_5$ ,  $\text{SF}_6$ ,  $\text{IF}_7$ )-Solvation energy - solubility ionic solids polarizing power and polarizability of ions- Hydrogen bonding properties - consequences Intermolecular forces - London forces-**Van der Waals forces and weak intermolecular forces.**

#### UNIT III: Organic Chemistry

Nomenclature of organic compounds IUPAC naming of simple aliphatic compounds containing different functional groups naming of aromatic compounds and alicyclic compounds-

Bond Types of bonds homolytic and heterolytic fission of bonds orbital overlap sigma and pi bonds - hybridization and geometry of molecules methane, ethane ethylene, acetylene and benzene.

#### Unit IV: Gaseous State

Gaseous state -The gas constant R in different units - Deviation from ideal behaviour -van der Waals equation for real gases -critical phenomenon -PV isotherm of real gases, critical temperature -critical volume -molecular velocities -root, mean square- average and most probable velocities - Maxwell law for distribution of molecular speed(No need of derivation) -collision number and mean free path -collision diameter.

### **UNIT V: Titrimetric Analysis**

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

### **TEXT BOOKS**

- 1-Puri B-R-, Sharma L-R-, Kalia K-K-, Principles of Inorganic Chemistry, (23rd edition), New Delhi, ShobanLalNagin Chand & Co-, (1993)
- 2-Lee J-D-, Concise Inorganic Chemistry, UK, Black well science (2006)

### **REFERENCES**

- 1-Puri B-R-, Sharma L-R-, PathaniaM-S-,Principles of Physical Chemistry, (23rd edition) New Delhi, ShobanLal, Nagin Chand & Co-, (1993)-
- 2-Morrison R-T- and Boyd R-N-, Organic Chemistry (6th edition), New York, Allyn& Bacon Ltd-, (1976)
- 3-Bahl B-S- and ArunBahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co-, (1997)-

### **Learning outcomes:**

1. Are learn the structure of atoms
2. Understand the bonding in chemical compounds
3. Understand the nomenclature of organic molecules

### Question Pattern

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
43	1	1	1	43	2	2	2	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER-I

### VOLUMETRIC ANALYSIS PRACTICAL

<b>Core Practical:</b>	<b>II</b>	<b>Hours</b>	<b>: 3</b>
<b>Course code :</b>	<b>18UCH2CP1</b>	<b>Credits</b>	<b>: 3</b>
		<b>Max-Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 40</b>
		<b>External</b>	<b>: 60</b>

#### Objectives:

1. To learn the techniques of titrimetric analyses
2. To learn handling procedure of chemical balance

#### Experiments:

1. Estimation of HCl by NaOH using standard H<sub>2</sub>SO<sub>4</sub> solution
2. Estimation of HCl by NaOH using standard oxalic acid solution
3. Estimation of Na<sub>2</sub>CO<sub>3</sub> by HCl using standard Na<sub>2</sub>CO<sub>3</sub> solution
4. Estimation of oxalic acid by KMnO<sub>4</sub> using standard oxalic acid solution
5. Estimation of FeSO<sub>4</sub> by KMnO<sub>4</sub> using standard Mohr-s salt solution
6. Estimation of KMnO<sub>4</sub> by Thio using standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution
7. Estimation of Fe<sup>2+</sup> ion by K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> using standard Mohr-s salt solution
8. Estimation of CuSO<sub>4</sub> by thio using standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution
9. Estimation of Ca(II) by EDTA solution
10. Estimation of As<sub>2</sub>O<sub>3</sub> by I<sub>2</sub> solution using standard As<sub>2</sub>O<sub>3</sub> solution
11. Estimation of Total Hardness of Water (Demonstration only)

#### References:

1. Sundaram, Krishnan, Raghavan, *Practical Chemistry* (Part II), S- Viswanathan Co- Pvt-, 1996-
2. B-S- Furniss, A-J- Hannaford, P-W- G- Smith, A-R- Tatchell, *Vogel-s Text Book of Practical*
3. N-S- Ganapragasam and G- Ramamurthy, *Organic Chemistry-Lab manual*, S- Viswanathan Co- Pvt-, 1998-

#### Learning outcomes:

1. To learn the basic techniques of titrimetric analyses
2. Known the handling procedure of chemical balance

### Scheme of valuation

criteria	markes
<b>Record</b>	<b>5</b>
<b>Tabulation</b>	<b>10</b>
<b>Procedure writing</b>	<b>10</b>
<b>Results</b>	
< 1 %	35
1-2%	30
2-3%	25
3-4%	15
>4%	10

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
11	7	0	0	4	64	0	0	36	Local
Local-Green; Regional-Pink; National-Blue; Global-Brown									

**SEMESTER-II  
GENERAL CHEMISTRY-II**

**Core course:** II  
**Course code:** 18UCH2CC2

**Hours** : 6  
**Credits** : 6  
**Max-Marks** : 100  
**Internal** : 25  
**External** : 75

**Objectives:**

1. *To learn metallurgy*
2. *To understand the principles of radioactivity and nuclear chemistry*
3. *To understand the conformations and chemistry of alkanes*

**Unit I: Metallurgy and s block elements**

Occurrence of metals, steps involved in the metallurgical processes concentration of ore by froth floatation, gravity separation and magnetic separation processes, Calcination, roasting, smelting-aluminothermic process- Purification of metals by electrolysis - zone refining-Position of Hydrogen in the periodic table, isotopes of hydrogen, ortho and para hydrogen, s Block elements, alkali metals-general characteristics oxides, hydroxides, halides -Alkaline earth metals-general characteristics-preparation of gypsum and its role in setting of cement preparation and properties of plaster of paris.

**Unit II: Radioactivity and Nuclear chemistry**

Radiations emitted by radioactive substances, the half- life period, radioactive equilibrium, SoddyFajan group displacement law- Theory of radioactivity, N/P ratio-**packing fraction**- Isotopes, isobars and isotones, Applications of radio activity - Nuclear forces, packing fraction - mass defect, binding energy - Nuclear fission, atom Bomb and nuclear reactors - Nuclear fission-fusion reaction in the sunHydrogen bomb.

**Unit III: Alkanes**

Nomenclature of alkanes and cycloalkanes, Petroleum source of alkanes -Methods of preparing alkanes Chemical properties-Mechanism of free radical substitution in alkanes by halogenation-Uses -Conformational study of ethane and n butane,Relative stability of

cycloalkanes from cyclopropane to cyclooctane - cyclohexane and mono and disubstituted cyclohexanes.

#### **Unit IV: Chemistry of Benzene**

General methods of preparation of benzene -molecular orbital picture -aromatic character-**anti aromatic –non aromatic**-Huckels rule of aromaticity (Benzenoid and nonbenzenoid compounds) - Aromatic Electrophilic substitution Reactions of benzene-General Mechanism -Mechanism of Nitration, sulphonation, halogenations- FriedelCrafts Alkylation and Acylations- Orientation and reactivity of mono and disubstituted benzenes.

#### **UNIT V: Liquid State**

Properties of liquids, vapour pressure, measurement of vapour pressure, heat of vapourization, Troutons rule, surface tension, measurement of surface tension, surface tension and vapour pressure- Viscosity - determination of viscosity, variation of viscosity with temperature and pressure, liquid crystals -definition, classification- structure, properties and applications-Colloids - types of colloidal systems-Electrical properties -Electrophoresis -Electroosmosis, protection of colloids -Gold number -Theories of protection -stabilities of Sols-**entropy properties of liquid state.**

#### **TEXT BOOK**

1. P- L- Soni, Mohan Katyal, "Text book of Inorganic Chemistry", 20th Revised Edition (2007), Sultan Chand & Sons, New Delhi-
2. P- L- Soni, "Text book of Organic Chemistry", S- Chand and Company Ltd-, New Delhi-
3. R- D- Madan, J- S- Tiwari and G- L- Mudhara, "A text book of First Year B-Sc- Chemistry", S- Chand and Company Ltd-, New Delhi-

#### **REFERENCES**

1. R- D- Madan, "Modern Inorganic Chemistry", 2nd Edition (2008), S- Chand and Company Ltd-, New Delhi-
2. B-S- Bahl and ArunBahl, "Advanced Organic Chemistry," S -Chand and Company Ltd-, New Delhi-
3. P- L- Soni and H- M- Chawla, "Text book of Organic Chemistry", (1994), Sultan Chand & Sons, New Delhi-
4. B- R- Puri and Sharma, "Principles of Physical Chemistry", Meerut Publications, Meerut-

**Learning outcomes:**

1. Are learn *metallurgy*
2. *Understand the principles of radioactivity and nuclear chemistry*
3. *To learn the conformations and chemistry of alkanes*

**Question Pattern**

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
49	1	1	1	49	2	2	2	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER-II

### VOLUMETRIC ANALYSIS PRACTICAL

<b>Core Practical:</b>	<b>II</b>	<b>Hours</b>	<b>: 3</b>
<b>Course code :</b>	<b>18UCH2CP1</b>	<b>Credits</b>	<b>: 3</b>
		<b>Max-Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 40</b>
		<b>External</b>	<b>: 60</b>

#### Objectives:

1. To learn the techniques of titrimetric analyses
2. To learn handling procedure of chemical balance

#### Experiments:

1. Estimation of HCl by NaOH using standard H<sub>2</sub>SO<sub>4</sub> solution
2. Estimation of HCl by NaOH using standard oxalic acid solution
3. Estimation of Na<sub>2</sub>CO<sub>3</sub> by HCl using standard Na<sub>2</sub>CO<sub>3</sub> solution
4. Estimation of oxalic acid by KMnO<sub>4</sub> using standard oxalic acid solution
5. Estimation of FeSO<sub>4</sub> by KMnO<sub>4</sub> using standard Mohr-s salt solution
6. Estimation of KMnO<sub>4</sub> by Thio using standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution
7. Estimation of Fe<sup>2+</sup> ion by K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> using standard Mohr-s salt solution
8. Estimation of CuSO<sub>4</sub> by thio using standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution
9. Estimation of Ca(II) by EDTA solution
10. Estimation of As<sub>2</sub>O<sub>3</sub> by I<sub>2</sub> solution using standard As<sub>2</sub>O<sub>3</sub> solution
11. Estimation of Total Hardness of Water (Demonstration only)

#### References:

1. Sundaram, Krishnan, Raghavan, *Practical Chemistry (Part II)*, S- Viswanathan Co- Pvt-, 1996-
2. B-S- Furniss, A-J- Hannaford, P-W- G- Smith, A-R- Tatchell, *Vogel-s Text Book of Practical*
3. N-S- Ganapragasam and G- Ramamurthy, *Organic Chemistry-Lab manual*, S- Viswanathan Co- Pvt-, 1998-

**Learning outcomes:**

1. *To learn the basic techniques of titrimetric analyses*
2. *Known the handling procedure of chemical balance*

**Scheme of valuation**

<b>criteria</b>	<b>markes</b>
<b>Record</b>	<b>5</b>
<b>Tabulation</b>	<b>10</b>
<b>Procedure writing</b>	<b>10</b>
<b>Results</b>	
<b>&lt; 1 %</b>	<b>35</b>
<b>1-2%</b>	<b>30</b>
<b>2-3%</b>	<b>25</b>
<b>3-4%</b>	<b>15</b>
<b>&gt;4%</b>	<b>10</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
11	7	0	0	4	64	0	0	36	Local
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER .III

### GENERAL CHEMISTRY.III

<b>Core course:</b>	<b>III</b>	<b>Hours</b>	<b>: 6</b>
<b>Course code:</b>	<b>18UCH3CC3</b>	<b>Credits</b>	<b>: 6</b>
		<b>Max.Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

#### Objectives:

1. To learn the p.group elements.
2. To understand the solid state chemistry
3. To understand the theoretical aspects of group separation.

#### UNIT I: Boron and Carbon Group Elements

**Boron family** Comparative study of boron family elements-**Clathrates**-compounds of boron - diborane structure discussion, borax, boron nitride, boron carbide and borazole.

**Carbon family** Comparative study of carbon family elements and their compounds (hydrides, halides and oxides).

**Chemistry of cyanogens**- Hydrocyanic acid, cyanic acid, thiocyanic acid, ammonium thiocyanate and carbon disulphide, structure of diamond and graphite.

#### UNIT II: Nitrogen and Oxygen Group Elements

**Nitrogen family** Comparative study of nitrogen family elements and their compounds (oxides, halides, hydrides and oxyacids), Chemistry of hydrazine, hydrazoic acid, hydroxyl amine and sodium bismuthate, Non aqueous solvents - classification -**liquid ammonia** as a solvent- Preparation - properties and uses of  $\text{PH}_3$ ,  $\text{P}_2\text{O}_5$  and  $\text{H}_3\text{PO}_4$ .

**Oxygen family** comparative study, oxygen fluorides, Ozone, preparation, properties structural elucidation and uses -Green House effect ozone hole and protection of ozone layer-Thionic acids their preparation -properties, uses and structures, sodium hyposulphite and sodium thiosulphate, preparation, properties, uses.

#### Unit III: Alkenes and Alkynes

**Alkenes:** Nomenclature, Geometrical Isomerism, Petroleum source of alkenes and aromatics- General methods of preparation of alkenes -Chemical properties, Uses -Elimination mechanisms ( $\text{E}_1$ ,  $\text{E}_2$ ,  $\text{E}_1\text{CB}$ )-Electrophilic addition, General mechanism, Addition of HX

(Markovnikov and Anti Markovnikovs)- Addition of bromine- Addition of water (Oxymercuration, Demercuration, Hydroboration-oxidation) -Hydroxylation (Syn and anti-dihydroxylation)- Reduction-DielsAlder reaction –ozonolysis, introduction to alkenes.

**Alkynes:** Nomenclature, General methods of preparation of alkynes-Physical properties, Electrophilic addition of HX, water (Markovnikov and AntiMarkovnikovs), Hydrogen (to form Alkynes), DielsAlder Reaction- Deprotonation: formation of alkynyl anions, ozonolysis.

#### **Unit IV: Solid state:**

Solid state -crystalline and amorphous solids, isotropic and anisotropic solidsCrystal systems (Cubic system only) space lattice and unit cell-Seven crystal systems - crystal structure of NaCl, CsCl- Packing in crystals -hcp, ccp, bcc, Bravais lattice, law of rational indices, Weiss indices and Miller indices- Xray diffraction - Derivation of Braggs equation -Determination of crystal structure -Laue powder method-Adsorption on solids -Chemisorptions - physisorptions, potential energy diagrams -Freundlich, Langmuir, and BET adsorption isotherms (No Derivation).

#### **Unit V: Analytical Methods**

**Analysis of basic-acid-radicals-Elementary tests for acid radicals-basic radicals-Group separation and confirmatory tests for basic radicals-Uses of complexing agents in qualitative analysis- common ion effect and solubility product.**

**Qualitative Inorganic Analysis:**Dry test, flame test, Cobalt nitrate test - Wet confirmatory tests for acid radicals - Interfering acid radicals- Theory of Interference- Elimination of Interfering acid radicals.

#### **TEXT BOOK:**

1. J- D- Lee, *Concise Inorganic Chemistry*, 5th Ed-, Blackwell Science, London, 1996-
2. B-S- Bahl and ArunBahl, "Advanced Organic Chemistry," S -Chand and Company Ltd-,
3. Frank J- Welcher and Richard B- Hahn, *Semimicro Qualitative Analysis*, New Delhi, Affiliated East-west Press Pvt- Ltd- (1969)-

#### **REFERENCES:**

1. D- F- Shriver and P- W- Atkins, *Inorganic Chemistry*, 3rd Ed-, W- H- Freeman and Co, London, 1999-
2. B- R- Puri, L- R- Sharma, K- C- Kalia, *Principles of Inorganic Chemistry*, ShobanLalNagin Chand and Co-, Delhi, 1996-

- R- T- Morrison and R- N- Boyd, *Organic Chemistry*, 6th Edition, Printice-Hall Of India Limited, New Delhi, 1992-
- B- Y- Paula, *Organic Chemistry*, 3rd Edition, Pearson Education, Inc-(Singapore), New Delhi, reprint, 2002-

**Learning outcomes:**

- Know the p-group elements-
- understand the solid state chemistry
- understand the theoretical aspects of group separation-

6.		4. Question Patern	
<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>	
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>	
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>	
<b>Total Marks</b>		<b>75</b>	

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
52	2	2	2	52	4	4	4	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMIMICRO ANALYSIS PRACTICAL

<b>Core Practical:</b>	<b>II</b>	<b>Hours</b>	<b>: 3</b>
<b>Course code:</b>	<b>18UCH4CP2</b>	<b>Credits</b>	<b>: 3</b>
		<b>Max-Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 40</b>
		<b>External</b>	<b>: 60</b>

### Objectives:

1-To learn the techniques of semi micro qualitative analysis of inorganic salt mixtures-

2-To understand the reaction problem

### Inorganic Qualitative Analysis

Analysis of a mixture containing two cations and two anions of which one will be an interfering ion-

Simple anions:

Carbonate, nitrate, sulphate, sulphide, sulphite, chloride and bromide

Interfering anions:

Borate, fluoride, oxalate, phosphate, arsenite and chromate

Cations:

Group I cations: Lead, silver, mercurous

Group II cations: Mercuric, copper, cadmium, bismuth, antimony, tin

Group III cations: Aluminium, ferrous, ferric, chromium-

Group IV cations: Cobalt, nickel, manganese, zinc

Group V cations: Barium, strontium, calcium

Group VI cations: Magnesium, ammonium

### TEXT BOOK :

1. *Vogel-s Text Book of Inorganic Qualitative Analysis*, 4th edition, ELBS, London, 1974-

### REFERENCES

1. V-V- Ramanujam, *Inorganic Semi Micro Qualitative Analysis*, 3rd edition, The National Publishing Company, Chennai, 1974

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
7	0	0	0	7	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

**SEMESTER-III**  
**CHEMISTRY IN EVERYDAY LIFE**

**NME : I**  
**Course code: 18UCH3NME1**

**Hours : 2**  
**Credits : 2**  
**Max-Marks : 100**  
**Internal : 25**  
**External : 75**

**Objectives:**

- 1-*To learn the water, agricultural, food and materials chemistry*
- 2-*To understand the importance of food storage*
- 3-*To know the chemical usage in gasmitics*

**UNITI: Water Chemistry**

Water, Characteristics of water-**pH- conductance**- soft water and hard water-

Removal of hardness -Purification of water by ion exchange and reverse -osmosis methods-

Water pollution: Sources and effects of water pollution (Domestic, Industrial,Agricultural),  
Eutrophication.

Heavy metals such as Hg, Cr, Cd, Zn, Cu and metals like Pb, As, Ba, Temperature, Radio activity- synthetic detergents etc.).

**UNITII: Agricultural Chemistry**

Plant nutrients-**micronutrient–macronutrient**- Requisites of good fertilizers, Effect of Nitrogen on plant growth, deficiency, symptoms - examples for nitrogenous fertilizers- Effect of Phosphorous on plant growth- deficiency, symptoms , examples for phosphatic fertilizers-Effect of potassium on plant growth, deficiency, symptoms- examples for potassium fertilizers - Functions of secondary and micronutrients.

**UNITIII: Food Chemistry**

Food, classification and functions, Digestion in mouth, stomach and intestine, Absorption, spoilages, preservation techniques (canning, dehydration, freezedrying, salting, pickling, pasteurizing, fermenting and carbonating)-Food additives, colouring (Natural and synthetic colours)-List of permitted colours (CurcuminFlavouring agents -Anti oxidants, Emulsifiers, Acidulants and beverages- Soft drinks aerated water (ingredients and side effects).

#### **UNIT IV: Cosmetic and other Materials**

Cosmetics -Face powder -constituents, uses, side effects- Nail polish, hair dye -composition and side effects-Tooth powder -composition and manufacture-Lotions-

Cleaning agents: Soaps- types and cleaning action -detergents -types -merits and demerits of soap and detergents -chemical definitions of shampoo, washing powder and bleaching powder.

#### **UNIT V: Material Chemistry**

Polymers: Explanations, uses and examples for thermo setting and thermo plastic polymers - Vulcanization of rubber-

Fibers: Natural fibers (cellulosic and proteinous) -Semi synthetic (Rayon) Synthetic fibers (Poly ester, Nylon and Acrylic) -Pretreatment of fibers (Sizing, Desizing- Bleaching)-

Dyes and Dyeing process: Difference between dye and pigment -Witt's colour theory- classification of dyes based on application (Direct, Vat, Acid, Reactive, Mordant and Disperse).

#### **TEXT BOOK:**

1. Jayashree Gosh, "Text book of Pharmaceutical Chemistry" New Delhi, S- Chand & Company Ltd-, (2003)-
2. A Thankamma Jacob (1979), A Text Book of Applied Chemistry, 1st edition, McMillan India Ltd-
3. Alex Ramani, "Food Chemistry", MJP publishers (2009), Chennai-

#### **REFERENCES:**

1. K- Kumarasamy, A- Alagappa Moses and M- Vasanthi, "Environmental studies",
2. K- Bagavathi Sundari, "Applied Chemistry" MJP Publishers, (2006) Chennai-
3. Hesse P-R, A text book of soil chemical analysis John Murray, New York, 1971-

#### **Learning outcomes:**

1. *Learn the water, agricultural, food and materials chemistry*
2. *Understand the importance of food storage*
3. *Know the chemical usage in cosmetics*

### Question Patern

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
46	0	0	0	46	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER -IV

### GENERAL CHEMISTRY-IV

<b>Core course:</b>	<b>VI</b>	<b>Hours</b>	<b>: 6</b>
<b>Course code:</b>	<b>18UCH4CC4</b>	<b>Credits</b>	<b>: 6</b>
		<b>Max-Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

#### Objectives:

1. To learn the halogen and zero group elements
2. To understand the chemistry of organo metallic compounds
3. To understand the chemical kinetics and quantum chemistry

#### UNIT I: Halogen Family and Zero Group Elements

Comparative study of halogens and their compounds oxides and oxy acids of halogens (structure only)-**electronegativity-periodic tendency-estimation of available chlorine** in bleaching powder - basic properties of halogens-Interhalogen compounds preparation, properties and uses - pseudo halogens - preparation, properties and uses of cyanogens and thiocyanogen, comparison with halogens- Zero group, position in the periodic table, isolation of noble gases from the atmosphere and uses -compounds of xenon - XeF<sub>2</sub>, XeF<sub>4</sub>, XeF<sub>6</sub>, XeO<sub>3</sub>, XeOF<sub>4</sub>- structure and uses.

#### Unit II: Chemistry of Organometallic compounds

Introduction-**oxidative addition - reductive elimination**-preparation of organo magnesium compounds - physical and chemical properties, uses, preparation of organozinc compounds - physical and chemical properties, uses preparation of organolithium compounds - physical and chemical properties,uses chemistry of organo copper, organolead, organophosphorus and organo boron compounds.

#### Unit III: Chemistry of Alcohols, Phenols and Ethers

Nomenclature-**laboratory preparation of alcohols-industrial source of alcohols**- physical properties, chemical properties, uses- chemistry of glycols and glycerols, uses, preparation of phenols including di and tri hydric phenols, physical and chemical properties, uses, aromatic electrophilic substitution

mechanism, theory of orientation and reactivity, laboratory preparation of ethers, epoxides, physical properties, chemical properties, uses - introduction to crown ethers structures, applications.

#### **UNIT IV: Chemical Kinetics**

Rates of reaction, rate laws, rate constants-order and molecularity of reactions- Rate equations for zero, first, second and third order reactions- Derivation of rate constants for first- second order reactions- Fractional order reactions, examples- half-life period- pseudo-first order reactions - examples- Methods of determining the order of reactions-Integration- graphical, half-life and Ostwald's isolation methods- Temperature dependence of reaction rates - Arrhenius parameters and calculations.

#### **Unit V: Basic Quantum Chemistry**

CGS and SI units - Basic units - derived units - subsidiary units - dimensional analysis - Quantum theory and atomic spectra - Bohr's model of atom - Limitations of Bohr model - Sommerfeld's model - photo electric effect - Compton effect - de Broglie equation, Davisson and Germer experiment - Heisenberg's uncertainty principle - Schrödinger's wave equation (statement only) Particle in a box- Eigen values - Eigen function - Significance of  $\Psi$  and  $\Psi^2$  Radial and angular distribution function - Concept and Shapes of orbitals.

#### **TEXT BOOK :**

1. P- L- Soni, Mohan Katyal, "Text book of Inorganic Chemistry", 20th Revised edn-, (2007), Sultan Chand & Sons, New Delhi-
2. P-L-Soni, "Text book of Organic Chemistry", S-Chand and Company Ltd-, New Delhi-
3. B-S-Bahl and Arun Bahl, "Advanced Organic Chemistry," S-Chand and Company Ltd-, New Delhi-
4. Bruce H-Mahan, "University Chemistry", Narosa Publishers, New Delhi-1989

#### **REFERENCES:**

1. R- D- Madan, "Modern Inorganic Chemistry", 2nd edn-, (2008), S- Chand and Company Ltd-, New Delhi-
2. New Delhi-
3. B-R-Puri, L-R-Sharma and K-C-Kalia, "Principles of Inorganic Chemistry", 30th Edn- (2008), Milestone Publishers and Distributors, New Delhi-
4. P-L-Soni and H- M- Chawla, "Text book of Organic Chemistry", (1994), Sultan Chand & Sons, New Delhi-

5. K-S-Tewari and N-K-Vishnoi, "A Text book of Organic Chemistry", (2006), 3rd edition, Vikas Publishing House Pvt- Ltd-
6. M-K-Jain "Organic Chemistry" 12th edition, ShobanLalNagin Chand and Co-
7. D-N-Bajpai, "Advanced Physical Chemistry", S- Chand and Company Ltd-, New Delhi-

**Learning outcomes:**

1. *Learn the halogen and zero group elements*
2. *Understand the chemistry of organ metallic compounds*
3. *Understand the chemical kinetics and quantum chemistry*

**Question Patern**

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
59	3	3	3	59	5	5	5	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER-IV

### SEMIMICRO ANALYSIS PRACTICAL

<b>Core Practical:</b>	<b>II</b>	<b>Hours</b>	<b>: 3</b>
<b>Course code:</b>	<b>18UCH4CP2</b>	<b>Credits</b>	<b>: 3</b>
		<b>Max-Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 40</b>
		<b>External</b>	<b>: 60</b>

#### **Objectives:**

- 1-To learn the techniques of semi micro qualitative analysis of inorganic salt mixtures-
- 2-To understand the reaction problem

#### **Inorganic Qualitative Analysis**

Analysis of a mixture containing two cations and two anions of which one will be an interfering ion

#### Simple anions:

Carbonate, nitrate, sulphate, sulphide, sulphite, chloride and bromide-

#### Interfering anions:

Borate, fluoride, oxalate, phosphate, arsenite and chromate-

#### Cations:

Group I cations: Lead, silver, mercurous

Group II cations: Mercuric, copper, cadmium, bismuth, antimony, tin

Group III cations: Aluminium, ferrous, ferric, chromium

Group IV cations: Cobalt, nickel, manganese, zinc

Group V cations: Barium, strontium, calcium

Group VI cations: Magnesium, ammonium

#### **TEXT BOOK :**

1. Vogel-s Text Book of Inorganic Qualitative Analysis, 4th edition, ELBS, London, 1974-

#### **REFERENCES**

1. V-V- Ramanujam, *Inorganic Semi Micro Qualitative Analysis*, 3rd edition, The National Publishing Company, Chennai, 1974-

**Learning outcomes:**

1. Learn the techniques of semi micro qualitative analysis of inorganic salt mixtures-
2. Understand the reaction problem

**Scheme of valuation**

<b>Criteria</b>	<b>marks</b>
<b>Record</b>	<b>5</b>
<b>Aim and tabulation</b>	<b>5</b>
<b>4- radicals with correct procedure</b>	<b>50</b>
<b>3- radicals with correct procedure</b>	<b>35</b>
<b>2- radicals with correct procedure</b>	<b>25</b>
<b>1- radical with correct procedure</b>	<b>15</b>
<b>spotting</b>	<b>10</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
7	0	0	0	7	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

**SEMESTER -IV**  
**HEALTH CHEMISTRY**

**NME-: 2**

**Course code:18UCH4NME2**

**Hours : 2**

**Credits : 2**

**Max-Marks : 100**

**Internal : 25**

**External : 75**

**Objectives:**

*To understand the chemistry behind drugs, enzymes and diseases*

**UNIT I: Health**

Definition- Food, FoodPyramid Health- Hygiene- mal- under- over nutrition- their causes - remedies- sanitation.

**UNIT II: Drugs**

Drugs - Types of drugs-depressant- anticonvulsant- narcotics- antipyretics- antibiotics- anti-septics- analgesics- muscle- relaxants – cardiovascular – vasodepressants- steroids (Only Applications).

**UNIT III: Body Fluids**

Blood volumegroupscoagulation- blood -pressure- anaemia- blood- sugar- haemoglobin- -Chemistry of urine.

**UNIT IV: Enzymes and Hormones**

Types of enzymes- enzyme action, Characters of –hormones- action- examples of essential-hormones.

**UNIT V: Common Diseases**

Common -diseases -**Diabetes- Depression- anxiety**-Jaundice- vomiting, fever- night blindness- ulcer- diabetes.

**TEXT BOOK :**

1. Alex V Ramani, Food Chemistry, MJP Publishers, Chennai, 2009
2. JayashreeGhosh, A Text book of Pharmaceutical Chemistry, S- Chand and Co-Ltd, 1999-

**REFERENCES:**

1. Deb A C, Fundamentals of Biochemistry, New Central Book Agency, Calcutta, 1994-
2. Satake M and Mido Y, Chemistry for Health Science, Discovery Publishing House, New Delhi, 2003-
3. AshutoshKar, Medicinal Chemistry, Wiley Easterns Limited, New Delhi, 1993-

**Learning outcomes:**

Understand the chemistry behind drugs, enzymes and diseases

**Question Pattern**

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
55	0	0	35	20	0	0	64	36	National
Local-Green; Regional-Pink; National-Blue; Global-Brown									

**SEMESTER - V**  
**INORGANIC CHEMISTRY - I**

<b>Core course:</b>	<b>V</b>	<b>Hours</b>	<b>: 5</b>
<b>Course code:</b>	<b>18UCH5CC5</b>	<b>Credits</b>	<b>: 5</b>
		<b>Max-Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

**Objectives:**

1. *To understand the chemistry of d and f-block elements*
2. *To study the coordination compounds*
3. *Solvation properties of inorganic compound*

**UNIT I: Transition metals (d ,block elements)**

First, second and third transition series, General characteristics - Metallic character- atomic and ionic radii-**ionization energy- electronegativity- electron affinity-** oxidation states, colour, complex formation, catalytic and magnetic properties, Nonstoichiometric compounds-Important compounds of transition metals-Ziegler Natta catalyst- Prussian blue- Sodium nitro prusside-Turnbulls blue-Nickel DMG complex-Wilkinsons Catalyst-KMnO<sub>4</sub> and K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>.

**UNIT II: Inner transition metals (f ,block elements)**

Lanthanides: Properties of lanthanides, Electronic configuration, oxidation states, ionic radii-**atomic radii - ionization energy- electronegativity- electron affinity-tendancy-**lanthanide contraction- Colour and magnetic properties -Extraction of mixture of lanthanides from monazite sand and separation of lanthanides, Uses of lanthanides, Actinides: Sources of actinides, preparation of transuranic elements, Electronic configuration - oxidation states-ionic radii-Colour of ions- comparison with lanthanides-Extraction of thorium from monazite sand, Production and uses of plutonium.

**UNIT III: Coordination compounds I**

Coordination compounds-central metal ion- ligands, types of ligands, coordination number-oxidation numbers- coordination sphere - Nomenclature isomerism (structural and stereo) - Werners theory of complexes- EAN rule , Magnetic properties- VB theory- applications and limitations, Factors affecting stability of complexes- Crystal Field theory- Crystal field splitting in

octahedral- tetrahedral and square planar fields - factors influencing the magnitude of crystal field splitting - CFSE calculations- magnetic properties - colour.

#### **UNIT IV: Coordination compounds II**

Labile and inert complexes- stepwise and overall stability constants- Reaction mechanism - substitution reactions in octahedral complexes- Acid hydrolysis:  $S_N1$  and  $S_N2$  mechanisms - mechanism of electron transfer reactions- inner sphere and outer sphere mechanisms - Two electron transfer reactions , Complementary and non, complementary reactions- Application of coordination compounds-separation of copper, cadmium ions - estimation of nickel using DMG - aluminium using oxine.

#### **UNITV: Acid, bases and Nonaqueous solvents**

**Acids and Bases:** Arrhenius concept, concept of Lowry and Bronsted, Lux , Flood concept, Lewis concept, Relative strengths of acids and bases- Hard and Soft acids and bases- Pearsons concept - bonding in hard -hard and soft - soft combinations, HSAB principle, basis for hard hard and soft soft interactions.

**Nonaqueous solvents:** Physical properties of solvents- Types of solvents and their general characteristics- Acidbase reactions - Oxidation reduction reactions - Solubility, Salvation number- Medium effect - pH measurements in nonaqueous media, liquid  $NH_3$ ,  $SO_2$ , and  $HF$  as solvents.

#### **TEXT BOOK:**

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

#### **REFERENCES:**

1. Puri B-R-, Sharma L-R-, Kalia K-K-, Principles of Inorganic Chemistry, (23rd edition)New Delhi, ShobanLal, Nagin Chand & Co-, (1993)-
2. Lee J-D-, Concise Inorganic Chemistry, UK, Black well science (2006)-

#### **Learning outcomes:**

1. Understand the chemistry of d and f-block elements
2. Find the coordination compounds
3. Knows the proper solvation properties of inorganic compound

### Question Pattern

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
70	0	0	0	70	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

**SEMESTER - V**  
**ORGANIC CHEMISTRY I**

<b>Core course:</b>	<b>VI</b>	<b>Hours</b>	<b>: 5</b>
<b>Course code:</b>	<b>18UCH5CC6</b>	<b>Credits</b>	<b>: 5</b>
		<b>Max-Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

**Objectives:**

- 1. To learn the Stereochemistry of organohalogen compounds*
- 2. To learn the chemistry of organohalogen compounds*
- 3. To learn the chemistry of carbonyl compounds*

**UNIT I: Stereochemistry**

Stereoisomerism- Definition, classification, Optical isomerism - Optical activity -conditions for optical activity, Asymmetric centre, Chirality - Elements of symmetry - Optical activity of lactic and tartaric acids, Racemization, Resolution - Various methods of resolving a racemic mixture - Asymmetric synthesis, Waldens inversion, R & S Notations - Cahn Ingold,- Prelog rules, Erythro and threo representations- Geometrical Isomerism:Cis trans, Syn, Anti and E Z notations.

**UNIT II: Alkyl and Aryl halides**

Nomenclature-General methods of preparation of haloalkanes, Physical properties, Chemical properties, Uses, Nucleophilic substitution mechanisms ( $S_N1$ ,  $S_N2$  and  $S_Ni$ ),Evidences - Stereochemical aspects of Nucleophilic substitution mechanisms - General methods of preparation of halobenzenes - Physical properties - Chemical properties, Uses - Mechanisms of electrophilic and nucleophilic substitution reactions - Theory of orientation and reactivity.

**UNIT III: Aldehydes and Ketones**

Nomenclature, Laboratory preparation of aliphatic carbonyl compounds - Physical properties - Chemical properties, Uses, Molecular Orbital picture of Carbonyl group - Nucleophilic addition mechanism at carbonyl group, Acidity of alpha hydrogen- General methods of preparation of aromatic carbonyl compounds, Physical and Chemical properties ,Uses, Effect

of aryl group on the reactivity of carbonyl group- Perkin, Knoevenagel condensations- Cannizzarro reaction.

#### **UNIT IV: Carboxylic acids and their derivatives**

Nomenclature - General methods of preparation of carboxylic acids(including Arndt-Eistert synthesis) - Physical properties - Structure and acidity - Chemical properties - preparation of dicarboxylic acid - Physical and Chemical properties - Uses - Introduction to Derivatives of Carboxylic acids, nucleophilic substitution mechanism at acyl carbon, Acyl chlorides, Anhydrides, Esters, Amides.

#### **UNIT V: Heterocyclic compounds**

Preparation-**physical properties-chemical properties- applications- heterocyclic compounds-** uses of furan, pyrrole, thiophene and pyridine-Comparative basic characters of pyrrole, pyridine and piperidine with alkyl amines-Synthesis and reactions of Quinoline, Isoquinoline and Indole with special reference to Skraup, and Fischer indole synthesis  
- Fischer Napieralski synthesis, Polynuclear hydrocarbons-Naphthalene- anthracene and phenanthrene, preparation, properties and uses.

#### **TEXT BOOK:**

1. B- Y- Paula, *Organic Chemistry*, 3rd Edition, Pearson Education, Inc-(Singapore), New Delhi, reprint, 2002-
2. Bahl and ArunBahl, *Organic Chemistry*, S- Chand and Sons, New Delhi, 2005-

#### **REFERENCES:**

1. R- T- Morrison And R- N- Boyd, *Organic Chemistry*, 6th Edition, Printice-Hall Of India Limited, New Delhi, 1992-
2. T- W- Graham Solomons, *Organic Chemistry*, 6th edition, John Wiley and Sons, 1996-
3. Jerry March, *Advanced Organic Chemistry*, 4th Edition, John Wiley And Sons, New York,

#### **Learning Outcomes:**

1. Learn the Stereochemistry of organohalogen compounds
2. Understand the chemistry of organohalogen compounds
3. Know the chemistry of carbonyl compounds

### Question Pattern

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
46	1	1	1	46	2	2	2	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

**SEMESTER - V**  
**PHYSICAL CHEMISTRY -I**

<b>Core course:</b>	<b>VII</b>	<b>Hours</b>	<b>: 6</b>
<b>Course code:</b>	<b>18UCH5CC7</b>	<b>Credits</b>	<b>: 5</b>
		<b>Max-Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

**Objectives:**

- 1. To study the laws of thermodynamics and thermochemistry*
- 2. To learn the various spectroscopic techniques*
- 3. Theoretical aspects of solutions*

**Unit I: First Law of Thermodynamics and Thermo Chemistry**

**Basic concepts-first law of Thermodynamics**-Terms used in thermodynamics, Conservation of energy- internal energy, work and heat- state function, path function, exact and inexact differentials, zeroth law of thermodynamics- first law of thermodynamics- definition- heat capacity,  $C_p$  and  $C_v$ , JouleThomson effect, definition, Joule Thomson coefficient and inversion temperature-**properties of pure substances**-Calculation of  $\Delta U$ ,  $\Delta H$ ,  $q$  and  $w$  for ideal gases, calculation of  $\Delta U$ ,  $\Delta H$ ,  $q$  and  $w$  for real gases - Reversible and irreversible isothermal expansion- reversible and irreversible adiabatic expansion-**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- Enthalpies of compounds and formation of ions, Kirchhoff equation, Hess's law and its application.

**UNIT II: Second Law of Thermodynamics**

**Concepts of second law of Thermodynamics**-Need for the law, spontaneous process, Carnot's cycle, efficiency of Carnot's engine, Carnot's theorem-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- Entropy change accompanying change of phase - Solid to liquid- liquid to vapour crystalline changes, isothermal, isochoric and isobaric processes, entropy of mixture of ideal gases- entropy of mixing- Physical significance of entropy, Other state functions, Free energy, work functions, variation of  $G$  with  $T$  and  $P$ , Maxwell's relations  $\Delta A$ ,  $\Delta G$ , Criteria for spontaneity and equilibrium-Gibbs Helmholtz equation and its applications.

### **UNIT III: Third Law of Thermodynamics and Phase Rule**

Third law of thermodynamics - Nernst heat theorem, Third law of thermodynamics, Determination of absolute entropies, Absolute entropies of elements and compounds, Application of Third law-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 components system - Simple eutectic system PbAg 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: Spectroscopy I**

Electromagnetic radiation, quantisation of energies in molecules (Translational, rotational, vibrational and electronic) - Microwave spectroscopy - condition - molecular rotation - theory of microwave spectroscopy - selection rule - effect of isotopic substitution -Calculation of R and bond length of diatomic molecules-Infrared spectroscopy, condition - molecular vibration -modes of vibration of linear and Nonlinear molecules - Diatomic CO<sub>2</sub>, H<sub>2</sub>O - stretching and bending vibrations - selection rules - calculation of force constant - isotope effect -Applications of IR spectra (Group frequencies, finger printing and Hydrogen bonding only).

### **UNIT V: Colligative Properties of solutions**

Ideal solutions: Vapour pressure- Composition diagrams of solutions- Raoult's law, positive and negative deviations from the law-

Principle of fractional distillation: Binary systems- Vapour diagram - azeotropic distillation, Partially miscible binary systems (CSTUCST, LCST, and both UCST and LCST)- Effect of addition of solute on CSTSteam distillation-Solubility of gases in liquids; Henry's law, its relationship with Raoult's law.

#### **TEXT BOOK:**

1. P-W- Atkins, *Physical chemistry*, Oxford university press, 1978-
2. K- L- Kapoor, *A textbook of Physical chemistry*, (volume-2 and 3) Macmillan, India Ltd, 1994-
3. S-K- Dogra and S- Dogra, *Physical chemistry through problems*, New age international, 4th edition 1996-

#### **References:**

1. S-H- Maron and J-B- Lando, *Fundamentals of physical chemistry*, Macmillan limited, New York, 1966-

2. B-R- Puri and L-R- Sharma, *Principles of physical chemistry*, ShobanLalNagin Chand and Co- 33rd edition, 1992-
3. Gilbert- W- Castellan, *Physical chemistry*, Narosa publishing house, third edition 1985-

**Learning outcomes:**

1. Know the laws of thermodynamics and thermochemistry
2. Understand the various spectroscopic techniques
3. Find the theoretical aspects of solutions

**Question Pattern**

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
62	1	1	1	62	2	2	2	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

**SEMESTER -V**  
**PHYSICAL CHEMISTRY PRACTICAL**

<b>Core Practical :3</b>	<b>Hours</b>	<b>: 3</b>
<b>Course code: 18UCH5CP3</b>	<b>Credits</b>	<b>: 3</b>
	<b>Max-Marks</b>	<b>: 100</b>
	<b>Internal</b>	<b>: 25</b>
	<b>External</b>	<b>: 75</b>

**Objectives:**

- 1. To learn the fundamentals of conductometric and potentiometric titrations*
- 2. To understand the method of determination of critical solution temperature, transition temperature and rate constant*
- 3. To learn the instrumental techniques*

**Experiments**

1. Determination of partition coefficient of iodine between water and carbon tetrachloride and determination equilibrium constant for the formation of potassium triiodide from iodine and KI
2. Phase diagram of a simple eutectic system and determination of unknown composition
3. Phenol -water system: Phase diagram, CST, and effect of impurities on CST
4. Transition temperature of a salt hydrate -determination of molecular weight
5. Kinetics of acid catalyzed hydrolysis of methyl acetate and comparison of rate constants
6. Kinetics of persulphate - iodide reaction: Determination of pseudo first order rate constant
7. Conductometry - Acid -base titration (HCl vs NaOH)
8. Conductometry -Determination of limiting molar conductance of a strong electrolyte (KCl)
9. Potentiometry -Determination of solubility product of a sparingly soluble substance-
10. Potentiometry -Redox titration of ferrous vs dichromate
11. Verification of Beer-Lambert-s law and determination of concentration of metal ions

spectrophotometrically

**References:**

1. Venkateswaran V, Veeraswamy R-, Kulandaivelu A-R-, Basic Principles of Practical Chemistry, (2nd edition), New Delhi, Sultan Chand & Sons, (1997)-
2. Daniels et al-, Experimental Physical Chemistry, (7th edition), New York, McGraw Hill, (1970)-
3. Findlay, A-, Practical Physical Chemistry, (7th edition), London, Longman (1959)-

**Learning outcomes:**

1. Understands fundamentals of conductometric and potentiometric titrations
2. Known the method of determination of critical solution temperature, transition temperature and rate constant
3. Learn the instrumental techniques

**Question Pattern**

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

### Scheme of valuation

<b>criteria</b>	<b>marks</b>
<b>Record</b>	<b>5</b>
<b>Aim and tabulation</b>	<b>10</b>
<b>calculation</b>	<b>10</b>
<b>Results</b>	
<b>Allowed error 5%</b>	<b>35</b>
<b>5-10%</b>	<b>20</b>
<b>10%&lt;</b>	<b>10</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
11	0	0	0	11	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

**SEMESTER -V**  
**ANALYTICAL CHEMISTRY**

**MBE : I**  
**Course code: 18UCH5MBE1**

**Hours : 5**  
**Credits : 5**  
**Max-Marks : 100**  
**Internal : 25**  
**External : 75**

**Objectives:**

- 1. To help the student to develop the habit of accurate manipulation and an attitude of critical thinking-*
- 2. To learn the basic analytical methods and appreciate what is involved in an analysis-*
- 3. To understand the application of the various analytical techniques*

**UNIT 1: Laboratory Hygiene and safety**

**Chemical hygiene-** Storage and handling of corrosive, flammable, explosive, toxic, carcinogenic and poisonous chemicals, Simple first aid procedures for accidents involving acids, alkalis, bromine, burns and cut by glass, Threshold vapour concentration, safe limits, **Laboratory Hygiene and safety-** Evaluation of analytical data: Idea of significant figures, its importance- Accuracy, methods of expressing accuracy, error analysis, types of errors minimizing errors- Precision methods of expressing precision, mean, median, mean deviation, standard deviation and confidence limit, Method of least squares, problems involving straight line graphs.

**UNIT 2: Quantitative Analysis**

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

### **UNIT 3: Thermo and Electro Analytical Techniques**

**Thermo analytical methods:** Principle of thermo gravimetry- differential- thermal analysis, differential scanning calorimetry, Instrumentation for TGA- DTA and DSC - Characteristics of TGA and DTA curves -**copper sulphate pentahydrate**- factors affecting TGA and DTA curves- applications - TGA of calcium oxalate monohydrate DTA of calcium acetate monohydrate-Electro analytical techniques, electro gravimetry -theory of electro gravimetric analysis - determination of copper (by constant current procedure), electrolytic separation of metals: Principle - separation of copper and nickel, coulometry : principle of coulometric analysis - coulometry at controlled potential - apparatus and technique - separation of nickel and cobalt.

### **UNIT 4: Spectro Analytical Techniques**

Colorimetry and spectrophotometry-Beer Lamberts law - principle of colorimetric analysis - visual colorimetry - standard series method, balancing method estimation of  $\text{Ni}^{+2}$  and  $\text{Fe}^{+3}$  colorimetrically - photoelectric photometer method spectro photometric determination of chromium and manganese in alloy steel -infra red spectroscopy (Instrumentation only)-block diagram- source-monochromator-cell-detectors and recorders-sampling techniques-NMR spectroscopy(instrumentation only)

### **UNIT 5: Chromatography Techniques**

**Basic concepts of chromatography**-Column chromatography- principle, types of adsorbents, preparation of the column, elution, recovery of substances and applications- Thin layer chromatography - principle, choice of adsorbent and solvent, preparation of chromatoplates,  $R_f$ -values, factors affecting the  $R_f$ -values, Significance of  $R_f$ -values- Ion - exchange chromatography - principle - types of resins - requirements of a good resin -action of resins - experimental techniques - separation of Na-K, Ca-Mg, Co-Ni and chloride, bromide mixture, gas chromatography principle, experimental techniques, instrumentation and applications- High Pressure Liquid Chromatography (HPLC)-principle -experimental techniques - instrumentation and advantages.

#### **TEXT BOOK:**

1- Sharma, B-K-, Instrumental Methods of Chemical Analysis, Coel Publishing House, Merrut, (1997)

1. Gopalan- R-, Subramaniam P-S- and Rengarajan K-, Elements of Analytical Chemistry, Sultan Chand and Sons-

**References:**

1. Douglas A- Skoog and Donald M- West, F-J- Holler, Fundamentals of Analytical Chemistry, 7th edition, Harcourt College Publishers-
2. Mendham J-, Denney R-C-, Barnes J-D-, Thomas M-, Vogel-s Text book of Quantitative Chemical analysis 6th edition Pearson education-
3. Usharani S-, Analytical Chemistry, Macmillian-

**Learning outcomes:**

1. Know the student to develop the habit of accurate manipulation and an attitude of critical thinking-
2. Learn the basic analytical methods and appreciate what is involved in an analysis-
3. Understand the application of the various analytical techniques

**Question Patern**

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
63	0	0	0	63	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

**SEMESTER - VI**  
**ORGANIC CHEMISTRY II**

**Core course:** VIII  
**Course code:** 18UCH6CC8

**Hours** : 6  
**Credits** : 6  
**Max-Marks** : 100  
**Internal** : 25  
**External** : 75

**Objectives:**

- 1. To learn the chemistry of nitrogen compounds*
- 2. To learn the chemistry of amino acids and proteins*
- 3. To study the chemistry of carbohydrates*

**UNIT I: Chemistry of nitrogen compounds**

Nitrogen compounds, nomenclature, nitro alkanes, alkyl nitrites, differences-aromatic nitro compounds - preparation and reduction of nitro benzene under different conditions- Amino compounds - effect of substituents on basicity, reaction of amino compounds (primary, secondary, tertiary and quaternary amine compounds)- mechanism of carbylamine reaction, diazotization, and comparison of aliphatic and aromatic amines - diazonium compounds - preparation and synthetic importance of diazomethane, benzene diazonium chloride and diazo acetic ester.

**UNIT II: Amino acids, proteins and nucleic acids**

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

**UNIT III: Carbohydrates**

Classification, structural elucidation of glucose and fructose, Reactions of glucose and fructose - osazone formation mutarotaion and its mechanism - cyclic structure determination of ring size - configuration of monosaccharides, Epimerization, ascending and descending of aldoses and ketoses- Inter conversion of aldoses and ketoses- Disaccharides reactions and structural elucidation of maltose and sucrose polysaccharides starch and cellulose properties, uses and structures[structural elucidation not necessary]

#### **UNIT IV: Industrial Organic Chemistry**

Dyes theory of color and constitution - chromophore, auxochrome, classification according to application and structure - preparation and uses of nitro dyes, naphthol yellow, nitroso fast green O, azo dyes, methyl orange, triphenyl methane dyes, malachite green, indigo dyes-

Polymers-definition, types of polymers-mechanism of cationic, anionic and free radical polymerization, thermo setting polymers - preparation of caprolactam, Nylon 66, polyester, epoxide resin, molecular weight of polymers ( elementary treatment )

#### **UNIT V: Organic Spectroscopy**

UV VIS spectroscopy –**Instrumentations-sampling techniques**-types of electronic transitions - solvent effects on  $\lambda_{\max}$  Woodward Fieser rules, calculation of  $\lambda_{\max}$  :dienes and  $\alpha, \beta$  unsaturated carbonyls

IR spectroscopy - number and types of fundamental vibrations - modes of vibrations and their energies, position of IR absorption frequencies for functional groups like aldehyde, ketone, alcohol, acid and amide- factors affecting the frequency absorption - conjugation, inductive effect and hydrogen bonding-

NMR spectroscopy, principle, equivalent and non equivalent protons - shielded and deshielded protons, anisotropy, chemical shift - TMS, tau and delta scales, integral, splitting of signals - spin-spin coupling, NMR spectrum of EtOH, n propyl bromide and isopropyl bromide.

#### **TEXT BOOK:**

1. Finar I-L, Organic Chemistry Vol 2, (6th edition) England, Addison Wesley Longman Ltd- (1996)
2. YR Sharma, Elements of Organic Spectroscopy, S Chand Pub- (2010)-

#### **References:**

- 1-Morrison R-T, Boyd R-N-, Organic Chemistry, (4th edition) New York, Allyn&Bacon Ltd-, (1976)
- 2-Bahl B-S, ArunBahl, Advanced Organic Chemistry, (12th edition) New Delhi, Sultan S Chand and Co-, (1997)-
3. J L Jail, Elements of Biochemistry S Chand Pub-
4. Stryer, Fundamentals of Biochemistry
5. JayashreeGhosh, A Text book of Pharmaceutical Chemistry (1999)-
6. Kalsi- L-, Organic Spectroscopy, New Delhi, New Age International Company- (1998)-

**Learning outcomes:**

1. Learn the chemistry of nitrogen compounds
2. Learn the chemistry of amino acids and proteins
3. Study the chemistry of carbohydrates

**Question Pattern**

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
42	0	0	0	42	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

**SEMESTER - VI**  
**PHYSICAL CHEMISTRY -II**

<b>Core course:</b>	<b>IX</b>	<b>Hours</b>	<b>: 6</b>
<b>Course code:</b>	<b>18UCH6CC9</b>	<b>Credits</b>	<b>: 6</b>
		<b>Max-Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

**Objectives:**

- 1. To learn the various spectroscopy*
- 2. To understand the applications of electrolytic conductance and electromotive force*
- 3. To study the various catalysis-*

**Unit I: Spectroscopy II**

Raman spectroscopy – principle, selection rule- condition - Raleigh and Raman scattering - Stokes and Antistokes lines- applications- Difference between Raman - IR spectroscopy - structural elucidation - Rotational Raman spectra- Application to covalent compounds - Mutual exclusion principle, UV visible spectroscopy, conditions, theory of electronic spectroscopy- types of electronic transitions -FrankCondon principle - Predissociation - Dissociation energy, Applications.

**UNIT II: Electrolytic Conductance and Transference**

Ionic mobility, Definition, experimental determination, experimental proof for migration of ions, transport number - Definition, Hittorf's rule, experimental determination - Hittorf's method, moving boundary method, effect of concentration on transport number-Transport of ions in solution, DebyeHuckel Onsager (DHO) theory, assumption and mathematical form, Validity of DHO equation, drawbacks of DHO equation, Extension of DeybeHuckelOnsager theory to strong electrolytes.

**UNIT III: Electromotive Force of Galvanic Cells**

Galvanic cell, Definition, chemical cell, concentration cell reversible cell and irreversible cell, types of reversible electrodes, Metalmetal ion electrodes, amalgam electrodes, gas electrodes, metalinsoluble metal salt electrode and oxidation, reduction electrode, single electrode potentialEMF of galvanic cell and cell reaction, Cell emf, sign conventions of cell emf - cell reaction, Nernst equation for cell emf, reference electrode - primary and secondary reference electrode, standard electrode potential and its determination, electro chemical series, standard cell

#### **UNIT 4: Catalysis**

Catalysis- Types-Importance of catalysts Homogeneous and heterogeneous catalysis-Industrial catalyst, catalyst carrier, catalyst promoter, catalyst inhibitor, catalytic poison- activity of catalyst - concept of acidbase and enzyme catalysis- MichaelisMenton equation- Factors affecting enzyme catalysis- Theory of heterogeneous catalysis on the basis of Langmuir adsorption -Uni bimolecular reactions on solid surfaces.

#### **UNIT V: Physical Properties and Chemical Structure**

Polarization of molecules in an electric field - Polarizability and dipole moment - Induced and orientation polarization - ClausiusMosotti equation - measurement of molar polarization - Dipole moment - Measurement of dipole moment in solution (using Debye equation and dilute solution methods) - dipole moment of diatomic and poly atomic molecules - Bond moments - Lorenz-Lorentz equation - Applications of dipole moment measurements - determining the percentage of ionic character of bonds- shapes of simple molecules like  $\text{BCl}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{CO}_2$ ,  $\text{NH}_3$  and  $\text{CCl}_4$ .

##### **TEXT BOOK:**

1. Kuriacose and Rajaram, Thermodynamics for students of Chemistry, ShobanLalNagin Chand & Co- Delhi, 1996-
2. B-R- Puri, L-R- Sharma and M-S- Pathania -Principles of Physical Chemistry, Vishal Publications, Jalandhar, 2000-

##### **References:**

- 1-N-Kundu and S-K-Jain, Physical Chemistry, S-Chand& Co- Ltd-1998, New Delhi-
- 2-Gurtu and Snehi, Advanced Physical Chemistry, PragatiPrakashan, 2002, Meeru
- 3.Peter Atkins, "Physical Chemistry", New Z-A-Publishers, 8th Edn, 2009-

##### **Learning outcomes:**

1. Learn the various spectroscopy
2. Understand the applications of electrolytic conductance and electromotive force
3. Study the various catalysis

### Question Pattern

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
45	0	0	0	45	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER -VI

### GRAVIMETRIC & ORGANIC ANALYSIS

<b>Core Practical :</b>	<b>IV</b>	<b>Hours</b>	<b>: 6</b>
<b>Course code :</b>	<b>18UCH6CP4</b>	<b>Credits</b>	<b>: 5</b>
		<b>Max-Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 40</b>
		<b>External</b>	<b>: 60</b>

#### **Objectives:**

1. To learn the techniques of gravimetric analysis
2. To learn the methods of organic preparations

#### **Experiments**

1. Determination of melting and boiling points of organic substances
2. Organic analysis:
  - a- Identification of acidic, basic, phenolic, and neutral organic substances
  - b- Detection of N, S and halogens
  - c- Test for aliphatic and aromatic nature of substances
  - d- Test for saturation and unsaturation
  - e- Identification of functional groups:
    - i) Carboxylic acids ii) Phenols iii) Aldehydes iv) Ketones v) Esters vi) Carbohydrates vii) Amines viii) Amides
    - ix) Halogen compounds
  - f- Preparation of derivatives for the functional groups-
- 2- Organic preparations  
Single stage organic preparations involving bromination, hydrolysis, nitration, oxidation, and benzylation-
- 3- Gravimetric analysis  
Estimation of sulphate as barium sulphate-Estimation of barium as barium chromate-Estimation of copper as copper as copper thiocyanate-Estimation of nickel as Ni-DMG-  
Estimation of magnesium as magnesium pyrophosphate

Estimation of calcium as calcium oxalate

Estimation of copper in an alloy

**References:**

1. N-S- Gnanapragasam and G- Ramamurthy, *Organic Chemistry-Lab manual*, S- Viswanathan Co- Pvt-, 1998-
2. J-N- Gurthu and R- Kapoor, *Advanced Experimental Chemistry (Organic)*, S- Chand and Co-, 1987-
3. B-S- Furniss, A-J- Hannaford, P-W- G- Smith and A-R- Tatchell, *Vogel-s Text Book of Practical Organic Chemistry- 5th Edn-*, Pearson Education, 2005-

**Learning outcomes:**

1. Learn the techniques of gravimetric analysis
2. Learn the methods of organic preparations

**Scheme of valuation**

Criteria	Marks		
Record	5		
Procedure writing	5		
Physical constant	5		
Organic preparation	10		
Organic analysis	{15}	Gravimetry{20}	
Aliphatic/aromatic	2	error	Marks
Saturated/unsaturated	2		
Element test	4	< 1 %	20
Functional group	4	1-2%	15
Derivative	3	2-3%	10
		>3%	5

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
8	0	0	0	8	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER -VI

### NUCLEAR AND INDUSTRIAL CHEMISTRY

MBE-2 : VI

Course code: 18UCH6MBE2:1

Hours : 6

Credits : 6

Max-Marks : 100

Internal : 25

External : 75

#### Objecives:

1. To study the bio-inorganic chemistry
2. To learn the metallic state
3. To learn the basics of nano chemistry and industrial inorganic chemistry

#### Unit I: Bioinorganic Chemistry

Metal ion in biology and their vital role in the active site, Structure and functions of Metallo proteins and enzymes-**micronutrients- macronutrients**-Ion transport mechanism in cell membrane - Na and K pumps, Ionophores - Structures - characteristic features of Haemoglobin and myoglobin – Vitamin B12

#### UNIT II: Metallic State

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

#### UNIT III: Some Special Classes of Compounds

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

#### UNIT 4: Industrial Inorganic Chemistry

Fossil fuels - varieties of coal and petroleum - petroleum refineries in India- fuel gases - calorific value -**bomb calorimetry**-composition and preparation of water gas, semi water gas- carburetted

water gas-producer gas- natural gas- LPG and biogas- Fertilizers - manufacture of NPK and mixed fertilizers - micronutrients and their role in plant life- safety matches, fireworks and explosives - manufacturing details paints and varnishes - manufacture and uses.

### **Unit V: Nanotechnology and Organometallic Compounds**

Basics of nanoscience and nanotechnology - chemistry of nanoparticles - nanotechnology - Methods of synthesis of nano materials - plasma arching, sol gels -applications of nano chemistry -catenanes -carbon nanotubes -types- synthetic methods-fullerene-its properties- Introduction to Organometallic compounds- alkenes, alkynes and cyclopentadiene based Organometallic compounds.

#### **TEXT BOOK:**

1. Soni P-L-, Text book of Inorganic Chemistry, S-Chand& Co, New Delhi (2006)
2. Lee J-D-, concise Inorganic Chemistry ELBS edition-

#### **References:**

- 1-Puri B-R- and Sharma L-R-,Principles of Inorganic Chemistry, sobanLalNagin Chand & Co-
- 2.Satyaprakash, Tuli, G-D-, Basu, S-K-, and Madan, R-D, Advanced Inorganic chemistry (vol I & II ), S- Chand, New Delhi (2006)

#### **Learning outcomes:**

1. To study the bio-inorganic chemistry
2. To learn the metallic state
3. To learn the basics of nano chemistry and industrial inorganic chemistry

#### **Question Pattern**

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
62	0	0	0	62	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

**SEMESTER-VI**  
**AGRICULTURAL CHEMISTRY**

<b>MBE-2</b>	<b>: VI</b>	<b>Hours</b>	<b>: 2</b>
<b>Course code:</b>	<b>18UCH6MBE2:2</b>	<b>Credits</b>	<b>: 2</b>
		<b>Max-Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

**Objectives:**

*To give the students the importance of Agricultural chemistry and an exposure to find, analyse and find a suitable method to cultivate and promote agricultural methods-*

**UNIT 1: Soil Chemistry**

Soil analysis, Composition of soil Organic-Inorganic constituents- Soil acidity, buffering capacity of soils-**Soil basicity**-Limiting of soil-

Absorption of cations and anions - availability of soil nutrients to plants

**UNIT 2: Fertilizers**

Peat organic manures (composts)-Role of humus-Effluent form gobar gas plants-

Use of fertilizers, urea, DAP, Super phosphate, Gypsum-NPK-mixed fertilizers-Optimal addition of Fertilizers to obtain estimated yields.

**UNIT 3: Pesticides**

Insecticides- stomach - contact poisons- Plant derivatives -pyrethrine- Nicotine - rotenone

Synthetic organic- carbophos- carbaryl- p-DCB, dimethoate, butachlor, Endrin, Aldrin (Chemical name and uses)- Rodenticides-Fungicides - Inorganic (Bordeaux Mixture) - ganic(dithiocarbamate)-

Industrial fungicides-creosote fractions-Herbicides -weedicides- Selective - non-selective, 2, 4D, 2, 4, 5t (structure function).

**UNIT 4: Plant Growth Regulators**

3Indole acetic acid- Naphthalene acetic acid- Ethepon (2 chloroethyl phosphoric acid)- Alar (succinin acid<sub>2</sub>, 2dimethyhydrzine ) their function.

**UNIT 5: Plant hormones**

Plant hormones- Gibberlin- Cyclocel- Phosphon- dwarfing compound (CCC<sub>2</sub>Chlorethyltrimethyl ammonium chloride)Defoliant.

**TEXT BOOK:**

1. G-T- Austin-, shreve-s Chemical Process Industries, 5th edition, Mc-Graw-Hill, 1984

**References:**

1. B-A- Yagodin (Ed)- Agricultural Chemistry, 2 Volumes, Mir Publishers (Moscow), 1976-

**Learning outcomes:**

Give the students the importance of Agricultural chemistry and an exposure to find, analyse and find a suitable method to cultivate and promote agricultural methods-

**Question Patern**

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
45	0	0	0	45	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

**SEMESTER-VI**  
**FOOD CHEMISTRY**

<b>Core course:</b>	<b>VI</b>	<b>Hours</b>	<b>: 5</b>
<b>Course code:</b>	<b>18UCH6MBE3:1</b>	<b>Credits</b>	<b>: 5</b>
		<b>Max-Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

**Objectives:**

- 1. To learn the importance of food and nutrition*
- 2. To know the chemical composition and importance of balanced diet*
- 3. To learn the food adulterants and identification of them*

**UNIT 1: Food Adulteration**

Sources of food, types, advantages - disadvantages-Food adulteration -contamination of Wheat-Rice, Alial, Milk- Butter etc, with clay stones, water, toxic chemicals, Common adulterants, ghee adulterants - their detection- Detection of adulterated food by simple analytic techniques.

**UNIT 2: Food Poison**

Food poisons - natural poisons (alkaloids - nephrotoxic- pesticides- (DDT- BHC- Malathion)  
- Chemical poisons - first aid for poison consumed victims.

**UNIT 3: Food Additives**

Food additives-artificial sweeteners - saccharin cyclamate – aspartate, Food flavours esters, aldehydes - heterocyclic compound- Food colours - nestricted use- spurious colours - Emulsifying agents - preservatives learning agents- Baking powder yeast - taste makers - MSG vinegar.

**UNIT 4: Beverages**

Beverages -**hard drinks**-Soft drinks - soda - fruit juices - alcoholic beverages examples- Carbonation - addiction to alcohol - cirrhosis of liver - social problems.

**UNIT 5: Edible Oils**

Fats, Oils, - Sources of oils -production of refined vegetable oils- preservation- Saturated - unsaturated fatty acids -iodine value - role of MUFA and PUFA in preventing heart diseases - determination of iodine value and RM value, saponification values and their significance- Estimation of iodine - RM values in edible oils.

**TEXT BOOK:**

1. Thanlamma Jacob, text books of applied chemistry for home science and allied science, Macmillan-

**References:**

- 1-Swaminathan M-, Food Science and Experimental foods, Ganesh and Company-
2. JayashreeGhosh, Fundamental concepts of applied chemistry, S- Chand & Co- Publishers-

**Learning outcomes:**

1. Learn the importance of food and nutrition
2. Know the chemical composition and importance of balanced diet
3. Learn the food adulterants and identification of them

**Question Patern**

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
50	0	0	30	20	0	0	60	40	National
Local-Green; Regional-Pink; National-Blue; Global-Brown									

**SEMESTER-VI**  
**POLYMER CHEMISTRY**

**MBE : IV**  
**Course code: 18UCH6MBE3:2**

**Hours : 2**  
**Credits : 2**  
**Max-Marks : 100**  
**Internal : 25**  
**External : 75**

**Objectives:**

- 1. To understand structure, types and formation of polymers-*
- 2. To study the preparation and applications of important industrial polymers-*
- 3. To evaluate the application of various type polymer*

**UNIT 1: Introduction to Polymer**

Monomers- Oligomers- Polymers - their characteristics - Classification of polymers - Natural synthetic, linear, cross linked and network; plastics-elastomers- fibres- Homopolymers - Copolymers -Bonding in polymers : Primary - secondary bond forces in polymers ; cohesive energy and decomposition of polymers - Determination of Molecular mass of polymers: Number Average molecular mass (M<sub>n</sub>) - Weight average molecular mass (M<sub>w</sub>) of polymers - determination by (i) viscosity (ii) Light scattering method (iii) Gel Permeation Chromatography (iv) osmometry - ultracentrifuging.

**UNIT 2: Kinetics and Mechanism for Polymerization**

Chain growth polymerization :Cationic- anionic- free radical polymerization- Stereo regular polymers : Ziegler Natta polymers - Polycondensation-non catalysed, acid catalysed polymerization- molecular weight distribution Step growth polymers.

**UNIT 3: Techniques of Polymerization and Polymer Degradation**

Bulk- Solution-Emulsion-Suspension- Melt polycondensation, solution polycondensation interfacial and gas phase polymerization - Types of Polymer Degradation- Thermal degradation- mechanical degradation-Photodegradation- Photo stabilizers- Solid - gas phase polymerization.

**UNIT 4: Industrial Polymers**

Raw material, preparation, fibre forming polymers, elastomeric material, Thermoplastics :Polyethylene- Polypropylene, polystyrene, Polyacrylonitrile- Poly Vinyl Chloride- Poly tetrafluoro ethylene- nylon and polyester - Thermosetting Plastics : Phenol formaldehyde and

epoxide resin - Elastomers : Natural rubber and synthetic rubber -**preparation, properties-vulcanization-** Buna N, BunaS and neoprene  
 Conducting Polymers :Elementary ideas ; examples : poly sulphur nitriles, poly phenylene, poly pyrrole and poly acetylene.

**UNIT 5: Introduction to Polymer Processing**

Compounding: Polymer Additives: Fillers, Plasticizers antioxidants and thermal stabilizers fire retardants and colourants - Processing Techniques: Calendaring, die casting, compression moulding, injection moulding, blow moulding, extrusion moulding and reinforcing- Film casting, Thermoforming, Foaming.

**TEXT BOOK:**

1. F- N- Billmeyer, Textbook of Polymer Science, Wiley Interscience, 1971-
- 2- V-R- Gowariker, Polymer Science, Wiley Eastern, 1995-

**References:**

1. G-S- Misra, Introductory Polymer Chemistry, New Age International (Pvt) Limited, 1996-
2. A- Kumar and S- K- Gupta, Fundamentals and Polymer Science and Engineering, Tata McGraw-Hill, 1978-

**Learning outcomes:**

1. Understand structure, types and formation of polymers-
2. Study the preparation and applications of important industrial polymers-
3. Learn the application of various type polymer

**Question Patern**

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
48	0	0	0	48	0	0	0	100	Global

Local-Green; Regional-Pink; National-Blue; Global-Brown

# **VALUE ADDED COURSES**

# FUNDAMENTALS OF CHEMISTRY & BASIC LABORATORY TECHNIQUES

Course Code: 18VACH01  
Credit: 2

Hours: 30  
Marks: 100

## OBJECTIVES

- To be able to identify common acids and bases and ways of testing them
- To determine the sequence of elementary reactions, or the reaction mechanism, those comprise complex reactions.
- The science learning goals of laboratory experiences include enhancing mastery of science subject matter, developing scientific reasoning abilities, increasing understanding of the complexity and ambiguity of empirical work, developing practical skills, increasing understanding of the nature of science

## LEARNING OUTCOMES

- To be able to state the formulas of common acids and bases To know that alkalis are bases soluble in water
- Understand the concept of rate of change associated with chemical change, recognizing that the rate of change and how it can be measured
- To able to: understand how the concept of valency can account for, and predict the formulas of compounds.
- Understanding of theoretical knowledge

## UNIT I: Physical and Chemical Reactions

### Acids and Bases

General introduction of mineral Acids, their strength and handling- General introduction of common alkalis and their handling- Environmental effect of acid rain- Acid base equilibrium.

### Redox Reaction

Application of Electrochemical series and electrochemical cells- Common oxidizing and reducing agents - Redox reaction in biology.

## UNIT II: Chemical equilibria & Chemical Kinetics

General introduction of reversible reactions-Industrial application chemical equilibria- Types of equilibria- Application of chemical kinetics in trace determination

## UNIT III: Chemical Bonding

Introduction to intermediate bonds- Non-classical bonding- Delta bonding in complexes, Synergic bonding in metal carbonyls- Introduction of quintuple bonds.

## UNIT IV: Stoichiometry Defects

Definition- Types of defects-Stoichiometry and chemical reactions

## UNIT V: Basic Lab Techniques

Safety measure of handling of chemicals- MSDS of some common chemicals Precision and accuracy Purification- Fractional distillation- Recrystallization

**References:**

1. Vogel's text book of Qualitative Chemical Analysis (Longman ELBS Edition)
2. Vogel's text book of Quantitative Analysis (Longman ELBS Edition)
3. Practical Organic Chemistry by A.I. Vogel
4. Practical Organic Chemistry by O.P. Agrawal.
5. Practical Organic Chemistry by F. G. Mann & B. C. Saunders
6. Comprehensive Practical Organic Chemistry Qualitative Analysis by V. K. Ahluwalia
7. A Text Book of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis: A.I. Vogel (Third Ed.).

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
22	2	0	19	1	9	0	86	5	National
<b>Local: GREEN</b> <b>Regional: PINK</b> <b>National: BLUE</b> <b>Global: BROWN</b>									

## **CRYSTALLISATION AND CHROMATOGRAPHY TECHNIQUES**

Course Code: 18VACH02  
Credit: 2

Hours: 30  
Marks: 100

### **OBJECTIVES**

- To separate the various substances that makes up a mixture.
- Crystallization processes are, first, separation and purification of substances,
- To monitor the progress of a reaction, identify compounds present in a given mixture, and determine the purity of a substance.

### **LEARNING OUTCOMES**

- Understand the methods of crystallization
- Explain the principles and techniques of column and thin-layer chromatography Techniques.
- Purify the compounds by crystallisation technique.
- Analyse and detect the sample by thin layer chromatography
- Separate the isomers of a compound by column chromatography technique

### **Unit I**

**6 hrs**

#### **Crystallisation**

Principle-Methods of crystallisation-Melt crystallization,Suspension crystallisation; solvents for recrystallization, Precipitation, Nucleation, Supersaturation- Common challenges in crystallization- Processes involved in crystallization and its applications.

### **Unit II**

**6 hrs**

#### **Chromatography Techniques**

Chromatography-Adsorption, Partition chromatography. Column Chromatography -Principle, Adsorbents, developers, solvents, columns, packing of the columns, elution, eluting solvent

selection-polar and non-polar; Applications. Thin Layer chromatography-Principle, Rf, preparation of chromatoplates - application of sample on the chromatoplates - choice of adsorbents - selection of solvent, locating reagents - developing chamber, development of chromatogram and Applications.

### Unit III

Practical 6 hrs

#### Crystallisation of simple compounds

Zinc oxide - Copper sulphate - Sodium acetate, Sodium Chloride - Potash alum, Phthalic acid, Benzoic acid, Acetyl salicylic acid - Urea and Sugar.

### Unit IV

Practical 6 hrs

#### Thin Layer Chromatography

Separation of Mixture of benzophenone and naphthalene - Separation of Mixture of 2-nitrophenol and 4-nitrophenol - Separation of Mixture of Diphenylamine, Benzophenone and Naphthalen-Separation of Mixture of Azobenzene, Hydroxyazobenzene and p-aminoazobenzene

### Unit V

Practical 6 hrs

#### Column Chromatography

Separation of  $KMnO_4$  and  $K_2Cr_2O_7$  - Isolation of 2-nitrophenol and 4-nitrophenol

#### Text Books:

1. P.S. Subramanian R.Gopalan, K Rangarajan Elements of Analytical Chemistry S. Chand & company Ltd, New Delhi. 2003 I & III
2. V. K. Srivastava and K. Kishore Introduction to chromatography Theory and practice 3 rd edition S. Chand & company Ltd, New Delhi. 1991 I & III
3. Brian S. Furniss, Antony J. Hannaford, Peter W. G. Smith and Austin R. Tatchell Vogel's Text Book of Practical Org 5 th Edition Longman Group 1989 I-V
4. Practical Organic Chemistry by A.I. Vogel
5. Practical Organic Chemistry by O.P. Agrawal.

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
31	14	0	17	0	45	0	55	0	National

**Local: GREEN**

**Regional: PINK**

**National: BLUE**

**Global: BROWN**

# **THANTHAI HANS ROEVER COLLEGE**

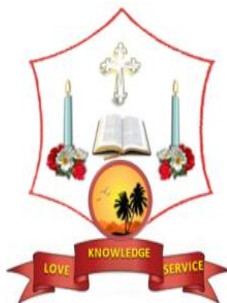
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*Accredited by NAAC*

*UGC Recognized 2(f) and 12(B) Institution*

*Affiliated to Bharathidasan University, Tiruchirapalli*

**Perambalur-621 220, Tamil Nadu, India**



**ALLIED CHEMISTRY**

**CHOICE BASED CREDIT SYSTEM SYLLABUS**

**SEMESTER PATTERN**

**PG & RESEARCH DEPARTMENT OF**

**CHEMISTRY**

**(2018-2019 ONWARDS)**



THANTHAI HANS ROEVER COLLEGE(AUTONOMOUS), ELAMBALUR, PERAMBALUR

**Diploma in chemistry – Course Structure Under CBCS**  
**(For the candidates to be admitted from the academic year 2018-1019 onwards)**



Semester	Course	Course Code	Title of the Course	Ins. Hours/ Weeks	Credit	Exam Hours	CIA (Max)	ESE (Max)	Total (Max)
I	Allied Course-I (Physics & Bot-Zoo)	18UCH3AC3	Allied Chemistry-I	4	4	3	25	75	100
II	Allied Course-II (Physics & Bot-Zoo)	18UCH4AC4	Allied Chemistry-II	4	4	3	25	75	100
	Allied Practical- I (Physics & Bot-Zoo)	18UCH4AP1	Volumetric And Organic Analysis	3	3	3	40	60	100
	Allied Practical- II (Bot-Zoo)	18UCH4AP2							
				<b>Grand Total</b>	<b>11</b>	<b>11</b>	<b>9</b>	<b>90</b>	<b>210</b>

**CIA**- Continuous Internal Assessment

**ESE**- End Semester Examination

**SEMESTER-I**  
**ALLIED CHEMISTRY-I**

**Allied course:** 1  
**Course code :** 18UCH3AC3

**Hours** : 4  
**Credit** : 4  
**Max.Marks** : 100  
**Internal** : 25  
**External** : 75

**Objectives**

To know the properties of elements and fertilizer

To understand the reactions of alkane

To analyze theoretical aspects of volumetric analysis

**Unit I**

Periodic properties-**atomic radii- ionic radii-** ionization potential- electron affinity and electro negativity - variation in the periodic table -Molecular Orbital Theory: Some important basic concepts of molecular orbital theory, LCAO Bonding, antibonding orbitals - bond order - applications of MO theory to H<sub>2</sub>, He<sub>2</sub>, O<sub>2</sub> and F<sub>2</sub> molecules, Industrial Chemistry: Fuel gases - Water gas, Producer gas- L.P.G., Gobar gas, Natural gas, Fertilizers, N.P.K and mixed fertilizers- Soap and detergents - An elementary idea of soap, detergent-Cleansing action of soap and detergents.

**Unit II**

Volumetric analysis- Standard solution- titration- equivalence point- end point- indicators- primary and secondary standards- expressing concentrations of standard solutions - Normality, Molarity, Molality and mole fraction Volumetric titrations - Acid base titrations - theory - strong acid Vs strong base, strong acid Vs weak base- Redox titrations theory-Mohr salt Vs KMnO<sub>4</sub>- complexometric titrations - theory EDTA titrations.

**Unit – III**

**Nomenclature of alkanes-** General methods of preparation of alkanes- properties- mechanism of free radical halogenation of alkanes- conformation analysis of ethane- n butane and cyclohexane- Methods of preparation of alkenes-stereochemistry of dehydrohalogenation (E<sub>1</sub>, E<sub>2</sub>, E<sub>1</sub>C<sub>B</sub>mechanism)-Properties of alkenes- electrophilic - nucleophilic addition mechanisms.

## UNIT IV

Synthetic polymers – Teflon, Alkyl Epoxy resins, Polyesters, definitions - uses Types of polymerization - Thermosetting - thermoplastics- Heterocyclic compounds:Furan, thiophene, pyrrole and pyridine - Preparation and properties-Stereoisomerism:Optical isomerism - lactic and tartaric acid - Racemic mixture and resolution - Geometrical isomerism -maleic and fumaric acid.

## Unit V

Rate of reaction - **rate constant**- order, molecularity, first order rate law and simple problems, half life period of first order equation, pseudo first order reaction, zero - second order reactions. Arrhenius and collision theories- assumption, derivation, demerits- experimental determination of order of reactions.

## REFERENCES:

- 1.Bahl and ArunBahl – “Advanced Organic Chemistry” – 19th Edition., (2005) – Sulthanand Chand company, New Delhi.
2. M.K. Jain – “Organic Chemistry” – 12th Ed., (2003) Sulthan and Chand Company, New Delhi.
3. R.D. Madan, J.S. Tiwari and G.L. Mudhara – A Textbook of First Year B.Sc. Chemistry: S.Chand and Co, 2002.
4. B.R. Puri and L.R. Sharma – Principles of Inorganic Chemistry: ShobanLalNagin Chand and Co., New Delhi (2000).
5. B.R. Puri, L.R. Sharma and S. Pathania – Principles of Physical Chemistry: ShobanLalNagin Chand and Co., New Delhi, 2001.
- 6.R. Gopalan, P.S. Subramanian, K. Rangarajan – “Elements of Analytical Chemistry”, Sultan Chand & Sons, 1995.

## Question Pattern

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
58	0	0	0	58	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMASTER-II

**Allied course:** 2

**Course code :** 18UCH4AC4

**Hours** : 4

**Credit** : 4

**Max.Marks** : 100

**Internal** : 25

**External** : 75

### OBJECTIVES

1. To understand the basic concepts of C-ordination compounds and Carbohydrates.
2. To learn about the aromaticity and electrochemistry.
3. To know about chromatography

### Unit I: Coordination Chemistry (12 hrs)

Nomenclature and isomerism of coordination compounds- EAN rule, VB and Crystal field theories of octahedral, tetrahedral and square planar complexes. Chelation - its industrial applications. Magnetic studies- **paramagnetic-diamagnetic properties** magnetism susceptibility- ferromagnetism - anti ferromagnetism.

### UNIT II : Carbohydrates

Classification, Glucose and fructose, Preparation and properties, Sucrose Manufacture and properties, Starch and cellulose Properties and uses- **Classification**-Amino Acids and Proteins: Amino acids Classification and preparation, properties. Peptides (Elementary treatment) -

Proteins - Classification based on physical properties and biological functions. Nucleic acid:DNA, RNA functions (Structure not necessary).

### **UNIT III Aromaticity**

Aromaticity- Conditions - Huckel's rule - aromaticity of benzene- Substitution reactions, Nitration,- halogenations, sulfonation, alkylation of benzene-Halogen containing compounds: Preparation - uses of Dichloromethane, Chloroform, Carbon tetrachloride, DDT, BHC- Name reactions: Benzoin, Perkin- Cannizzaro- Claisen- Haloform- Carbylamine reactions - Biuret reaction.

### **Unit IV Electrochemistry:**

Specific and equivalent conductance - their determination - Effect of dilution on conductivities - An elementary idea about ionic theory - Ostwald's Dilution Law, Kohlrausch Law, Conductometric titrations- pH and Buffer: Importance of pH and buffers in the living systems- pH determination by colorimetric - electrometric methods. Corrosion: Types of corrosion, Prevention.

### **Unit V Chromatography**

Principles of column- paper - thin layer chromatography- Photochemistry- Photochemical reaction - Lambert's law - Beer's law – Absorbance- Extinction Coefficient – **Rf value**-The law of Photochemical equivalence, Quantum efficiency- Some Photochemical reactions and their quantum yield-Phase Rule-Phase- Component- Degree of freedom- Phase Rule - Definition- One component system - Water system.

### **REFERENCE**

- 1.Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, (23<sup>rd</sup> edition), New Delhi, ShobanLalNagin Chand & Co.,(1993)
- 2.Bahl and ArunBahl – “Advanced Organic Chemistry” – 19<sup>th</sup> Edition., (2005) – Sulthan and Chand company, New Delhi.
- 3.B.R. Puri, L.R. Sharma and S. Pathania – Principles of Physical Chemistry: ShobanLalNagin Chand and Co., New Delhi, 2001.

### **Question Pattern**

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
52	0	0	0	52	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER III

### ALLIED CHEMISTRY PRACTICAL

**Allied practical: 1**  
**Course code : 18UCH3AP1**

**Hours : 3**  
**Credit : 3**  
**Max.Marks : 100**  
**Internal : 40**  
**External : 60**

#### **OBJECTIVES**

1. To understand the basic principles and different types of volumetric analysis.
2. To identify the organic compounds.
3. To know the difference between qualitative and quantitative analysis

#### **I. VOLUMETRIC ANALYSIS**

a) Acidimetry and Alkalimetry

- i) Estimation of hydrochloric acid
- ii) Estimation of sodium hydroxide

b) Permanganometry

iii) Estimation of oxalic acid using  $\text{KMnO}_4$

iv) Estimation of ferrous sulphate using  $\text{KMnO}_4$

## II. ORGANIC ANALYSIS A study of

- (i) reactions of the following organic compounds along with
- (ii) tests for Aromatic/ Aliphatic, saturated/ unsaturated, solubility in common solvents, and presence of Nitrogen :
- (iii) Carbohydrate
- (iv) Diamide
- (v) Aldehyde
- (vi) Ketone
- (vii) Acid
- (viii) Amine
- (ix) The students may be trained to perform the specific reactions like- aliphatic or aromatic, saturated or unsaturated, solubility test, nitrogen test involving ( $\text{Zn} / \text{Na}_2\text{CO}_3$ ) fusion, and functional group present and record their observation.

### Reference Book

1. V.Venkateswaran, R.Veerasingam, A.R. Kulandaivelu, "Basic Principles of Practical Chemistry" Sultan Chand & Sons, New Delhi, 1997.

### Scheme of valuation

Criteria	Marks		
Record	5		
Procedur writing	10		
Organic analysis {15}	volumetry{30}		
Aliphatic/aromatic	2	Error	Marks
Saturated/unsaturated	2		
Element test	4	< 1 %	30
Functional group	4	1-2%	25
derivative	3	2-3%	15
			10

		>3%	
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Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
7	0	0	0	7	0	0	0	100	Global

Local-Green; Regional-Pink; National-Blue; Global-Brown

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**Perambalur – 621 220, Tamil Nadu, India**



**M.Sc. CHEMISTRY**

**CHOICE BASED CREDIT SYSTEM SYLLABUS SEMESTER PATTERN**

**PG & RESEARCH DEPARTMENT OF CHEMISTRY**

**(2018-2019 ONWARDS)**



**THANTHAI HANS ROEVER COLLEGE, (AUTONOMOUS)**  
**PERAMBALUR – 621220**  
**M.Sc. CHEMISTRY – COURSE STRUCTURE UNDER CBCS**



*(For the candidates admitted from the academic year 2016-2017 onwards)*

Semester	Course Code	Course/ Elective	Title of the Course Paper	Hours/ week	Credits	CIA	ESE	Total
I	18PCH 1CC1	Core course-1	Organic Chemistry – I	6	5	25	75	100
	18PCH 1CC2	Core course-2	Inorganic Chemistry – I	6	5	25	75	100
	18PCH 1CC3	Core course-3	Physical Chemistry – I	6	5	25	75	100
	18PCH2CP1	Core practical-1	Organic Chemistry Practical – I**	6	4	40	60	100
	18PCH2CP2	Core practical-2	Inorganic Chemistry Practical – I**	6	4	40	60	100
<b>Total</b>				<b>30</b>	<b>23</b>			<b>500</b>
II	18PCH2CC4	Core course-4	Inorganic Chemistry – II	6	5	25	75	100
	18PCH2CC5	Core course-5	Physical Methods in Chemistry - I	6	5	25	75	100
	18PCH2CP3	Core practical-3	Organic Chemistry Practical – II	6	4	40	60	100
	18PCH2CP4	Core practical-4	Inorganic Chemistry Practical – II	6	4	40	60	100
	18PCH2EC1:1	Elective course-1	Concepts And Models In Chemistry	6	4	25	75	100
	18PCH2EC1:2		Bio -organic chemistry(*)					
<b>Total</b>				<b>30</b>	<b>22</b>			<b>500</b>
III	18PCH3CC6	Core course-6	Organic Chemistry-II	6	5	25	75	100
	18PCH3CC7	Core course-7	Physical Methods in Chemistry – II	6	5	25	75	100
	18PCH3CP5	Core practical-5	Physical Chemistry Practical – I***	6	4	40	60	100
	18PCH3EC2:1	Elective course-2	Selected topics in Chemistry – I	6	4	25	75	100
	18PCH3EC2:2		Solid State Chemistry(*)					
	18PCH3EC3:1	Elective course-3	Electro Organic Chemistry	6	4	25	75	100
	18PCH3EC3:2		Analytical Chemistry(*)					
<b>Total</b>				<b>30</b>	<b>22</b>			<b>500</b>
IV	18PCH4CC8	Core course-8	Physical Chemistry – II	6	5	25	75	100
	18PCH4CP6	Core practical-6	Physical Chemistry Practical – II***	6	4	40	60	100
	18PCH4PW	Project work	Project Work and Dissertation Dissertation=80 Marks [2 reviews - 20+20=40 marks; Report Valuation = 40 marks] Viva = 20 Marks	6	6	-	-	100
	18PCH4EC4:1	Elective cour-4	Instrumentation Techniques	6	4	25	75	100
	18PCH4EC4:2		Nano and green chemistry(*)					
	18PCH4EC5:1	Elective cour-5	Special topics in chemistry	6	4	40	60	100
	18PCH4EC5:2		Industrial chemistry(*)					
<b>Total</b>				<b>30</b>	<b>23</b>			<b>500</b>
<b>Grand Total</b>				<b>120</b>	<b>90</b>			<b>2000</b>

**CIA** :Continuous Internal Assessment; **ESE**:End Semester Examination; **CH**:Core Course; **CHE**:Elective Course.

**Note:**

1. Organic practical I and inorganic I will be conducted in the end semester only
2. (\*) indicate the elective papers chosen by the student

CIA Splitting	MID SEMESTER I	MID SEMESTER II	ASSIGNMENT	TOTAL
	10 MARKS	10 MARKS	5 MARKS	25 MARKS

- ❖ Core Course - 8
- ❖ Core Practical - 6
- ❖ Elective Course - 5
- ❖ Project - 1

Project : 100 Marks  
Dissertation : 80 Marks  
Viva Voice : 20 Marks

**Note:**

1. Theory Internal 25 marks External 75 marks
2. Practical " 40 marks " 60 marks
3. Separate passing minimum is prescribed for Internal and External
  - a) The passing minimum for CIA shall be 40% out of 25 marks (i.e. 10 marks)
  - b) The passing minimum for University Examinations shall be 40% out of 75 marks (i.e. 30 marks)
  - c) The passing minimum not less than 50% in the aggregate.

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# SEMESTER-I

## ORGANIC CHEMISTRY I

Core Course : I  
Course Code : 18PCH1CC1

Hours : 6 h  
Credit : 5  
Max. Marks : 100  
Internal : 25  
External : 75

### OBJECTIVES

- To learn the concepts of Aromaticity
- To understand the special arrangement of atoms or groups in 3Dimention
- To understand conformation of organic compounds
- To study the nucleophilic and electrophilic reactions of organic compounds

### UNIT I: AROMATICITY:

Aromaticity, definition, Huckel's, Craig's rules - effects of aromaticity on bond lengths - ring currents - aromatic character in 3,4,5,6,7,8 member rings non benzenoid- rings - 2, 4, 8, 10, 14 and 18  $\pi$  electron systems Concept of Homoaromaticity- Antiaromaticity-alternant and non-alternant hydrocarbons- Aromaticity of annulenes- 10, 12, 14, 16 and 18 annulenes, heteroannulenes-sydnones- fullerenes.

### UNIT II: STEREOCHEMISTRY

**STEREOCHEMISTRY:** Optical activity chirality Classification of chiral molecules as asymmetric and dissymmetric A brief Study of dissymmetry of allenes, biphenyls, spiro compounds- trans cyclooctanecyclononene molecules with helical structures absolute configuration - R, S notation of biphenyls and allenes Fischer projection Inter conversion of Sawhorse, Newmann and Fischer projections- Molecules with more than one asymmetric center (restricted to five carbons). e.g. Erythro - threo compounds- Optical activity- optical activity calculations- optical purity.

### UNIT III: CONFORMATIONAL ANALYSIS

**Conformational Analysis-** Conformational analysis of disubstituted cyclohexane and their stereo chemical features (geometric and optical isomerism (if shown) by these derivatives) Conformation and reactivity of substituted cyclohexanol (oxidation)-

cyclohexanone(reduction) and cyclohexane carboxylic acid derivatives (esterification and hydrolysis) Conformation and stereochemistry of cis and trans decalin and 9 - methyldecalin. Baeyer 's strain theory – alpha haloketone effect- 3alkyl ketone effect, 2alkyl ketone effect

#### **UNIT IV: ALIPHATIC NUCLEOPHILIC SUBSTITUTION REACTION**

**Aliphatic Nucleophilic Substitution Reaction:**  $SN^1$ ,  $SN^2$  and  $SN^i$  mechanisms - Neighboring group participation - reactivity, structural and solvent effects - substitution in norbornyl and bridgehead systems - substitution at allylic - vinylic carbons - substitution by ambident nucleophiles - substitution at carbon doubly bonded to oxygen and nitrogen - alkylation and acylation of amines, halogen exchange, Von-Braun reaction, alkylation and acylation of active methylene carbon compounds, hydrolysis of esters, Claisen - Dieckmann condensation  $SE^1$ ,  $SE^2$  and  $SE^i$  mechanism, double bond shift, Reactivity, Migration of double bond- keto enol interconversion- HVZ reaction- Stark-Enamine reaction- halogenation of aldehydes and ketones and decarboxylation of aliphatic acids.

#### **UNIT V: AROMATIC ELECTROPHILIC AND NUCLEOPHILIC SUBSTITUTION REACTIONS**

##### **Aromatic Electrophilic Substitution Reactions:**

The arenium ion mechanism. Orientation and reactivity (ortho, meta and para directing groups). Typical reactions - nitration, halogenation, alkylation, acylation and diazonium coupling, Formylation, Reimer - Tieman reaction, Vilsmeier - Haack, Gattermann, GattermannKoch, Kolbe reaction.

##### **Aromatic Nucleophilic Substitution Reactions:**

Aromatic Nucleophilic substitution of activated halides Ziegler alkylation- Chichibabin reaction Kinetic -nonkinetic methods of determining organic reaction mechanism Hammett and Taft equations - Simple Problems

#### **REFERENCES**

1. Organic Synthesis by R.O.C. Norman, Chapman and Hall, NY, (1980)
2. Physical Organic Chemistry by Niel Isaacs, ELBS Publications (1987)
3. Organic Reaction Mechanism by S.M. Mukherji and S.P. Singh, MacMillan India Ltd., Chennai (2010).
4. Organic Chemistry IV Edition by Stanley Pines
5. Stereochemistry of organic compounds, Principles and applications, D.Nasipuri.
6. Structures and Mechanism by E.S. Gould

7. Advanced Organic Chemistry, Part A and B, by Francis A. Carey and Richard J. Sundberg, 3rd Edition (1990), Plenum Press.
8. Aromatic Nucleophilic Substitution by J. Miller
9. Advanced Organic Chemistry III Edition by J. Miller
10. Reactive Molecules, C. Wentrup, John Wiley and Sons, New York (1984)
11. Advanced organic reaction mechanism and structure by J. March, Tata McGraw Hill.
12. Organic Chemistry, Marc London
13. Organic Chemistry, Mc Murray
14. Organic Chemistry, Graham Solomons
15. Carbenes, Nitrenes and Arynes by T.L. Gilchrist and C.W. Rees, Thomas Nelson and Sons Ltd., London.
16. Stereochemistry, Conformation analysis and Mechanism by P.S. Kalsi, 2nd Edition (1993), Wiley Eastern Limited, Chennai.
17. Stereochemistry of carbon compounds by Ernest Eliel
18. Stereochemistry and Mechanism through solved problems by P.S. Kalsi. Wiley Eastern Ltd., (1994)
19. Basic principles of Organic Stereochemistry by P. Ramesh - Madurai Kamaraj University.
20. Organic Reaction Mechanism by R.K. Bansal.
21. Reaction Mechanism 5<sup>th</sup> Edition by Aluwalya
22. A Guide book to mechanism in organic chemistry by Longman.
23. Structure and mechanism in organic chemistry by C.K. Ingold, cornell University press.

### Question Pattern

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
49	0	0	0	49	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

# SEMESTER-I

## INORGANIC CHEMISTRY-I

Core Course : II  
Course Code : 18PCH1CC2

Hours : 6 h  
Credit : 5  
Max. Marks : 100  
Internal : 25  
External : 75

### OBJECTIVES

- To understand the properties of lanthanides.
- To study the fusion and fission reactions of inorganic elements.
- To know the high level ideas about co-ordination complex.

### UNIT I: Chemistry of Lanthanides

Studies, Application of Lanthanides- Actinides: Spectral-Magnetic properties-Methods of separation of Lanthanides-Actinides using complex formation- Solvent extraction ion exchange- fractional crystallization, Organometallic Compounds of lanthanides-Application of lanthanides and actinides compounds in Industries-Use of lanthanides compounds as Shift reagents.

### UNIT II: Nuclear Chemistry

Nuclear Chemistry, Radioactive decay, equilibrium, Nuclear Reactions, Types, Q value, Cross Section of reactions- Chemical effects of nuclear transformation, Nuclear Fission - Fission Products, Fission Yield, Nuclear Reactors, Nuclear Fusion- stellar energy, Radioactive techniques: (i) Tracer techniques (neutron activation analysis), (ii) Countering Techniques such as G.M Ionization - Proportional counters- Applications of nuclear chemistry.

### UNIT III: Main group Chemistry

Chemistry of boron, borane, higher boranes, carboranes, borazines, boron nitrides, Classification, Nomenclature, preparation- Structure, Bonding, Wade's rule, Chemistry of silicon- silanes- higher silanes- multiple bonded systems, disilanes, silicon nitrides, siloxanes and silicates, PN compounds- cyclophosphazenes, cyclophosphazanes, SN compounds -  $S_4N_4$ ,  $(SN)_x$ .

### UNIT IV: Coordination Chemistry: Theories of Metal-Ligand Bond

VB theory and its limitations, Crystal field theory, splitting of d orbitals under various geometries- Factors affecting splitting- CFSE and evidences for CFSE (Structural and thermodynamic effects) Spectrochemical series, Jahn-Teller distortion, Spectral and magnetic

properties of complexes - Site preferences- Limitations of CFT - Ligand field theory - MO theory - sigma and pi bonding in complexes - Nephelauxetic effect - The angular overlap model.

### **UNIT V: Coordination Chemistry: Reaction Mechanism**

Kinetics and mechanism of reactions in solution labile and inert complexes Ligand displacement reactions in octahedral and square planar complexes - acid hydrolysis, base hydrolysis and anation reactions - trans effect - theory and applications, Electron transfer reactions - electron exchange reactions - complementary and non-complementary types - inner sphere and outer sphere processes, isomerization and racemization reactions of complexes - Molecular rearrangement, Reactions of four and six-coordinate complexes - Inter conversion between stereoisomers. Reactions of coordinated ligands, Template effect - Macrocyclic ligands-Factors affecting stability of complexes.

### **REFERENCES**

1. M.C. Day, J. Selbin, Theoretical Inorganic Chemistry, 2<sup>nd</sup> Ed., East West Press, 1985.
2. F.A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, 4<sup>th</sup> Ed., John Wiley & Sons, 1986.
3. J.E. Huheey, Inorganic Chemistry, 3<sup>rd</sup> Ed., Harper & Row publisher, 1983.
4. S.F.A. Kettle, Physical Inorganic Chemistry – A Coordination Chemistry Approach, Oxford University Press, 1996.
5. D.E. Douglas, D.H. McDaniel, J.J. Alexander, Concepts and Models in Inorganic Chemistry, 3<sup>rd</sup> Ed. 1994.
6. J.D. Lee, Concise Inorganic Chemistry, 5<sup>th</sup> Ed, Wiley, 1999.
7. D.F. Shriver, P.W. Atkins, Inorganic Chemistry, 3<sup>rd</sup> Ed, 1999.
8. A.G. Sharpe, Inorganic Chemistry, Pearson Education, 2008.

### **Question Pattern**

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<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
45	0	0	0	45	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

# SEMESTER-I

## PHYSICAL CHEMISTRY – I

**Core Course : III**  
**Course Code : 18PCH1CC3**

**Hours : 6 h**  
**Credit : 5**  
**Max. Marks : 100**  
**Internal : 25**  
**External : 75**

### OBJECTIVES

- *To predict the notation of symmetry elements in molecule.*
- *To understand the thermal influence and rate of the reaction.*
- *To gather the information of radiation absorption and emissions involved reactions.*

### UNIT 1: Elements of Group Theory

Introduction, Symmetry elements, Symmetry operations, n fold Proper axis of symmetry, Centre of Symmetry, Plane of Symmetry, nfold Improper axis of Symmetry, Group, Rules for forming a Group- Finite Group- Infinite Group- Abelian Group- Cyclic Group- Sub Groups, Group Multiplication Table- Class and Similarity transformation. Point Group - Method of Assigning Point Group, Matrix Representation Theory - Matrix Representation of Symmetry operation, Reducible, Irreducible Representation The Great Orthogonality Theorem, Properties of Irreducible Representation, Construction of Character Table for C<sub>3v</sub>, C<sub>2v</sub> Point Groups-Explanation of Character Table, Correlation Table.

### UNIT II: Basic concept of classical and quantum mechanical

Classical mechanics, General principles, basic assumptions, postulates of classical mechanics, conservation laws, Lagrange and Hamilton equations of motion (no derivation). Operator algebra: operator, linear and hermitian, eigen functions and eigen values, angular momentum operator, commutation relations- Application of wave mechanics to simple systems - particle in a box, one and three dimensional, distortion of the box and Jahn Teller effect - quantum numbers, Orthogonalisation and normalization - Potential barrier of definite thickness: Quantum mechanical tunneling

### UNIT III: Chemical Kinetics

Theories of reaction rate, Absolute reaction rate theory (ARRT) significance of reaction coordinate Potential energy surfaces Kinetic isotopic effect - molecular dynamics - Marcus

theory of electron transfer processes - Principle of microscopic reversibility, Steady-state approximation Chain reactions - thermal and photochemical reactions between hydrogen and bromine - explosions and hydrogen - oxygen reactions. Factors influencing reaction rates in solution, application of ARRT to solution kinetics - effect of solvent and ionic strength, influence of pressure on rates in solution - significance of volume of activation

#### **UNIT IV: Classical Thermodynamics**

Thermodynamics of systems -variable composition - partial molar property - partial molar quantities of E, V, H, A, G and S, chemical potential- physical significance of chemical potential, variation of chemical potential with respect to T and P, chemical potential in terms of U and H, partial molar quantities from experimental data - direct method, apparent molar properties, intercepts method and general methods, Calculation of thermodynamic properties of real gases - fugacity concept, variation of fugacity with T and P - calculation of fugacity of real gases, determination of fugacity - graphical method, equation of state method, determination of fugacity in gas mixtures -Lewis-Randall rule.

#### **UNIT V: Photochemistry and Radiation Chemistry**

Photochemistry and Radiation chemistry: Photo physical process in electronically excited molecules -Quantum yield-Fluorescence and phosphorescence- Jablonski diagram - Stern-Volmer equation - Chemical Actinometers - Lasers and their applications- Radiation chemistry: Sources of high energy radiation - radiolysis of water - solvated electrons - Scavenging techniques - Applications of radiation chemistry.

**Fast reaction techniques:** Introduction, flow methods (continuous and stopped flow methods)- Relaxation methods (T and P jump methods) - Pulse techniques (pulse radiolysis, flash photolysis, Shock tube method)- molecular beam method - lifetime method.

#### **REFERENCES**

1. F.A.Cotton, Chemical Application of Group Theory. 2nd Edn. Wiley – Eastern Press, 1995.
2. K.V.Raman Group theory and its Application to Chemistry. Tata McGraw –Hill Publishing Company Limited New Delhi, 2000.
3. F.L.Pillar, Elementary Quantum Chemistry, McGraw Hill, 1970
4. A.K.Chandra, “Introductory Quantum Chemistry” 4th edition; Tata – McGraw Hill, 2010.
5. R.K.Prasad, Quantum Chemistry, New Delhi, Wiley-Eastern Ltd, 1992.

6. K. J. Laidler, Chemical Kinetics, 2nd ed, Tata McGraw Hill (1975),
7. A. A. Frost and R. G. Pearson, Kinetics and Mechanisms, John Wiley & Sons (1953),
8. J. C. Kuriacose and J. Rajaram, Kinetics and Mechanisms Transformations, Macmillan & Co., (1993),
9. S. Glasstone, Thermodynamics for Chemists, East-west Affiliated Pvt Ltd, New Delhi (1969),
10. R. P. Rastogi and R. R. Misra, An Introduction to Chemical Thermodynamics Vikas Publishing House Pvt Ltd., (1992)
11. K. L. Kloz and P. M. Rosenberg, Chemical Thermodynamics: Basics Theory and Methods, 3rd ed., W. A. Benjamin, NY (1974)
12. K. K. Rohatgi and Mukerjee, Fundamentals of Photo Chemistry, Wiley Eastern Ltd (1986)
13. G. Hughes, Radiation Chemistry, Oxford University Press (1973)
14. S. Glasstone, Introduction to Electro Chemistry, Affiliated East-west Press, 1968
15. D. R. Crow, Polarography of metal complexes, Academic Press, New York.

### Question Pattern

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<b>Section :C (10 Marks)</b>	<b>Answer three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
53	0	0	0	53	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

# SEMESTER-I

## ORGANIC CHEMISTRY PRACTICAL – I

<b>Core Practical</b> : 1	<b>Hours</b> : 6 h
<b>Course Code</b> :18PCH2CP1	<b>Credit</b> : 4
	<b>Max. Marks</b> : 100
	<b>Internal</b> : 40
	<b>External</b> : 60

### OBJECTIVES

- To know the separation technique of organic compounds
- To expert the preparation of organic compounds

### 1. Separation of Organic Mixtures

- I. Pilot separation
- II. Bulk separation
- III. Determination of melting point/boiling point
- IV. Analysis
- V. Derivatization

### 2. Preparations – (Two stages)

- I. Acetanilide to *p*-bromoacetanilide to *p*-bromoaniline.
- II. Acetanilide to *p*-nitroacetanilide to *p*-nitroaniline.
- III. Preparation of  $\text{Cu}_2\text{Cl}_2$ ; 2-chlorobenzoic acid from anthranilic acid.
- IV. Benzoin to benzil to benzilic acid.
- V. Benzophenone to benzopinacol to benzopinacolone.

### REFERENCE:

1. J. Mohan, Organic Analytical Chemistry, Theory and Practice, Narosa, 2003.
2. V.K. Ahluwalia, P. Bhagat, R. Aggarwal, Laboratory Techniques in Organic Chemistry, I.K. International, 2005.
3. N.S. Gnanaprakasam, G. Ramamurthy, Organic Chemistry Lab Manual, S.V. Printers, 1987.
4. A.I. Vogel, A.R. Tatchell, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, Vogel's Textbook of Practical Organic Chemistry, 5<sup>th</sup> Ed., Prentice Hall, 1996.

### Scheme of valuation

Criteria	Marks	
<b>Record</b>	5	
<b>Procedure writing</b>	10	
<b>Organic preparation</b>	15	
<b>Analysis</b>		
	<b>I</b>	<b>II</b>
<b>Aliphatic/aromatic</b>	2	2
<b>Saturated/unsaturated</b>	2	2
<b>Element test</b>	4	4
<b>Functional group</b>	5	5
<b>derivative</b>	2	2

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
6	0	0	0	6	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER-I

### INORGANIC CHEMISTRY PRACTICAL - I

Core Practical : II	Hours	: 6 h
Course Code : 18PCH2CP2	Credit	: 4
	Max. Marks	: 10
	Internal	: 40
	External	: 60

#### OBJECTIVES

- To improve the knowledge about inorganic qualitative analysis
- To practice the colorimetric titrations

#### 1. Semi-micro Qualitative Analysis

Analysis of two common and two rare earth elements in a given inorganic mixture

Common : Pb, Cu, Bi, Cd, Zn, Co, Ni, Ca, Ba, Sr

Rare : W, Se, Te, Mo, Ce, Zr, Th, V, Li.

#### 2. Colorimetric Estimation:

Cu, Fe, Mn, Ni, Cr

#### REFERENCE:

- 1.V.V. Ramanujam, Inorganic Semi Micro Qualitative analysis, National Pubs, 1988.
- 2.A.I. Vogel, Text Book of Quantitative Inorganic Analysis, 3<sup>rd</sup> Ed., Longman, 1966.

#### Scheme of Valuation

Criteria		Marks	
Record		5	
Aim and tabulation		5	
Mixture analysis [30]		Colorimetry [20]	
4- radicals with correct procedure	30	Error	Marks
3- radicals with correct procedure	25	< 1 %	20
2- radicals with correct procedure	20	1-2%	15
1- radical with correct procedure	10		

<b>spotting</b>	10	2-3%	10
		3%	5

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
6	0	0	0	6	0	0	0	100	Global

Local-Green; Regional-Pink; National-Blue; Global-Brown

**SEMESTER-II**  
**INORGANIC CHEMISTRY – II**  
**(BIOINORGANIC AND ORGANOMETALLIC CHEMISTRY)**

**Core Course : IV**  
**Course Code : 18PCH2CC4**

**Hours : 6 h**  
**Credit : 5**  
**Max. Marks : 100**  
**Internal : 25**  
**External : 75**

**OBJECTIVES**

- *To know the mechanism of Bioinorganic Chemistry.*
- *To understand the function and transport of alkali and alkaline earth metal ions.*
- *To gather the information of Organometallics functions.*

**UNIT I**

General Principles of Bioinorganic Chemistry-Occurrence - availability of Inorganic elements in Organisms - Biological function of inorganic elements - Biological ligands for metal ion coordination of proteins - enzymatic catalysis - Porphyrins and other Macrocycles - Nucleobases, nucleotides Nucleic acids as ligands, bleomycin-siderophores- Communication roles for metals in biology. Function and Transport of Alkali - Alkaline Earth Metal Ions- Characterization of  $K^+$ ,  $Na^+$ ,  $Ca^{2+}$  and  $Mg^{2+}$  - Metal ion transport and storage - complexes of alkali and alkaline earth metal ions with macrocycles - Ion channels - ion pumps, Metals at the Center of Photosynthesis, Primary Processes in Photosynthesis - Photosystems I - II - Light Absorption (Energy Acquisition) - Exciton transport (Direct Energy Transfer) - Charge separation - electron transport.

**UNIT II**

Cobalamins: Reactions of the alkyl cobalamins - One electron Reduction and Oxidation - coenzyme  $B_{12}$  - Alkylation reactions of methylcobalamine, Heme Non-heme Proteins: Hemoglobin and Myoglobin - Hemerythrin - Oxygen transport and storage - Electron transfer - Ferredoxins - Rubredoxins- Cytochromes - Cytochrome C Oxidase - Oxygen activation - Mononuclear non heme iron- enzymes model systems, Copper Containing Proteins: Classification of copper proteins and examples - Electron transfer (Cu,

Zn), Blue copper proteins - Oxygen transport - Hemerythrin - Oxygenation - Oxidases - reductases - Superoxide dismutase-Nickel containing Enzymes: Urease, Hydrogenases

### **UNIT III**

Medicinal Bioinorganic Chemistry: Bioinorganic Chemistry of quintessentially toxic metals. Lead, Cadmium, Mercury, Aluminum, Chromium- Iron, Copper- Plutonium.

Chemotherapy: Chemotherapy with compounds of certain non-essential elements. Platinum complexes in Cancer therapy Cisplatin and its mode of action Cytotoxic compounds of other metals -Gold containing drugs as antirheumatic agents - their mode of action - Lithium in Psychopharmacological drugs.

### **UNIT IV**

Organometallics: Basic Concepts: Hapticity, ligand classification, synthesis and structure - The 18 electron rule - applications and limitations Isolobal concept and its usefulness. Preparation, properties- structure and bonding in Metal carbonyls, nitrosyls, Metal olefins, acetylenes, Metallocene and arene complexes.

Classification based on captivity - polarity of MC bond, organometallic compounds of lanthanides and actinides fluxional organometallic compounds - application of organometallics.

### **UNIT V**

Organometallic Chemistry: Reactions and Catalysis by Organometallics: Organometallic reactions - Ligand association and dissociation - oxidative addition and reductive elimination Insertion reactions, Reactions of coordinated ligands in organometallics - Hydrogenation, hydroformylation, epoxidation, polymerization of olefins, olefin oxidation (Wacker process) and carbonylation of methanol-Sensitive of agostic interactions.

### **REFERENCE:**

1. J. E. Huheey, Inorganic Chemistry, 3<sup>rd</sup> Ed., Harper & Row Publishers, 1983.
2. K.F. Purcell, J.C. Kotz, Inorganic Chemistry, Saunders Golden Sunburst Series, 1977.
3. S.J. Lippard, J.M. Berg, Principles of Bioinorganic Chemistry, Panima Publishing Company, 1977.
4. W. Kaim, B. Schwederski, Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life, John Wiley & Sons, 1994.
5. F.A Cotton, G. Wilkinson, Advanced Inorganic Chemistry, 5<sup>th</sup> Ed., John Wiley & Sons, 1992.

6. Bioinorganic Chemistry, Chem. Education, 62, No. 11, 1985.
7. G.L. Eichorn, Inorganic Biochemistry, Volumes 1 & 2, 2<sup>nd</sup> Ed., Elsevier, 1973.
8. Oxford Chemistry Primers Series, No.12, M. Bochmann, Organometallics 1: Complexes with transition metal-carbon  $\sigma$  bonds and No. 13 M. Bochmann, Organometallics 2: Complexes with transition metal- carbon  $\pi$ -bonds.
9. J.P. Collman, L.S. Hegeudus, J.R. Nortan, R.G. Finke, Principles and Applications of Organotransition Metal Chemistry, University Science Books, 1980.
10. R. Hoffmann, Angew. Chem. Int. Ed., Engl. 21, 711-800, 1982.

### Question Pattern

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Answer three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
63	0	0	0	63	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER-II

### PHYSICAL METHODS IN CHEMISTRY - I

Core Course : V  
Course Code : 18PCH2CC5

Hours : 6 h  
Credit : 5  
Max. Marks : 10  
Internal : 25  
External : 75

#### OBJECTIVES

- To know the Rotational and Vibrational Spectroscopy.
- To understand the functions of NMR, IR, UV.
- To meet the information about the spectrum studies.

#### UNIT I

##### Rotational and Vibrational Spectroscopy

**Rotational Spectroscopy:** Microwave spectroscopy, rotational spectra of diatomic molecules, rigid and non rigid rotors-Intensity of spectral lines-Effects of isotopic substitution - Microwave spectra of polyatomic molecules, Linear - symmetric top molecules, techniques and instrumentation- **UV Visible Spectroscopy:** Introduction - Instrumentation, Sampling techniques, WoodwardFieser - Scott rules for conjugated dienes and polymers, ketones, aldehydes-  $\alpha$ ,  $\beta$  unsaturated acids-esters nitriles and amides, Differentiation of geometrical isomers and positional isomers -Disubstituted benzene, Study of steric effect in aromaticity.

#### UNIT II

##### Advanced Spectroscopy: NMR

$^1\text{H}$  NMR Spectroscopy - Multiplicity - Coupling constant - First order and second order proton, Spin - spin splitting - Dependence of J on dihedral angle, Vicinal and geminal coupling constants, Karplus equation - long range coupling constants- Influence of stereochemical factors on chemical shift of protons-Simplification of complex spectra - double resonance techniques, shifts reagents, Chemical spin decoupling of rapidly exchangeable protons (OH, SH, COOH, NH,  $\text{NH}_2$ ), an elementary treatment of NOE phenomenon, DEPT spectra. Identification of small compounds based on NMR data-2D Techniques:  $^1\text{H}$   $^1\text{H}$  COSY -  $^1\text{H}$   $^{13}\text{C}$  COSY - HMBC - NOESY.

#### UNIT III

##### Advanced Spectroscopy: IR

**Infrared Spectroscopy:** Introduction, Instrumentation, Sampling techniques, factors influencing group frequencies - Both internal and external , quantitative studies. Hydrogen bonding - (intermolecular and intramolecular)-

Infrared spectra - diatomic molecules, simple harmonic and anharmonic oscillators, diatomic vibrating rotator, rotation-vibration spectrum of carbon monoxide- Interaction of rotation and vibration (breakdown of Born,Oppenheimer approximation) Influence of the rotation on the spectrum of polyatomic molecules, linear and symmetric top molecules, parallel and perpendicular vibrations- influence of nuclear spin.

#### **UNIT IV**

##### **Electrons spin resonance spectroscopy:**

Basic principles - comparison between ESR and NMR spectra - hyperfine splitting - factors affecting the magnitude of g values-calculation of unpaired electron density on an atom in a delocalized system- applications to organic free radicals.

##### **Mass Spectrometry:**

Instrumentation, Resolution, EI and CI methods - Base peak, isotopic peaks, metastable peak, parent peak, determination and use of molecular formula, recognition of molecular ion peak - FAB. Fragmentation - General rules - Pattern of fragmentation for various classes of compounds- McLafferty rearrangement-Importance of metastable peaks.

#### **UNIT V**

##### **X Ray Diffraction:**

X Ray diffraction by single crystal method - space groups - systematic absences in X ray data and identification of lattice types, glide planes and screw axes - X ray intensities - structure factor and its relation to intensity and electron density - phase problem - structure solution by heavy atom method - direct method - determination of absolute configuration of molecules - a brief account of Cambridge Structural Database (CSD) - Protein Data Bank (PDB).

#### **REFERENCE:**

1. C.N. Banwell, Fundamentals of molecular Spectroscopy, 3rd ed., TMH, New Delhi, 1995.
2. B.P. Straughan and S.Walker Spectroscopy Vol.3, Chapman Hall London, 1976.

3. G.M. Barrow, Introduction to Molecular Spectroscopy, McGraw Hill, New York, 1964.
4. P.K.Ghosh, Introduction to Photoelectron Spectroscopy, John Wiley New York, 1989.
5. P.M. Silverstein, F. X. Wester, Spectroscopic Identification of Organic Compounds, 6<sup>th</sup> ed., Wiley 1998.
6. W. Kemp, Organic Spectroscopy, 3rd Ed., MacMillon, 1994.
7. Y.R. Sharma , Elementary Organic Spectroscopy – Principles and Chemical applications, S.Chand,1992.
8. P.S.Kalsi, Spectroscopy of Organic Compounds.
9. Gurdeep R Chatwal and Sham K Anand, Spectroscopy, Himalaya Publishing House (2009).
10. Clegg,W., Crystal structure determination, Oxford University press , New York,1998.
11. Stout,G.H., Jensen , L.H. X-ray structure determination : A practical guide , John wiley& sons Publication: New York,1989
12. **Webpages :**
  - a) Cambridge Structural Database (CSD) - <http://www.ccdc.cam.ac.uk/products/csd/>
  - b) Protein Data Bank (PDB) - <http://www.rcsb.org/pdb/home/home.do>

**Question Pattern:**

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Answer three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
56	0	0	0	56	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER-II

### ORGANIC CHEMISTRY PRACTICALS – II

Core Practical :III	Hours	: 6 h
Course Code :18PCH2CP3	Credit	: 4
	Max. Marks	: 100
	Internal	: 40
	External	: 60

#### OBJECTIVES

- *To Practice the estimation of organic compounds.*
- *To expert the preparation & isolation of organic compounds.*

#### 1. Estimations

1. Estimation of Aniline
2. Estimation of Phenol
3. Estimation of Methyl ketones
4. Estimation of Glucose
5. Estimation of Hydroxyl group
6. Estimation of Nitro group
7. Saponification Reaction Value

#### 2. Preparation and Isolation

1. Aniline to tribromoaniline to tribromobenzene
2. Methyl benzoate to methyl-*m*-nitrobenzoate to methyl-*m*-nitrobenzoic acid
3. Methyl salicylate to salicylic acid to acetyl salicylic acid
4. Chlorobenzene to dinitrochlorobenzene to 2,4-dinitrophenylhydrazine
5. Hydroquinone to *p*-benzoquinone to 5-hydroxy-1,3-benzoxathiaole to 5-acetoxy-1,3-benzoxathiaole-2-one
6. Extraction of Caffeine from tea leaves
7. Extraction of Eugenol from clove

**REFERENCE:**

1. J. Mohan, Organic Analytical Chemistry, Theory and Practice, Narosa, 2003.
2. V.K. Ahluwalia, P. Bhagat, R. Aggarwal, Laboratory Techniques in Organic Chemistry, I.K. International, 2005.
3. N.S. Gnanaprakasam, G. Ramamurthy, Organic Chemistry Lab Manual, S.V. Printers, 1987.
4. A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith, Vogel's Textbook of Practical Organic Chemistry, 5<sup>th</sup> Ed., Prentice Hall, 19

**Scheme of Valuation**

Criteria		Marks	
Record		5	
Aim and tabulation		10	
Organic double stage preparation [25]		Organic estimation 20]	
Stage I	10	Error	Marks
		< 1 %	20
Stage II	15	1-2%	15
		2-3%	10
		3%	5

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
6	0	0	0	6	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER-II

### INORGANIC CHEMISTRY PRACTICAL - II

Core Practical : IV  
Course Code : 18PCH2CP4

Hours : 6 h  
Credit : 4  
Max. Marks : 100  
Internal : 40  
External : 60

#### OBJECTIVES

- *To improve the practical knowledge of gravimetric estimation.*
- *To develop the knowledge about preparation & characterization of coordination complex*

#### 1. Volumetric and gravimetric analysis of a solution containing two cations

1. Copper and Nickel
2. Copper and Zinc
3. Ferrous and Ferric ions
4. Barium and Calcium

#### 2. Preparations and Characterization of Co-ordination Complexes

1. Tris(thiourea)copper(I) sulphate
2. Tetramminecopper(II) sulphate
3. Pentathioureadicuprous nitrate
4. Potassium trioxalato ferrate
5. Potassium trioxalatoaluminate
6. Potassium trioxalatochromate
7. Cis-Potassium dioxalato diaquochromate
8. Hexathiourea plumbum nitrate
9. Hexamminecobalt(III) chloride

#### REFERENCE:

1. A.I. Vogel's, Quantitative Inorganic Analysis, 5<sup>th</sup> Ed., Prentice Hall, 1996.

### Scheme of valuation

Criteria		Marks	
Record		5	
Aim and tabulation		10	
Inorganic preparation [15]		Gravimetry 30	
Bulk precipitate	15	Error	Marks
		< 1 %	30
		1-2%	25
		2-3%	15
		3%	10

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
6	0	0	0	6	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

# SEMESTER-II

## CONCEPTS AND MODELS IN CHEMISTRY

**Elective Course: 1:1**  
**Course Code : 18PCH2EC1:1**

**Hours : 6 h**  
**Credit : 4**  
**Max. Marks : 100**  
**Internal : 25**  
**External : 75**

### OBJECTIVES

- *To study the information about bio-organic molecules and metal ions.*
- *To understand the chemical bonding and chemical thermodynamics.*
- *To know about chemical kinetics.*

### UNIT I Bioorganic Chemistry

Amino acids - proteins: Structure- classification- nomenclature and function of amino acids- functional groups- isoelectric point, Peptide structure structural levels of proteins - primary, secondary, tertiary – quaternary, alpha, beta helix- collagen- fibrous and globular proteins

-Nucleic acids: Structures, functions of RNA and DNA, Enzymes: Coenzymes, Classification - Characteristics- functions- factors affecting enzyme activity: pH temperature, substrate concentration, Examples for coenzymes and its functions.

### UNIT II Metal Ions in Biology & Chemotherapy

Metal Ions in Biology-Occurrence and availability of Inorganic elements in Organism - Biological function of inorganic elements-Biological ligands for metal ions - Coordination of Proteins and enzymatic catalysis Porphyrins and other Macrocycles Nucleobases- nucleotides - other Nucleic acids as ligands- Metal ion transport and storage Cobalamines -Metals at the Center of Photosynthesis. Dioxygen transport: Oxygen Transport, Storage through Hemoglobin and Myoglobin. Alternative oxygen Transport in some Lower Animals: Hemerythrin and Hemocyanin. **Chemotherapy**-Platinum complexes in Cancer therapy - Cisplatin - its mode of action - Cytotoxic compounds of other metals - Gold containing drugs as antirheumatic agents - their mode of action, Lithium ion -Psychopharmacological drugs.

### UNIT III: Chemical Bonding

Atomic structure - Core and valence electrons, periodicity, valence shells and chemical reactivity - valence and chemical formulas - covalent, ionic and coordinate bonds - hydrogen bonds - non covalent interactions - electronic - molecular structure -  $\sigma$ ,  $\pi$  and  $\delta$  bonds bond parameters -

conformation, configuration various representations - macromolecules and three dimensional structures.

#### **UNIT IV: Chemical Thermodynamics**

Energy - the First Law of Thermodynamics, Conservation of energy-principle- work - heat, enthalpy, exothermic - endothermic reactions-  $C_p$ & $C_v$ - Hess's law of heat summation- use of standard enthalpies of formation - Entropy and the second law of Thermodynamics, Kelvin - Clausius statements of Second Law definition of entropy- spontaneity and reversibility- entropy change of the system- molecular basis of entropy- free energy - chemical equilibrium, Factors affecting equilibrium.

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

Rate of Reaction-order of reaction - derivation of rate equation for first order reaction- Determination of rate equation by isolation method - Effect of temperature on reaction rate - Arrhenius equation - Enzyme Kinetics, Michaelis - Menten equation - Salt effect on reaction rate (derivation not needed).

#### **REFERENCE:**

1. R.T. Morrison and R.N. Boyd, Organic Chemistry, 6<sup>th</sup> Ed., Pearson, 1992.
2. I.L. Finar, Organic Chemistry, Vol.II, 5<sup>th</sup> ed., ELBS 1975.
3. S. J. Lippard and J. M. Berg, Principles of Bioinorganic Chemistry, Purnima Publishing Company, 1997.
4. J.E. Huheey, Inorganic Chemistry, 3<sup>rd</sup> Ed., Harper & Row publisher, 1983.
5. W. Kaim and B. Schwederski, Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life, John Wiley
6. C.H. Snyder, The extra-ordinary chemistry of ordinary things, John Wiley, 1992.
7. B.H. Mahan, University chemistry, Narosa Publishers.
8. Gordon M. Barrow, Physical Chemistry, Tata McGraw Hill, 1994.
9. Bruce H. Mahan, University chemistry, Narosa Publishers.
10. P.W. Atkins, Physical Chemistry, ELBS and Oxford University Press, 1998.

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### Question Patern

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
66	0	0	0	66	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER-II

### BIOORGANIC CHEMISTRY

<b>Elective Course</b>	<b>: 1:2</b>	<b>Hours</b>	<b>: 6 h</b>
<b>Course Code</b>	<b>: 18PCH2EC1:2</b>	<b>Credit</b>	<b>: 4</b>
		<b>Max. Marks</b>	<b>: 10</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

#### OBJECTIVES

- *To study the information about Amino Acids and Proteins.*
- *To understand the chemical synthesis and functions.*
- *To know about Analogue Synthesis.*

#### UNIT I: Amino Acids and Proteins:

Structure, classification, synthesis and properties of amino acids- isoelectric point- biosynthesis of amino acids. Peptides: oligo and polypeptides, geometry of peptide linkage N terminal and C terminal residue analysis- synthesis of peptides- amino - carboxyl protecting groups- solid phase peptide synthesis- Proteins: classification properties (denaturation, isoelectric point and electrophoresis), primary, secondary, tertiary and quaternary structures of proteins- collagen and triple helix- Effects of human and environment.

#### UNIT II: Enzymes and Cofactors

Mechanism of enzyme catalysis, Factors influencing enzyme action- Examples of typical enzyme mechanisms: chymotrypsin- ribonuclease and lysozyme- Enzyme-catalyzed addition, elimination, condensation, carboxylation and decarboxylation, isomerisation- group transfer and rearrangement reactions- structure - biological functions of coenzyme A, thiamine pyrophosphate- pyridoxal phosphate  $\text{NAD}^+$ ,  $\text{NADP}^+$ , FMN, FAD- lipoic acid - Vitamin  $\text{B}_{12}$ . Mechanisms of reactions catalysed by the above cofactors.

#### UNIT III: Nucleic Acids and Protein Synthesis

Nucleotides and nucleosides, DNA-nitrogen bases DNA Function- primary and secondary structure-replication of DNA. RNA and protein synthesis: Messenger RNA synthesis- transcription, Ribosomes-rRNA, Transfer RNA- genetic code translation. Determination of base sequence of DNA. Polymerase Chain Reaction (PCR). Antisense technology in chemotherapy and other nucleic acid-targeted drugs- intercalators, sequence specific drugs. A brief account of ribosome and iRNA.

## UNITIV :Lead and Analogue Synthesis 1

Synthons and synthetic equivalents, Synthone approach-nucleophilic and electrophilic Synthons-umpolung reactions-typical examples. Retrosynthetic analysis-designing syntheses by disconnection approach. Formation of carbon-heteroatom bonds. Ring opening and ring closure reactions, Regioselective and stereoselective alkylation-cyclic ketones-cyclic enones-1,3 diketones- $\beta$ ketoesters - $\alpha$  halo ketones- Protecting groups-protection of hydroxyl, carboxyl, carbonyl and amino groups-illustration of protection - deprotection in syntheses.

## UNITV: Lead and Analogue Synthesis2

Combinatorial synthesis in medicinal chemistry: Solid phase techniques-methods of parallel synthesis-mix and split techniques-dynamic combinatorial chemistry-screening and deconvolution-limitations of combinatorial synthesis Asymmetric synthesis: basic principles- stereoselective and stereospecific reactions- methods for determining enantiomeric excess- chiral auxiliary, reagents and catalysts - their applications (wherever applicable) in alkylation, hydrogenation, hydroxylation, epoxidation - hydroboration of alkenes, reduction of ketones- Cram and Felkin-ahn models.

## REFERENCE:

1. Bioorganic Chemistry: A Chemical approach to Enzyme action, Hermann Dugas and C.Penny, Springer-Verlag.
2. Fundamentals of Enzymology, N.C. Price and L.Stevens, Oxford University Press.
3. Enzymatic Reaction Mechanisms, C. Walsh, W.H.Freeman.
4. Designing Organic Synthesis: The Disconnection Approach by Stuart Warren, Wiley, 2nd edition, 1984.
5. Asymmetric Synthesis by H. B. Kagan, Thieme Medical Publishers, 2003.
6. Advanced Organic Chemistry: Part-A and Part-B by Francis A. Carey and Richard B. Sundberg, Springer, 5th edition, 2007.

### Question Pattern

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>

<b>Total Marks</b>	<b>75</b>
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Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
57	0	0	0	57	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER - III

### ORGANIC CHEMISTRY – II

Core course:	VI	Hours	: 6h
Course code:	18PCH3CC6	Credit	: 5
		Max.Marks	: 100
		Internal	: 25
		External	: 75

### OBJECTIVES

- *To develop the knowledge in organic photochemistry*
- *To understand the reagents and reaction of organic compounds*
- *To understand the theoretical aspect of organic synthesis*

### UNIT I

#### Organic Photochemistry:

Fundamental concepts, Jablonski diagram-energy transfer characteristics of photo sensitization - characteristics of photo reactions of ketones, Norrish type I and II reactions - photochemistry of alkenes, dienes and aromatic compounds - reactions of unactivated centres photo additions -PatternoBuchi reaction. Photo substitution Barton reaction Hoffmann-Loffler Freytag reaction. Photo rearrangement, Photo - Fries and di -  $\pi$  methane rearrangements.

### UNIT II: Pericyclic Reactions

Pericyclic reactions, Concerted reactions-Symmetry properties of molecular orbital,Electrocyclic reactions, correlation diagram and Frontier molecular orbital (FMO) approach, Woodward Hoffmann rules-Cycloaddition reactions-Diels Alder reaction,- stereochemical modes: superficial and antrafacial processes, orbital symmetry in cycloaddition reaction: correlation diagrams and FMO method Sigmatropic rearrangements,analysis, Cope and Claisen rearrangements-Applications of FMO methods to pericyclic reactions-WoodwardHoffman rules.

### **UNIT III :Heterocycles**

Nomenclature: Trivial, systematic and replacement nomenclatures - Non-aromatic heterocycles: Synthesis of Tetrahydrofuran's, Pyrrolidines, Tetrahydropyrans-Piperidines- Ring synthesis and reactivity of the following aromatic heterocycles: Aziridines-Oxiranes-Thiiranes-Azetidines, Oxazoles, Imidazoles, Thiazoles, Isooxazoles-Pyrazoles-Isothiazoles-Triazoles- Pyrimidines - Purines -Triazines.

### **UNIT IV: Named Reactions and Strategic Applications in Organic Synthesis**

Bamford-Stevens Reaction -Baylis-Hillman Reaction -Biginelli Reaction - Enamines and selective alkylation (mono and di) via enamine reactions - Henry Reaction -Hosomi-Sakurai Reaction, Hunsdiecker Reaction -Mukaiyama Aldol Addition -Nazarov Cyclization - Peterson Olefination - Prevost Reaction -Prins Reaction -Wittig reaction and its modifications. Palladium based reactions: Fukuyama Coupling - Heck Reaction -Hiyama Coupling -Stille Coupling - Suzuki Coupling - Tsuji-Trost Reaction.

### **UNIT V: Reagents in Organic Synthesis**

Catalytic hydrogenation and dehydrogenation - Reduction with LAH, NaBH<sub>4</sub>, tritertiarybutoxy aluminum hydride, NaCNBH<sub>3</sub>, tributyltin hydride, Me<sub>3</sub>SiCN, alkali metals for reduction- reductions with hydrazines- Osmium tetroxide, Sharpless asymmetric epoxidation-Chromyl chloride - Ozone - DDQ -Dioxiranes- Lead tetraacetate- Selenium dioxide - Gilman reagents - Dithione- DMSO either with Ac<sub>2</sub>O or oxalyl chloride -DessMartin reagent - LDA Phase transfer catalysis (PTC) Merrifield resin- Baker's yeast.

### **REFERENCE:**

1. S.M.Mukherji and S.P.Singh, Reaction Mechanism in Organic Chemistry, 3<sup>rd</sup> edition, Macmillan, 2010.
- 2.H.O. House, Modern Synthetic Reactions, 2<sup>nd</sup> Ed., W. A. Benjamin, 1972.
- 3.F.A. Carey, R.J. Sundberg, Advanced Organic Chemistry, Parts A & B, 5<sup>th</sup> Ed., Springer, 2007.
- 4.T. L. Gilchrist, Heterocyclic Chemistry, 3<sup>rd</sup> Ed., Prentice Hall, 1997.
- 5.R.K. Bansal, Heterocyclic chemistry- Syntheses, Reactions and Mechanisms, Wiley Eastern Ltd, 1990.

- 6.K. Mackie, M. Smith, Guide Book to Organic Synthesis, ELBS, England 1982.
- 7.L. Kurti, B. Czako, Strategic Applications of Named Reactions in Organic Synthesis, Elsevier, 2005.
- 8.Hassner, C. Stumer, Organic Synthesis Based on Name and Unnamed Reactions, Elsevier Science Ltd., UK, 1994.
- 9.G. Brahmachari, Organic Name Reactions: A Unified Approach, Alpha Science Intl. Ltd, 2006.
10. Also refer: <http://www.organic-chemistry.org/>; <http://www.organicworldwide.net>.

### Question Patern

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
66	0	0	0	66	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER - III

### PHYSICAL METHODS IN CHEMISTRY II

Core course: VII  
Course code: 18PCH3CC7

Hours : 6h  
Credit : 5  
Max.Marks : 100  
Internal : 25  
External : 75

#### OBJECTIVES

- To understand electronic spectroscopy of metal complexes.
- To study in detail IR, Raman and NMR of inorganic compounds
- To learn the EPR, Mossbauer and magnetic properties of metal complexes.

#### UNIT I: Electronic Spectroscopy

Electronic configuration-quantum numbers spin-spin coupling, orbit-orbit coupling and spin-orbit coupling, microstates, terms, Mulliken symbols for microstates and energy level splitting for  $d^1 - d^9$  ions in cubic and square fields - selection rule for electronic spectra Orgel diagram and Tanabe-Sugano diagram, evaluation of  $10Dq$  and  $\beta$  for octahedral complexes of cobalt, nickel and  $[\text{Ru}(\text{bipy})_3]^{2+}$  - intensity of bands - effect of distortion and spin-orbit coupling on spectra, applications to simple coordination compounds - charge transfer spectra - L-M and ML charge transfer transition ORD, CD-MCD principle - applications to metal complexes.

#### UNIT II: Infrared and Raman Spectroscopy

Conditions for IR active vibrations in simple molecules ( $\text{H}_2\text{O}$ ,  $\text{CO}_2$ ) and their symmetry notation for molecular vibrations - group vibrations and the limitations - combined uses of IR and Raman spectroscopy in the structural elucidation of simple molecules like  $\text{N}_2\text{O}$ ,  $\text{ClF}_3$ ,  $\text{NO}_3$  effect of coordination on ligand vibrations - uses of group vibrations in the structural elucidation of metal complexes of urea, Thiourea- cyanide, thiocyanate and dimethyl sulfoxide. Effect of isotopic substitution on the vibrational spectra of molecules - vibrational spectra of metal carbonyls with reference to the nature of bonding - geometry and number of CO stretching vibrations (group theoretical treatment) - applications of Raman spectroscopy.

#### UNIT III: NMR Spectroscopy

NMR spectroscopy - theory of NMR spectra- number of NMR signals - chemical shifts- factors affecting the chemical shift values - coupling constants involving different nuclei ( $^1\text{H}$ ,

$^{31}\text{P}$ ,  $^{13}\text{C}$ ) - AX and AB spin system - Effect of quadrupolar nuclei ( $^2\text{H}$ ,  $^{10}\text{B}$ ,  $^{11}\text{B}$ ) on the  $^1\text{H}$  NMR spectra.  $^{13}\text{C}$  NMR - proton decoupled and off resonance  $^{13}\text{C}$  NMR spectra - factors affecting the  $^{13}\text{C}$  NMR chemical shifts - Systems with chemical exchange - study of fluxional behaviour of molecules - NMR of paramagnetic molecules.

#### **UNIT IV: EPR Spectroscopy and Magnetic properties**

Theory of EPR spectroscopy - spin densities and McConnell relationship - factors affecting the magnitude of g and A tensors in metal species - zero-field splitting and Kramers degeneracy - spectra of V(II), Mn(II), and Cu(II) complexes, applications of EPR to a few biological molecules containing Cu(II) - Fe(III) ions- Magnetic properties, types of magnetism - dia-, para-, Ferro- and antiferromagnetism, magnetic properties of free ions - first-order Zeeman effect - second-order Zeeman effect - states  $kT$  - states  $\ll kT$  - determination of magnetic moments and their applications to the elucidation of structures of inorganic compounds- **Anisotropy in the hyperfine coupling constant-electron delocalization-instrumentation - applications.**

#### **UNIT V: Mossbauer Spectroscopy**

Isomer shifts - quadrupole splitting - Conditions of MB - magnetic interactions- applications to iron and tin compounds. NQR spectroscopy- characteristics of quadrupolar nucleus - effects of field gradient and magnetic field upon quadrupole energy levels - NQR transitions - applications of NQR spectroscopy.

#### **REFERENCES:**

1. R. S. Drago, Physical Methods in Inorganic Chemistry; Affiliated East-West Press Pvt. Ltd., New Delhi, 2012.
2. R. S. Drago, Physical Methods in Chemistry; Saunders College Publications, Philadelphia, 1992.
3. F. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, 6th Ed., Wiley-Eastern Company, New Delhi, 1999.
4. P. J. Wheatley, The Determination of Molecular Structure; 2nd Ed., Dover Publications, Mineola, 1981.
5. G. J. Leigh, N. Winterton, Modern Coordination Chemistry; Royal Society of Chemistry, UK, 2002.
6. E. A. V. Ebsworth, Structural Methods in Inorganic Chemistry; 3rd Ed., ELBS, Great Britain, 1987.

7. W. Kemp, Organic Spectroscopy; 3rd Ed., Palgrave, New York, 2011.
8. J. R. Dyer, Applications of Absorption Spectroscopy of Organic Compounds, PHI Learning, New Delhi, 2009.
9. Y. R. Sharma, Elementary Organic Spectroscopy – Principles and Chemical Applications; S. Chand and Co., New Delhi, 1992.
10. P. S. Kalsi, Spectroscopy of Organic Compounds; 6th Ed., New Age International Publishers, New Delhi, 2004.

### Question Patern

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
67	0	0	0	67	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER - III

### PHYSICAL CHEMISTRY PRACTICAL – I

<b>Core practical:</b>	<b>V</b>	<b>Hours</b>	<b>:</b>	<b>6</b>
<b>Course code :</b>	<b>18PCH3CP5</b>	<b>Credit</b>	<b>:</b>	<b>4</b>
		<b>Max.Marks</b>	<b>:</b>	<b>100</b>
		<b>Internal</b>	<b>:</b>	<b>40</b>
		<b>External</b>	<b>:</b>	<b>60</b>

**Any ten experiments from the following experiments (to be decided by the course teacher):**

1. Kinetics – Acid Hydrolysis of Ester – Comparison of strength of acids.
2. Kinetics – Acid Hydrolysis of Ester – Determination of Energy of Activation ( $E_a$ ).
3. Kinetics – Saponification of Ester – Determination of  $E_a$  by conductometry.
4. Kinetics – Persulphate – Iodide Reaction – Determination of order, effect of Ionic strength on rate constant.
5. Polymerization – Rate of polymerization of acrylamide.
6. Distribution Law – Study of iodine – Iodide equilibrium.
7. Distribution Law – Study of Association of Benzoic Acid in Benzene.
8. Adsorption – oxalic Acid \ Acetic Acid on charcoal using Freundlich isotherm.
9. Determination of critical solution temperature of phenol-water system and effect of impurity of added electrolyte on CST.
10. Determination of molecular weight by Rast Macro method
11. Determination of molecular weight by Transition Temperature.
12. Determination of eutectic temperature and eutectic composition of binary mixture.
13. Determination of primary salt effect.

**REFERENCES:**

1. B.P. Levitt, Ed., Findlay`s practical Physical Chemistry, 9<sup>th</sup> Ed., Longman, 1985.
2. J.N. Gurtu, R. Kapoor, Advanced Experimental Chemistry, Vol.I, S.Chand& Co., 1987.

**Scheme of valuation**

<b>criteria</b>	<b>Marks</b>
<b>Record</b>	<b>5</b>
<b>Aim and tabulation</b>	<b>10</b>
<b>calculation</b>	<b>10</b>
<b>Results</b>	<b>35</b>
<b>Allowed error 5%</b>	<b>20</b>
<b>5-10%</b>	<b>10</b>
<b>10%&lt;</b>	

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
13	0	0	0	13	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER-III

### SELECTED TOPICS IN CHEMISTRY – I

<b>Elective Course :2:1</b>	<b>Hours</b>	<b>: 6 h</b>
<b>Course Code :18PCH3EC2:1</b>	<b>Credit</b>	<b>: 4</b>
	<b>Max. Marks</b>	<b>: 100</b>
	<b>Internal</b>	<b>: 25</b>
	<b>External</b>	<b>: 75</b>

#### OBJECTIVES

- *To know the general information about spectroscopy, aminoacids , proteins and ionic concept*
- *To understand the oxidation-reduction reactions , metals in biology*

#### UNIT I: Introduction to Spectroscopy

Electromagnetic radiations and spectroscopy- UV Visible spectroscopy: Theory, Beer Lambert's law (derivation not required)- Important terminologies- molar absorptivity, chromophore-auxochrome, bathochromic shift, hypsochromic shift- Instrumentation (block diagram only)- Spectra of acetone - benzene - IR spectroscopy: Theory- Molecular vibrations- Characteristic group frequencies- Instrumentation (block diagram only)- Spectra of acetone and ethanol - NMR spectroscopy: Theory- Chemical shift- Spin-spin splitting- Instrumentation (block diagram only)- Spectra of ethanol and ethyl benzene- Mass spectroscopy: Introduction - Application for determination mass for simple organic molecules.

#### UNIT II: Amino acids and Proteins

Structure, Classification, Nomenclature, Functional groups, Isoelectric point, Peptide structure- Structural levels of proteins- Primary- secondary- tertiary and quaternary, alpha- beta helix- Collagen- fibrous and globular proteins- Nucleic acids- Structure of RNA - DNA **Enzymes** Classification of enzymes- Basic aspects of enzymes - Factors affecting enzyme activity- pH- temperature- substrate concentration - **Enzyme activity - kinetics- Michaelis-Menten**- Examples of Coenzymes and its function.

#### UNIT III: Ionic equilibria in aqueous solution

Acids and bases- Arrhenius theory- Lowry-Bronsted Concept - Lewis concept - Self ionization of water - Weak acids and bases, dissociation constants - hydrolysis - buffer solutions- action of buffers , acid base indicators, Acid base titrations - basics , Complex ion equilibria.

#### UNIT IV: Oxidation – Reduction reactions and redox potentials

Concept of Oxidation state (Oxidation number)- rules to assign oxidation states in polyatomic molecule - Half-reaction concept - balancing oxidation - reductions by half - reaction method - Galvanic cells, various types of electrode - Standard electrode (cell) potential - various conventions regarding half cell potentials - Nernst equation - Chemical and concentration cells - cell potentials and equilibrium constants.

#### **UINTV:Metals in biology**

Occurrence and availability of inorganic elements in organism - Biological function of inorganic elements - Biological ligands for metal ions - Coordination of proteins and enzymatic catalysis - Porphyrins and other macrocycles - Nucleobases- nucleotides - other nucleic acids as ligands - Metal ion transport and storage - Dioxygen transport - Oxygen transport and storage through hemoglobin and myoglobin - Alternative oxygen transport in some lower animals -Hemereythin and hemocyanin

#### **REFERENCES:**

1. P.M. Silverstein, F.X. Wester, Spectroscopic Identification of Organic Compounds, 6<sup>th</sup> Ed., Wiley 1998.
2. J. Mohan, Organic Spectroscopy Principles and Applications, 2<sup>nd</sup> Ed., CRC, 2004.
3. W. Kemp, Organic Spectroscopy, 3<sup>rd</sup> Ed., MacMillon, 1994.
4. D.L. Pavia, G.M. Lampman, G.S. Kriz, Introduction to Spectroscopy, 3<sup>rd</sup> Ed., Brooks Cole, 2000.
5. R.T. Morrison and R.N. Boyd, Organic Chemistry, 6<sup>th</sup> Ed., Pearson, 1992.
6. I.L. Finar, Organic Chemistry, Vol.II, 5<sup>th</sup> ed., ELBS 1975.
7. Bruce H. Mahan, University chemistry, Narosa Publishers, New Delhi, 1998.
8. S. J. Lippard and J. M. Berg, Principles of Bioinorganic Chemistry, Purnima Publishing Company, New Delhi, 1997.
9. J. E. Huheey, Inorganic Chemistry, 3<sup>rd</sup> ed., Harper & Row Publishers, Singapore.
10. W. Kaim and B. Schewederski, Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life, John Wiley & Sons, New York, USA.
11. G. L. Eichorn, Inorganic Biochemistry, Volumes 1 & 2, 2<sup>nd</sup> ed., Elsevier Scientific Publishing company, New York, 1973.

#### **Question Patern**

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>

<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
72	0	0	0	72	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER - III

### SOLID STATE CHEMISTRY

<b>Elective course:</b>	<b>2:2</b>	<b>Hours</b>	<b>:</b>	<b>6h</b>
<b>Course code :</b>	<b>18PCH3EC2:2</b>	<b>Credit</b>	<b>:</b>	<b>4</b>
		<b>Max.Marks</b>	<b>:</b>	<b>100</b>
		<b>Internal</b>	<b>:</b>	<b>25</b>
		<b>External</b>	<b>:</b>	<b>75</b>

#### OBJECTIVES

- *To learn the crystal structures of few inorganic solids.*
- *To study the chemistry of crystallization and vapour phase transport.*
- *To learn the applications of magnetic materials.*
- *To study the chemistry of organic solids.*

#### UNIT I: Crystal Structure and Crystal Engineering of Organic Solids

Types of close packing, hcp and ccp- packing efficiency, SC, BCC, and FCC, radius ratio rule - applications - polyhedral description of solids structure types: Na<sub>2</sub>O, Cs<sub>2</sub>O, rutile, perovskite (ABO<sub>3</sub>), ReO<sub>3</sub>, K<sub>2</sub>NiF<sub>4</sub>, spinels and antispinel, Supramolecular chemistry- motifs - concepts of different types of synthons based on non-covalent interactions - principles of crystal engineering and non-covalent synthesis, polymorphism and pseudopolymorphism, supramolecular isomorphism- polymorphism and crystal engineering of pharmaceutical phases.

#### UNIT II: Metallo Organic Frameworks

MOFs (Metallo Organic Frameworks) organometallic systems-combinations of different interactions to design molecular rods- triangles- ladders- networks, etc. Design of nanoporous solids. Interligand hydrogen bonds in metal complexes, implications for drug design - crystal engineering of NLO and OLED materials.

#### UNIT III: Preparative Methods in Solid State Chemistry

Experimental procedure, coprecipitation as a precursor to solid state reaction, other precursor methods, kinetics of solid state reactions - crystallizations of solutions, melts, glasses and gels, solutions and gels: zeolite synthesis - precipitation from solution or melt: flux method, epitaxial growth of thin layers, verneuil flame fusion method. Graphite intercalation

compounds, transition metal dichalcogenide and other intercalation compounds, ion exchange reaction, synthesis of new metastable phases by 'ChimieDouce'. Electrochemical reduction methods - preparation of thin films, chemical and electrochemical methods, physical methods - growth of single crystals, Czochralski method- Bridgman-Stockbarger methods - zone melting.

#### **UNIT IV: Magnetic Materials and Optical Properties**

Selected examples of magnetic materials and their properties - metals and alloys - transition metal oxides, spinels, garnets, ilmenite and perovskites. Magnetoplumbites, applications - structure/property relations - transformer, information storage- magnetic bubble memory devices, permanent magnets. Luminescence, Lasers and phosphors - definitions and general comments, configurational coordinate model, some phosphor materials- anti Stokes phosphors - lasers - the ruby laser- Neodymium lasers

#### **UNITV: Organic Solid State Chemistry**

Topochemical control of solid state organic reactions - intramolecular reactions - conformational effects - intermolecular reactions - molecular packing effects - photodimerization of 2ethoxycinnamic acid ( $\alpha$  form,  $\beta$  form,  $\gamma$  form) -photopolymerization of 2,5 distyrylpyrazine -photopolymerizations of diacetylenes. Asymmetric syntheses - dimerization of anthracene- control of molecular packing arrangements. Organic reactions within inorganic host structures - electrically conductive organic solids - organic metals, conjugated systems, doped polyacetylene, polyparaphenylene, polypyrrole, organic charge transfer complexes, new superconductors

#### **REFERENCES:**

1. A. R. West, Solid State Chemistry and Its Applications; 2nd Ed., John Wiley and sons, New York, 2014 (Unit III – V).
2. J. M. Lehn, Supramolecular Chemistry; VCH, Weinheim, 1995.
3. G. R. Desiraju, Crystal Engineering: The Design of Organic Solids; Elsevier, Amsterdam, 1989.
4. G. R. Desiraju, and T. Steiner, The Weak Hydrogen Bond in Structural Chemistry and Biology; Oxford University Press: Oxford, 2002.
5. G. A. Jeffrey, Introduction to Hydrogen Bonding; Oxford University Press, New York, 1997.
6. J. M. Lehn, Transition Metals in Supramolecular Chemistry; Vol 5, John Wiley and

Sons, New York, 1999.

7. C. N. R. Rao, Current Science, 2001, 81, 1030.

### Question Patern

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
47	0	0	0	47	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTR-III

### ELECTRO ORGANIC CHEMISTRY

**Core Course : 3:1**

**Course Code : 18PCH3EC3:1**

**Hours : 6 h**

**Credit : 4**

**Max. Marks : 100**

**Internal : 25**

**External : 75**

#### OBJECTIVES

- *To improve the knowledge about electro organic synthesis and electrochemical reactions*
- *To develop the information cathodic reduction and anodic oxidation reactions*
- *To know about the electro organic synthesis.*

#### UNIT I:Basic concepts of electro organic synthesis

Introduction- fundamental aspects of electro transfer reaction oxidation, reduction reactions vs electron transfer reactions in organic chemistry and electrochemistry - Standard potentials : Mechanism and theory of outer sphere electron transfer reactions - Fundamental aspects of electrode phenomena- monitoring a half reactions- general view of an electrode reaction- adsorption phenomena - Mass transfer in electro chemistry fundamental aspects steady state electrochemical methods- Transient electrochemical methods.

#### UNITII:Methods for studies of electrochemical reactions

Introduction, linear sweep voltammetry and cyclic voltammetry, Experimental setup- simple electrotransfer reaction- electron transfer reaction followed by chemical reaction and solutions-, limiting experimental factors- potential step and current step method, chronoamperometry-chronocoulometry-chronopotentiometry-polarography- methods for determination of number of electrons.

#### UNITIII: Cathodic reductions

Introduction- formation of radical anions-dianions and polyanions, experimental aspects- thermodynamics kinetics- addition of electrophilic reagents - related reaction-dimerization Electrochemical reduction of halogenated compounds-monohalogenated- alkanes-halogenated aromatic compounds- acyl halides, aliphatic alpha - halo carbonyl compounds-

cathodic reduction of nitro and related compounds- Aliphatic nitro compounds- aromatic nitro compounds (preparation of para amino phenol nitrobenzenes, nitramines - azides). Electrochemical reduction of carbonyl compounds, general aspects.

#### **UNITIV: Anodic oxidation of organic compounds**

Introduction- general mechanistic consideration- direct anodic oxidation- indirect anodic oxidation. Anodic oxidation of hydrocarbons, nitrogen containing compounds. Electrosynthesis of Bioactive materials: Introduction- simple Kolbe oxidation: application to synthesis of (+),  $\alpha$  onxerin and (+)pentacyclosqualene, Kolbe cyclisation and Tandem cyclization.

#### **UNITV: Special topic in electro organic synthesis**

Paired electro organic synthesis, simple examples -electrogenerated reagents Homogeneous redox catalysts - General aspects of indirect electron- exchanges, pure redox catalysis (general case) - use of indirect electrochemical reactions in synthesis, oxidations, reductions - Electrogenerated superoxides- Electrochemical partial fluorination: Introduction, Anodic fluorination of aromatic compounds- olefins, carbonyl compounds- heterocyclic compounds. Electroenzymatic synthesis: Introduction- principles of redox catalytic enzyme activation - cofactor regeneration -electroenzymatic reductions and oxidation (simple examples only).

#### **REFERENCES:**

1. Organic electro chemistry by Henning Lund & Ole Hammerich, 4th edition, Publisher: Marcel Dekker, Inc, New York.

<b>Question Patern</b>		
<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
51	0	0	0	51	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER - III

### ANALYTICAL CHEMISTRY

Elective course: 3:2  
Course code : 18PCH3EC3:2

Hours : 6h  
Credit : 4  
Max.Marks : 100  
Internal : 25  
External : 75

#### OBJECTIVES

- *To learn the instrumental methods*
- *To learn the nature of errors and their types.*
- *To understand the various techniques in chromatography.*

#### UNIT I: Analytical Techniques:

**Analytical chemistry**- chemical analysis - Advantages - limitations of chemical methods- types of chemical analysis- Instrumental methods- Advantages, Limitations of Instrumental methods- Analytical methods on the basis of Sample size -Sampling- sampling methods- sampling in different physical states- Sampling statistics- source of error in sampling- dangers during sampling.

**Techniques of Analysis**- Introduction, Classification of analytical techniques- classification of instrumental methods of analysis- factors affecting the choice of analytical methods- interferences- typical separation procedures-sensitivity - detection limits.

#### UNIT II Data Analysis

Mean, Average, Standard Deviation, Variance and its testing, Correlation and Regression, Least square method for curve fitting-Determinate errors- classification of determinate errors - **their minimization- indeterminate error - normal frequency distribution curve.**

#### UNIT III: Chromatography

Solvent extraction - principles of ion exchange, paper, thin layer and column chromatography techniques - columns, adsorbents, methods, R<sub>f</sub> values- McReynold's constants - their uses - HPTLC, HPLC techniques-adsorbents- columns- detection methods- estimations- preparative column- GC MS techniques, methods, principles and uses.

#### UNIT IV: Thermoanalytical Methods and Fluorescence Spectroscopy

Principles, instrumentations and applications of thermogravimetry analysis (TGA), for quantitative analysis- factors affecting thermogram-Differential Thermal Analysis (DTA) and Differential Scanning Calorimetry (DSC) thermometric titrations - types -advantages.Basic aspects of synchronousfluorescence spectroscopy spectral holeburning- flow cytometry fluorometers (quantization) -instrumentation -applications.

#### **UNIT V: Electroanalytical Techniques**

Electrochemical sensors, ion-sensitive electrodes, glass - membrane electrodes, solid-liquid membrane electrodes - ionselective field effect transistors- (ISFETs)sensors for the analysis of gases in solution-Principles - applications of extended Xray absorption fine structure (EXAFS) - surface extended -Xray absorption (SEXAFS) - atomic absorption spectroscopy (AAS) - flame emission spectroscopy (FES) -turbidimetry- theory - applications.

#### **REFERENCES:**

1. H. Kaur - "Instrumental methods of Chemical Analysis", 6th edition, (2010), Pragatiprakashan Publications, Meerut.
2. D. B. Hibbert and J. J. Gooding, Data Analysis for Chemistry; Oxford University Press, UK, 2006.
3. J. Topping, Errors of Observation and Their Treatment; 4th Ed., Chapman Hall, London, 1984.
4. Braithwaite and J. F. Smith, Chromatographic Methods; 5th Ed., Springer,Germany; 1995.
5. K. Srivastava and K. K. Srivastava, Introduction to Chromatography; 2nd Ed.,Holden Day, New York, 1985.
6. H. H. Willard, L. L. Merritt, J. A. Dean and F. A. Settle, Instrumental Methods ofAnalysis; 6th Ed., CBS Publishers and Distributors, Chennai, 1986.
7. D. A. Skoog, D. M. West and D. J. Holler, Fundamentals of Analytical Chemistry,7th Ed., Harcourt College Publishers, Singapore, 2004.
8. Sharma, S. G. Schulman, Introduction to Fluorescence Spectroscopy; Wiley-Interscience, New York, 1999.
9. N. Banwell and E. M. McCash, Fundamentals of Molecular Spectroscopy; 4<sup>th</sup>Ed., Tata McGraw-Hill, New Delhi, 1994.
10. I. Vogel, Text Book of Quantitative Inorganic Analysis; 6th Ed., Longman, NewDelhi, 2000.
11. D. C. Harris, Quantitative Chemical Analysis; 4th Ed., W. H. Freeman Publications,New York, 1995.

**Question Patern**

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
62	0	0	0	62	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

**SEMESTER-IV**  
**PHYSICAL CHEMISTRY -II**

**Core Course : VIII**  
**Course Code : 18PCH4CC8**

**Hours : 6 h**  
**Credit : 5**  
**Max. Marks : 100**  
**Internal : 25**  
**External : 75**

**OBJECTIVES**

- *To develop the knowledge about quantum chemistry and electro chemistry*
- *To improve the ideas about thermodynamics*
- *To understand about surface phenomena*

**UNIT I: Applications of Group Theory**

Applications of Group Theory, The Direct Product and its Applications, Applications of Group theory to Spectroscopy - Vanishing of Integrals- Symmetry selection rules for Vibrational, Raman and electronic spectroscopy- Infra red Spectroscopy - Reduction Formula - Determination of Normal Modes of Vibration and IR activity for H<sub>2</sub>O and NH<sub>3</sub> Molecule, Vibrational Raman Spectroscopy for H<sub>2</sub>O - NH<sub>3</sub> Molecule- Electronic Spectra of Formaldehyde. Hybridization Schemes of Orbitals (sp<sup>3</sup>, sp<sup>2</sup>, dsp<sup>2</sup>, sp<sup>3</sup>d<sup>2</sup>), Projection Operator - Symmetry Adapted Linear Combination (SALC) Procedure - Symmetry factoring of secular determinant and its applications to butadiene.

**UNIT II: Electrochemistry I**

Ionic: Debye-Huckel theory, radius of ionic atmosphere and its calculation, Debye-Huckel-Onsager equation and its modifications - asymmetry - electrophoretic effects - Debye-Huckel limiting Law. Electrode electrolyte equilibrium: Nernst equation derivation - its limitations, equilibrium electrode potentials - Calomel electrode-hydrogen electrode-concentration cells - liquid junction potentials- thermodynamic quantities from EMF data.

**UNIT III: Electrochemistry II**

Electro kinetic Phenomena: Theories of electrical double layer - Theory of multiple layers at electrode electrolyte interface - electro kinetic phenomena. Processes at electrodes - the rate of charge transfer - current density, Butler-Volmer equation, Tafel equation. Principles and applications of Polarography, Instrumentation, Types of cells, advantages of dropping

mercury electrode, interpretation of current voltage curves, determination of 'n' value, polarographic maxima. Cyclic voltammetry, advantages over polarography techniques - test of reversibility of electron transfer reactions

#### **UNIT IV: Surface Phenomena:**

B.E.T. isotherms - Surface area determination - Adsorption, adsorbent, adsorbate, physisorption, chemisorptions - van der Waals forces - Heat of adsorption and its determination, Adsorption from solution - Factors affecting adsorption isotherm - Gibbs adsorption isotherm - solid, liquid interfaces - wetting and contact angle - solid gas interfaces - soluble and insoluble film. Surface tension - methods of measuring surface tension - electrical phenomenon at Interfaces, including electro kinetic, micelles and reverse micelles, Solubilisation, Micro - emulsions, Role of surface in catalysis - semiconductor catalysis, n and p type surfaces - kinetics of surface reactions involving adsorbed species - Langmuir - Hinshelwood mechanism.

#### **UNIT V: Statistical Thermodynamics**

Partition functions: Translational, rotational, vibrational, electronic - calculation of enthalpy, internal energy, entropy and other thermodynamic functions - application of partition functions to mono and diatomic molecules, Heat capacity of solids: Einstein and Debye's treatments - concept of negative Kelvin temperature - Nonequilibrium thermodynamics: Thermodynamics of irreversible process - enthalpy production and entropy flow in open system - Onsager theory, phenomenological relations - Onsager reciprocal relations - steady state conditions.

#### **REFERENCES:**

1. K.V.Raman Group theory and its Application to Chemistry. Tata McGraw -Hill Publishing Company Limited New Delhi, 2000.
2. H.Goldstein, Classical Mechanics, Addison - Wesley Publishing company, 1956.
3. S. Glasstone, Introduction to Electrochemistry, Affiliated East-West Press, 1968.
4. D. R. Crow, Electrochemistry
5. S. Glasstone, Introduction to Electro Chemistry, Affiliated East-west Press, 1968
6. D. R. Crow, Polarography of metal complexes, Academic Press, New York
7. Daniel C.Harris, Quantitative Chemical Analysis, 4th edn, W.H.Freeman and Company, New York, 1995
8. P.W.Atkins - Physical Chemistry E.L.B.S. 6th Ed. 1998.

9. Samuel Glasstone – Textbook of Physical Chemistry 2nd Ed.1981, MacMillan India.
10. K.L.kapour – A text book of physical chemistry Volume -4 S.M.yogan at Machmillaln India press, Chennai -2009.
11. P. W. Atkins, Physical Chemistry, ELBS and Oxford University Press, Oxford,1983
12. J. Rajaram and J. C. Kuriacose, Thermodynamics for students of Chemistry - Classical,
13. Statistical and Irreversible, Shobhan Lal Nagin, New Delhi, 1981

### Question Patern

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
59	0	0	0	59	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER-IV

### PHYSICAL CHEMISTRY PRACTICAL - II

<b>Core Practical</b>	<b>: VI</b>	<b>Hours</b>	<b>: 6 h</b>
<b>Course Code</b>	<b>: 18PCH4CP6</b>	<b>Credit</b>	<b>: 4</b>
		<b>Max. Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 40</b>
		<b>External</b>	<b>: 60</b>

#### OBJECTIVES

- *To Practice the Conductometry titrations*
- *To Practice the potentiometric titrations*
- *To compare the theoretical values with experimental values*

**Any ten experiments (to be decided by the course teacher) out of the following experiments.**

1. Conductometry- Acid- alkali titrations.
2. Conductometry- Precipitation titrations.
3. Conductometry- Displacement titrations.
4. Conductometry- Determination of dissociation constant of weak acids.
5. Conductometry- solubility product of sparingly soluble silver salts.
6. Verification of Onsager equation- conductivity method.
7. Determination of degree of hydrolysis and hydrolysis constant of a substance.
8. Potentiometric titrations- Acid alkali titrations.
9. Potentiometric titrations- Precipitation titrations.
10. Potentiometric titrations- Redox titrations.
11. Potentiometry- Determination of dissociation constant of weak acids.
12. Potentiometry- Determination of solubility of silver salts.
13. Potentiometry- Determination of activity and activity coefficient of ions.
14. pH titration of ortho-phosphoric acid.
15. To determine the relative strength of two acids by conductance measurements.
16. To determine the pH of a buffer solution using a quinhydrone electrode.

## REFERENCES

1. J.B.Yadav, “ Advanced Practical Physical chemistry”, 20th edn. GOEL publishing House, Krishna Pakashan Media Ltd., (2001).
2. Findlay’s “Practical Physical Chemistry” Revised and edited by B.P. Levitt 9th ed.,Longman,London, 1985.
3. J.N. Gurtur and R.Kapoor, “Advanced Experimental chemistry”, Vol.I. Chand & Co., Ltd, New Delhi.

### Scheme of valuation

Criteria	Marks
Record	5
Aim and tabulation	10
calculation	10
Results	
Allowed error 5%	35
5-10%	20
10%<	10

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
16	0	0	0	16	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

# SEMESTER-IV

## INSTRUMENTATION TECHNIQUES

<b>Elective Course</b>	<b>: 4:1</b>	<b>Hours</b>	<b>: 6 h</b>
<b>Course Code</b>	<b>: 18PCH4EC4:1</b>	<b>Credit</b>	<b>: 4</b>
		<b>Max. Marks</b>	<b>: 100</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

### OBJECTIVES

- *To improve the technical knowledge about various spectroscopy*
- *To study the detailed information about conductometry*
- *To understand the separation of compounds by using chromatography*

**UNIT I : UV Visible spectroscopy:**Instrumentation- sources, filters -monochromators, slits, grating, cuvette, radiation detectors and indicators- photoelectric spectrophotometer - types, sources of errors during recording, calibration- presentation of spectral dataInfrared Spectroscopy,Dispersive infrared spectrometer, source (Nernst, Globar) monochromator, detector, double-beam spectrophotometer - presentation of spectra-sample preparation techniques for IR,FT IRsimple diagram of a Fourier transform infrared spectrometer- working mode - advantages.Raman spectroscopy: Instrumentation- source of light, filters, sample holders, spectrograph, detectors, Sample preparation.

**UNITII: Nuclear Magnetic Resonance (NMR):**Instrumentation, magnet, magnetic field sweep, radio frequency source- signal detector and recording system, sample holder, sample probe. Electron Spin Resonance (ESR):Instrumentation, electromagnet, source of micro wave radiation, sample cavity, choice of solvent crystal detectors and recorder,double resonance spectrometers.Mass Spectrometry:Instrumentation,sample preparation, generation of ions, analyzer, ion collector and measuring system, resolution, representation of mass spectrum - double focusing mass spectrometer.

**UNITIII: Conductometry:** Introduction, laws and definitions of conductance, effects of dilution, conductance measurements conductometric titrations,apparatus, types and advantages.Potentiometry:electrochemical series, reference electrodes , hydrogen electrode, calomel and silver-silver chloride electrode, measurement of pH - glass indicating electrode,

potentiometric titrations, variations in potentiometric titrations, its advantages. Atomic Absorption Spectroscopy: Introduction, principle of AAS, classification of atomic spectroscopic methods- measurement of atomic absorption, instrumentation, application, Atomic Emission spectroscopy- Introduction- origin of spectra, principle of emission spectroscopy- Instrumentation, measurement of light intensity and applications- Flame spectroscopy, instrumentation and application.

#### **UNIT IV: Ion Chromatography**

Electrophoresis : Separation by Adsorption- Affinity techniques, Affinity elution from Ion exchangers and other Adsorbents, Pseudo affinity adsorbents polycrylamide gel electrophoresis, Isoelectric focussing Isotachopheresis, Two dimensional gel electrophoresis, Capillary electrophoresis in rotation- stabilized media- Electrophoresis in stabilized salts- Applications in Nuclei acids, Clinical and capillary zone electrophoresis of carbohydrates.

#### **UNIT V: Mass Spectroscopy**

Mass spectrometry principle, Instrumentation, Ionization methods, EL, CI, FAB, arc & spark, photoionization-thermal ionization, FI\* & FD, laser induced- Photoelectric ionization, SIMS, Mass analyzers, Magnetic, Double focusing- Time of flight, Quadrupolar- Ion cyclotron resonance analyzer. Coupled techniques, GC FTIR, GCMS ( Use of stable isotopes) HPLC, MS.

#### **REFERENCES:**

1. H. Kaur - "Instrumental methods of Chemical Analysis", 6th edition, (2010), Pragati Prakashan Publications, Meerut.
2. Willard, Merritt, Dean and Settle – "Instrumental Methods of Analysis", 7th Ed., (2006), CBS Publishers.
3. B.K. Sharma – "Instrumental methods of Analysis", (2000), Goel Publications.
4. S.M. Khopkar, "Basic Concepts of Analytical Chemistry", Revised edition (2006) Wiley Eastern Ltd.
5. R.A. Day and A.L. Underwood – "Quantitative Analysis", (1999), Prentice-Hall of India Pvt., Ltd., New Delhi.
6. B.S. Furniss, A.J. Hannaford, P.W.G. Smith and A.R. Tatchell – "Vogel's Text book of Practical Organic Chemistry", fifth edition, 2009, Pearson Education Publisher.
7. L. Pavia – "Spectroscopy" Cengage Learning India Pvt. Ltd – 2010.

8. Harald Guther, "NMR Spectroscopy", Wiley india (p) Ltd, 2nd Edn,2010.
9. G.Aruldas –"Molecular structure &Spectroscopy ",PHI learning Pvt.Ltd.2nd Edition ,- 2008.
10. Colin N.Banwell – "fundemendals of Molecular structure Spectroscopy " Mc.Grow – Hill publishing company Ltd. 4th edition ,,1995.

### Question Patern

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
33	0	0	0	33	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER-IV

Course Code: 18PCH4EC4:2

Instruction Hours: 6

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

### ELECTIVE COURSE 4:2 - NANOAND GREEN CHEMISTRY

#### Course Outcomes:

- Learn a basic idea on nano and green chemistry
- Learn the knowledge about solvent free reactions
- Learn about the sono chemistry.
- Learn the various spectroscopies.
- Learn the essentials of green chemistry.

#### UNIT I: Synthesis And Applications Of Nanomaterials (18 Hours)

Preparation of nanomaterials, plasma arcing, CVD, electrodeposition, sol gel synthesis, ball milling, uses of natural nano particles- Synthesis and applications of carbon nanotubes, Self assembled mono layers, mono layers on gold preparation, structure, growth process - patterning mono layers - mixed mono layers- Semiconductor quantum dots- synthesis-electronic structure - spectral properties Monolayerprotected metal nanoparticles, characterization functionalization-Application - Core-Shell nano particles introduction types of systems, characterization- properties - Applications of Nanosensors- electrochemical sensors- sensors based on physical properties, nanobiosensors.

#### UNIT II: Characterization Of Nanomaterials (18 Hours)

Electron microscopes scanning electron microscopy (SEM)- Transmission electron microscopy (TEM)- Scanning Transmission Electron Microscopy (STEM)- Scanning Probe Microscopy (SPM) - scanning tunneling microscopy (STM) , Atomic manipulations, Focused Ion beam (FIB) technique - Atomic force microscopy (AFM) scanning probe Lithography (SPL), Dip pen nanolithography (DPN) Optical microscopies for nanoscience and Technology -Confocal microscopy- scanning near field optical microscopy particle size analysis.

#### UNIT III: Carbon nanotubes (18 Hours)

CNT -definition- Classification -Single wall CNTMultiwall CNTPreparation - arc method - laser ablation method - Chemical vapour deposition method - Electro-deposition method- Ball milling method. SWCNT and MWCNT - Properties- applications fullerenes, properties - uses. Nan composites, Classification, Properties, uses.

**UNIT IV: Essentials Of Green Chemistry****(18 Hours)**

Introduction to green chemistry-definition, origin, history, needs, goals, twelve principles of green chemistry. Usage of Conventional and Green solvents, Advantages, Limitations and drawbacks. Green Synthesis - Designing, Choice of starting materials, choice of reagents, choice of catalysts: bio catalysts, polymer supported catalysts, choice of solvents. Synthesis involving basic principles of green chemistry. Examples: synthesis of adipic acid, methyl methacrylate, paracetamol. Microwave, Ultrasonication and Ultrasound assisted reactions - esterification, reduction AND coupling reactions.

**UNIT V: Green Synthesis****(18 Hours)**

Adipic acid, catechol, methyl methacrylate, acetaldehyde, Ibuprofen, Paracetamol- Microwave assisted reaction in water, Definition - Hofmann eliminations - Hydrolysis- Oxidation- Microwave assisted reaction in organic solvents- Esterification - Fries rearrangement - Decarboxylation- Diels - Alder reaction. Ultrasound assisted reaction: Definition- Cannizzaro reaction -Strecker synthesis -Reformatsky reaction.

**Text Books:**

1. Sulabha K. Kulkarni Nanotechnology: Principles and practices (capital Pvt. Co.)-2002.
2. R.Sanghi and M.M srivastva, Green chemistry, Narosa Publications, 2003.

**References:**

1. Nanoscale materials in chemistry, Wiley interscience, Kenneth, J.Klaburde, 2002.
2. M. M. Srivastva and R.Sanghi, Chemistry for green environment, Narosa, 2005.
3. S, Delvin Green chemistry, IVY publication house, 2006.
4. F.J. Ownes Introduction to Nano technology John Wiley and New Jersey, 2003.

**Question Pattern**

<b>Section :A (1 Marks)</b>	<b>MCQ Type</b>	<b>20x1=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Answer three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
IV	20PCH4EC4:2	Nano and green chemistry	6	4						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
54	0	0	0	54	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER-IV

### SPECIAL TOPICS IN CHEMISTRY

<b>Elective Course</b>	<b>: 5:1</b>	<b>Hours</b>	<b>: 6 h</b>
<b>Course Code</b>	<b>: 18PCH4EC5:1</b>	<b>Credit</b>	<b>: 4</b>
		<b>Max. Marks</b>	<b>: 10</b>
		<b>Internal</b>	<b>: 25</b>
		<b>External</b>	<b>: 75</b>

#### OBJECTIVES

- *To develop the retrosynthetic technique*
- *To learn green chemistry, sonochemistry*
- *To study about ionic liquids & PTC*

#### UNIT I: Retrosynthesis

Synthons, Synthetic equivalents, Convergent, Linear synthesis - Retrosynthetic tree - Guidelines to a good disconnection - Functional Group Interconversions - One group and two group C X disconnections - One group C-C disconnections - 1,1 C C - 1,2 C C disconnections to synthesise alcohols and carbonyl compounds -Regioselectivity- Michael Wittig reactions - Use of acetylenes - aliphatic nitro compounds in organic synthesis - Two group C C disconnections - DielsAlder reaction - its stereochemical aspects - Robinson annelation. Guidelines for solving the problem of chemoselectivity, Umpolung reagents - Protecting groups for alcohols- amines - carbonyl compounds -Deprotection.

#### UNIT II: Green Chemistry

Need for green chemistry -goal of green chemistry planning of green synthesis , solvent free reactions – microwave assisted synthesis, role of ionic liquids in green chemistry ,cleaner technology with super critical fluids- catalytic approach to green chemistry- (Use of zeolites, clays, mesoporous materials)waste water treatment by exploitation and technology at ambient conditions. Remediation method for textile effluents - green chemistry , bio-catalytic reactions-Types of catalytic reaction, Green reactions: Aldol condensation, Cannizzaro reaction and Grignard reaction- comparison of the above with classical reactions.

#### UNIT III: Ionic liquids and PTC

Introduction - synthesis of ionic liquids - physical properties - applications in alkylation - hydroformylations- epoxidations - synthesis of ethers, Friedel craft reactions - Diels-Alder

reactions, Knoevenagel condensations - Wittig reactions - Phase transfer catalyst - Synthesis - applications.

#### **UNIT IV: Sono Chemistry**

Instrumentation, Physical aspects Types, Homogeneous liquid phase - Heterogeneous solid-liquid reactions - Synthetic applications - Esterification - Saponification - Hydrolysis/Solvolysis - alkylation - oxidation and reduction reactions - Bouveault reaction.

#### **UNIT V Diagnostic aids**

Determination of serum glucose - Folin & Wu's and *o*-toluidine methods, Determination of serum cholesterol - Sackett's method - Diagnostic tests for salt in serum and urine, Detection of diabetics and anemia, - Estimation of hemoglobin. Radiopharmaceuticals for scintigraphy, types of radiopaques – radiopaques- substances - radiographic procedure- Iopanoic acid - structure, functions and mode of action.

#### **REFERENCES:**

1. Nanoscale materials in chemistry, Wiley interscience 2002, Kenneth, J. Klaborde. Stuart Warren organic synthesis, methods and starting materials, the disconnections approach John, Wiley & sons-1992.
2. Futhrop, Penzlin, organic synthesis concepts, methods and starting materials, Verlagchemie 1983.
3. R. Sanghi & M. M. Srivastava Green chemistry, Narosa 2003.
4. M. M. Srivastava & R. Sanghi chemistry for green environment, Narosa 2005.
5. S. Delvin Green chemistry, IVY publication house 2006.
6. C. P. Jr. and F. J. Ownes Introduction to Nano technology John Wiley & New Jersey 2003.
7. P. S. Kalsi & J. P. Kalsi – Bioinorganic, Bioorganic & supra molecular chemistry – New Age International Publishers – 2010.
8. Nanotechnology: Principles and practices Sulabha K. Kulkarni (capital Pvt. Co.)-2002.
9. V. K. Ahluwalia and Renu Aggarwal, Organic synthesis, 2nd edition, Narosa, 2006.
10. Jagadamba Singh and L. D. S. Yadav, Organic synthesis, 4th edn., Pragathi Prakashan, 2009

#### **Question Pattern**

<b>Section :A (2 Marks)</b>	<b>Answer all the questions</b>	<b>10x2=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>

<b>Section :C (10 Marks)</b>	<b>Ans three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
62	0	0	0	62	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

### SEMESTER – IV

Course Code: 18PCH4EC5:2

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 5

External Marks: 75

### ELECTIVE COURSE 5:1 - INDUSTRIALCHEMISTRY

#### Course Outcomes:

- Learn develop the knowledge about chemical industries
- Learn the fuels and dyes
- Learn about synthesis of dyes and polymer chemistry
- Learn the application of chemistry in quality control measurements.
- Learn about the polymers.

#### UNIT I: Green Methods and Industrial Process

(18 Hours)

Basic ideas about unit operation - Flow charts - Chemical conversion - Batch versus continuous processing - Chemical process selection -Design,Chemical process control- Research & Development and its role in chemical industries- Industrial safety measures - Fire extinguisher, Fire retardant material, Fire retarding wood, Procedures for handling toxic chemicals and Applications.

## **UNIT II: Renewable Energy Resources**

**(18 Hours)**

Renewable energy sources:types of renewable energy sources Solar cells:basic principles-types and their applications- Fuel cells:basic principles, types - their applications-Working principle and applications of Biofuel cells-brief introduction about hydroelectric- biomass, wind power and geothermal power -their applications and limitations-energy from some other natural source-Wind energy working principle-its applications.

## **UNIT III: Polymers**

**(18 Hours)**

Polymers, definition, types of polymers - liquid crystalline polymers. Molecular mass number - mass average molecular mass - determination of molecular mass (osmometry, viscosity, diffusion, light scattering, and sedimentation methods)viscoelasticity- Rubber elasticity. Kinetics of linear stepwise polymerization - addition polymerization - free radical-cationic - anionic polymerization.Kinetics of copolymerization.Polymerization in homogeneous - heterogeneous systems - stereochemistry and mechanism of polymerization. Coordination Polymerization: Kinetics; mono and bimetallicmechanism.

## **UNIT IV: Commercial Polymers**

**(18 Hours)**

Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins and silicone polymers. Functional polymers-Fire retarding polymers and electrically conducting polymers.Biomedicalpolymers.

## **UNIT V: Industrial Water Pollution and its Control & Analysis**

**(18 Hours)**

Sources of water pollution, domestic , industrial , agricultural, soil and radioactive wastes assources of pollution-Water pollutants and their effects, Objectives of analysis, parameter for analysis, colour, turbidity - total solids - conductivity - acidity - alkalinity - hardness - chloride - sulphate - fluoride - silica phosphates- different forms of nitrogen, DO, BOD, COD Heavy metal pollution-public health significance of Cadmium - Chromium - Copper - Lead - Zinc - Manganese- Prevention - control its measures.

### **Text Books:**

1. B. K. Sharma, Industrial Chemistry; 8th Ed., Goel Publishing House, New Delhi, 1997.
2. V.R.Gowariker, N.V. Viswanathan and JayadevSreedhar, Polymer Science, New Age Publishers, New Delhi, 1986.
3. B.K. Sharma and H. Kaur, "Environmental chemistry" ,Goel Publishing House, Meerut, 2008

### **References:**

1. Chemical Process Industries – Norrish Shreve, R. and Joseph A. Brink Jr. McGraw Hill, Industrial Book Company, London.
2. Production and Properties of Industrial Chemicals – Brain A.C.S. Reinhold – New York.

- Petroleum Products Hand Book. Guthrie V., McGraw Hill, Tokyo.
- Outlines of Chemical Technology – For the 21st Century – M. Gopala Rao & MatshallSittig (3rd Edition)
- Charles E. Carraher, Polymer chemistry, 6th edn, Marcel Dckker, Pvt .Ltd, 2003.
- F.W.Billmeyer, Jr., A Text Book of Polymer Science, Wiley & Sons, New York, 1971.

### Question Pattern

<b>Section :A (1 Marks)</b>	<b>MCQ Type</b>	<b>20x1=20</b>
<b>Section :B (5 Marks)</b>	<b>Either OR choice</b>	<b>5x5=25</b>
<b>Section :C (10 Marks)</b>	<b>Answer three out of five</b>	<b>3x10=30</b>
<b>Total Marks</b>		<b>75</b>

### Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
IV	20PCH4EC5:1	Industrial chemistry	6	5						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
53	0	0	0	53	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

# VALUE ADDED COURSES

## FUNDAMENTALS OF CHEMISTRY & BASIC LABORATORY TECHNIQUES

Course Code: 18VACH01  
Credit: 2  
100

Hours: 30  
Marks:

### OBJECTIVES

- To be able to identify common acids and bases and ways of testing them
- To determine the sequence of elementary reactions, or the reaction mechanism, those comprise complex reactions.
- The science learning goals of laboratory experiences include enhancing mastery of science subject matter, developing scientific reasoning abilities, increasing understanding of the complexity and ambiguity of empirical work, developing practical skills, increasing understanding of the nature of science

## LEARNING OUTCOMES

- To be able to state the formulas of common acids and bases To know that alkalis are bases soluble in water
- Understand the concept of rate of change associated with chemical change, recognizing that the rate of change and how it can be measured
- To able to: understand how the concept of valency can account for, and predict the formulas of compounds.
- Understanding of theoretical knowledge

## UNIT I: Physical and Chemical Reactions

### Acids and Bases

General introduction of mineral Acids, their strength and handling- General introduction

of common alkalis and their handling- Environmental effect of acid rain- Acid base equilibrium.

### Redox Reaction

Application of Electrochemical series and electrochemical cells- Common oxidizing and reducing agents - Redox reaction in biology.

## UNIT II: Chemical equilibria & Chemical Kinetics

General introduction of reversible reactions-Industrial application chemical equilibria- Types of equilibria- Application of chemical kinetics in trace determination

## UNIT III: Chemical Bonding

Introduction to intermediate bonds- Non-classical bonding- Delta bonding in complexes,

Synergic bonding in metal carbonyls- Introduction of quintuple bonds.

## UNIT IV: Stoichiometry Defects

Definition- Types of defects-Stoichiometry and chemical reactions

## UNIT V: Basic Lab Techniques

Safety measure of handling of chemicals- MSDS of some common chemicals Precision and accuracy Purification- Fractional distillation- Recrystallization

### References:

1. Vogel's text book of Qualitative Chemical Analysis (Longman ELBS Edition)
2. Vogel's text book of Quantitative Analysis (Longman ELBS Edition)
3. Practical Organic Chemistry by A.I. Vogel
4. Practical Organic Chemistry by O.P. Agrawal.
5. Practical Organic Chemistry by F. G. Mann & B. C. Saunders
6. Comprehensive Practical Organic Chemistry Qualitative Analysis by V. K. Ahluwali
7. A Text Book of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis: A.I. Vogel (Third Ed.).

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
22	2	0	19	1	9	0	86	5	National
<b>Local: GREEN</b> <b>Regional: PINK</b> <b>National: BLUE</b> <b>Global: BROWN</b>									

## **CRYSTALLISATION AND CHROMATOGRAPHY TECHNIQUES**

Course Code: 18VACH02  
Credit: 2  
100

Hours: 30  
Marks:

### **OBJECTIVES**

- To separate the various substances that makes up a mixture.
- Crystallization processes are, first, separation and purification of substances,
- To monitor the progress of a reaction, identify compounds present in a given mixture, and determine the purity of a substance.

### **LEARNING OUTCOMES**

- Understand the methods of crystallization
- Explain the principles and techniques of column and thin-layer chromatography Techniques.
- Purify the compounds by crystallisation technique.
- Analyse and detect the sample by thin layer chromatography
- Separate the isomers of a compound by column chromatography technique

### **Unit I**

**6 hrs**

#### **Crystallisation**

Principle-Methods of crystallisation-Melt crystallization,Suspension crystallisation; solvents for recrystallization, Precipitation, Nucleation, Supersaturation- Common challenges in crystallization- Processes involved in crystallization and its applications.

### **Unit II**

**6 hrs**

#### **Chromatography Techniques**

Chromatography-Adsorption, Partition chromatography. Column Chromatography -Principle, Adsorbents, developers, solvents, columns, packing of the columns, elution, eluting solvent selection-polar and non-polar; Applications. Thin Layer chromatography-Principle, Rf, preparation of chromatoplates - application of sample on the chromatoplates - choice of adsorbents - selection of solvent, locating reagents - developing chamber, development of chromatogram and Applications.

### **Unit III**

**Practical 6 hrs**

#### **Crystallisation of simple compounds**

Zinc oxide - Copper sulphate - Sodium acetate, Sodium Chloride - Potash alum, Phthalic acid, Benzoic acid, Acetyl salicylic acid - Urea and Sugar.

**Unit IV**

Practical 6 hrs

**Thin Layer Chromatography**

Separation of Mixture of benzophenone and naphthalene - Separation of Mixture of 2-nitrophenol and 4-nitrophenol - Separation of Mixture of Diphenylamine, Benzophenone and Naphthalen-Separation of Mixture of Azobenzene, Hydroxyazobenzene and p-aminoazobenzene

**Unit V**

Practical 6 hrs

**Column Chromatography**

Separation of KMnO<sub>4</sub> and K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> - Isolation of 2-nitrophenol and 4-nitrophenol

**Text Books:**

1. P.S. Subramanian R.Gopalan, K Rangarajan Elements of Analytical Chemistry S. Chand & company Ltd, New Delhi. 2003 I & III
2. V. K. Srivastava and K. Kishore Introduction to chromatography Theory and practice 3rd edition S. Chand & company Ltd, New Delhi. 1991 I & III
3. Brian S. Furniss, Antony J. Hannaford, Peter W. G. Smith and Austin R. Tatchell Vogel's Text Book of Practical Org 5th Edition Longman Group 1989 I-V
4. Practical Organic Chemistry by A.I. Vogel
5. Practical Organic Chemistry by O.P. Agrawal.

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
31	14	0	17	0	45	0	55	0	National
<b>Local: GREEN</b> <b>Regional: PINK</b> <b>National: BLUE</b> <b>Global: BROWN</b>									



# **THANTHAI HANS ROEVER COLLEGE**

**(Autonomous)**

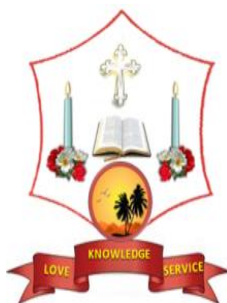
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*UGC Recognized 2(f) and 12(B) Institution*

*Affiliated to Bharathidasan University, Tiruchirapalli*

**Perambalur - 621 220,**

**Tamil Nadu, India**



**M.Phil CHEMISTRY**

**CHOICE BASED CREDIT SYSTEM SYLLABUS**

**SEMESTER PATTERN**

**PG & RESEARCH DEPARTMENT OF  
CHEMISTRY**

**(2018-2019 ONWARDS)**



**THANTHAI HANS ROEVER COLLEGE PERAMBALUR-621212**  
**(AUTONOMOUS)**  
**M.Phil Chemistry -Course Structure Under CBCS**  
**(For the candidates to be admitted from the academic year 2018-2019 onwards)**



Semester	Course Code No	Title of the Course Paper	Hours /week	Credits	Exam hours	CIA	ESE	Total
First Semester	18MPCH1CC1	Research Methodology in chemistry	4	4	3	75	25	100
	18MPCH1CC2	Recent Trends in Chemistry	4	4	3	75	25	100
	18MPCH1CC3	Teaching and Learning Skills	4	4	3	75	25	100
	18MPCH1CC4	Paper on Topic of Research (Guide will prepare the syllabus and it will be sent to the COE)	4	4	3	75	25	100
<b>Total</b>			<b>16</b>	<b>16</b>	-	-	-	<b>400</b>
Second Semester	18MPCH2DW	Dissertation and Viva-Voce	-	<b>8</b>	-	-	-	<b>200</b>
Total				<b>24</b>	-	-	-	<b>600</b>

**CIA**- Continuous Internal Assessment

**ESE**- End Semester Examination

## SEMESTER-I

### Research Methodology in chemistry

Core course: I  
Credits:4  
Max.Marks :100

Hours : 3  
Course code: 18MPCH1CC1  
Internal : 25  
External :75

#### OBJECTIVES

- To know the Idea about the problem choosing the research
- To under stand the method of research
- To know about prepare the thesis

#### UNIT I Basic Principles of Research

Meaning of Research - Need for research, Objectives, Motivation, Types of research - Significance - Formulation of Research Problem -Developing Hypothesis - Preparing Research Design - Selection of Research Problem -Determining Sample Design Characteristics of a Good Sample Design- Collection of Data -Methods of Data Collection - Execution of Work- Analysis of Data- Hypothesis-Testing, foot Notes-Generalization and Interpretation-Preparation of Report - Submission of Report in the form of Thesis.

#### UNIT II : Literature Searching and Writing Reports:

##### Literature Searching

Online searching, Database-Scifinder- Scopus-web of science- CA on CD Locating research article-Citation Index, Impact Factor

##### Writing scientific report :

Planning- preparation, draft revision and refining- writing project proposal to funding agency- Paper writing for International Journals submitting to editors- Conference presentation- preparation of effective slides and presentation.

#### UNIT III: Statistical Tools of research

Significant figures- Precision- accuracy-Error analysis- types of errors- Mean-median- measures of spread -range- standard deviation and variance- F test, t test, Q Test, Types of correlation, correlation coefficient, Regression analysis -binomial distribution, normal distribution -hypothesis generation and testing of hypothesis.

#### UNIT IV: Introduction to Computing and Networking

Introduction to computers and computing -hardware, Basic organization of a computer, CPU, Main memory, Secondary storage, I/O device, Software, System and application software, High and low level languages, Compilers, Algorithms and Flow charts-

Introduction to networking -Computer networks, Network components, Hubs, switches, repeaters, routers, bridges and gateways -LAN, WAN, internet and internet worldwide web, internet for chemists -online search of chemistry databases, e-journals-search engines for chemistry-chemweb.

### **UNITV Chemical safety and Disaster Management:**

**(a) Emergency response:** chemical spills-radiation spills- biohazard spills-leaking compressed gas cylinders-fires- medical emergency accident reporting

**b) General safety :** General safety and operational rules-safety equipments, personal protective equipments, compressed gas safety-safety practices for disposal of broken glass wares- centrifuge safety- treated biomedical wastes and scientific ethics.

### **REFERENCES:**

1. Thesis and Assignment writing, J. Anderson, B.H.Durston and M.Poole, John Wiley Publications, Sydney. 1970.
2. How to write a research paper, R.Berry, Pergoman, 1969.
3. Fundamentals of analytical Chemistry by D. A. Skoog, D. M. West and F. J. Hooler.
4. Quality in the Analytical Chemistry Laboratory by R. D. Treble and D. G. Holcombe.
5. Eckschlager K., 1969, —Errors, Measurement and results in chemical analysisl, London, Van Nostrant Reinhold company
6. K.V. Raman, “Computer in Chemistry”, Tata McGraw Hill, New Delhi, 1993.
7. Practical Skills in Chemistry, J. R. Dean, A. M. Jones, D. Holmes, R. Reed, J. Weyers and A Jones, Pearson Education Ltd. [ Prentice Hall] (2002)

### Question Pattern

<b>Section-A</b>	<b>Two Question For Each Unit</b>	<b>10x 2 = 20</b>
<b>Section-B</b>	<b>Internal Choice and On Set Of Questions From Each Unit</b>	<b>5x 5 = 25</b>
<b>Section-C</b>	<b>Answer Any Three Out Of 5 Questions and One Questions From Each Unit</b>	<b>3x 10= 30</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
60	0	0	0	60	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

**SEMESTER-I**  
**RESENT TRENDS IN CHEMISTRY**

**Hours :3**

**Course code: 18MPCH1CC2**

**Credit :4**

**Max.Marks :100**

**Internal : 25**

**External :75**

**OBJECTIVES**

- **To know the methods of analytical techniques**
- **To understand the handling of chemical in the times of analysis**
- **To carry out the interpretation of spectral data's**

**UNIT I : NMR, IR and Mass Spectroscopy:**

a) IR spectroscopy- Applications of IR in analysis - NMR spectroscopy: Chemical shifts- and coupling constant- Introduction of NOE- DEPT - 2D NMR, 3D NMR, <sup>13</sup>CNMR - its applications.

c) Mass spectroscopy: Mass spectral fragmentation of complex molecules and its applications-

d) Combined spectroscopic problems based on IR- NMR-and mass spectral data.

**UNIT II Electroanalytical Techniques**

Polarography Theory- DME and importance- Current Voltage curves-impedance Spectroscopy- Diffusion current and its theory- factors affection it Polarographic wave and half wave potentials, applications. Oscillographic Polarography-Square wave polarography- Tensimetry- Chronopotentiometry- Cyclic Voltammetry- Amperometry- theoretical principles- applications in chemical investigations-Electrogravimetry- Principles and applications.

**UNIT III**

**Nanotechnology:**

Introduction- Nanotechnology and Nanomachines molecular nanotechnology -methods of synthesis of nano materials - plasma arching, sol-gel method - electro deposition, ball milling – Chemical vapor deposition- analytical tools to study nano materials (SEM, TEM & SPM) - applications of nano chemistry - CNT and its applications, molecular switches, rotaxanes - catenanes - lithography -nano biometrics-metal nano clusters-nano crystals- quantum wells- dots-wires- etc biological materials - future applications

## **Sonochemistry**

Fundamentals of sound and ultrasound - cavitation and its principle - instrumentation - homogeneous and heterogeneous processes -sonoluminescence - uses in chemistry, material science, medicine and life - synthetic applications -esterification, sponification,hydrolysis, substitution, cannzaro reaction, stecker's synthesis

## **UNIT IV :Xray Diffraction, XPS, EDX and TEM :**

Principle instrumentation and application of Xray diffraction (XRD)- Xray photoelectron spectroscopy (XPS) - electron spectroscopy for chemical analysis (ESCA)- transmission electron microscopy (TEM)- Scanning electron microscopy (SEM).

## **UNITV: Computational Chemistry**

**Molecular Modeling:** Introduction -Coordinate Systems -Potential Energy surfaces- Molecular graphics, Surfaces, Mathematical concepts molecular mechanics- Introduction to non-bonded interactions, electrostatic interactions,van der Waals interactions, Manybody effects in empirical potentials -effective pair potentials, hydrogen bonding in molecular mechanics -force field models for the simulation of liquid water. Computer simulation methods: Introduction - calculation of simple thermodynamic properties- chem draw-phase space- practical aspects of computer simulation.

## **REFERENCES:**

1. Silverstein and Basallar: Spectroscopic identification of organic compounds.
2. V. M.Parikh: Absorption spectroscopy of organic compounds. ( J. Wiley )
3. D.W. Williams and Flemming: Spectroscopic methods of organic compound.
4. R.C. Kappor and B.S. Agarwal, Principles of polarography, Wiley Eastern Ltd., 1991.
5. <http://www.sjctni.edu/department/CH/ooc/biometrics.ppt>  
[http://www.sjctni.edu/department/CH/ooc/nano preparation.ppt](http://www.sjctni.edu/department/CH/ooc/nano%20preparation.ppt)  
<http://www.sjctni.edu/department/CH/ooc/sonochemistry.ppt>
6. Instrumental Methods of Analysis: Chatwal & Anand
- 7) Principles of Instrumentals Analysis: D.Skoog & West.

8. Andrew R. Leach, Molecular Modelling second edition Pearson Prentice Hall, England 2001.

**Question Pattern**

<b>Section-A</b>	<b>Two Question For Each Unit</b>	<b>10x 2 = 20</b>
<b>Section-B</b>	<b>Internal Choice and On Set Of Questions From Each Unit</b>	<b>5x 5 = 25</b>
<b>Section-C</b>	<b>Answer Any Three Out Of 5 Questions and One Questions From Each Unit</b>	<b>3x 10= 30</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
69	0	0	0	69	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

## SEMESTER - I

### CORE COURSE III - TEACHING AND LEARNING SKILLS

**Course Code: 18MPMB1CC3**

**Total Marks: 100**

**Hours: 6**

**External Marks: 75**

**Credit: 4**

**Internal Marks: 25**

#### Objectives

- Acquaint different parts of computer system and their functions
- Understand the operations and use of computers and common accessories
- Develop skills of ICT and apply them in teaching learning context and research
- Appreciate the role of ICT in teaching, learning and research
- Acquire the knowledge of communication skill with special reference to its elements, types, development and styles
- Understand the terms communication Technology and Computer mediated teaching and develop multimedia / e-content in their respective subject
- Understand the communication process through the web
- Acquire the knowledge of Instructional Technology and its Applications
- Develop different teaching skills for putting the content across to targeted audience

#### Unit I Computer Application Skills

Computer system: Characteristics, Parts and their functions - Different generations of Computer - Operation of Computer - switching on / off / restart - Mouse control - Use of key board and some functions of key - Information and Communication Technology (ICT): Definition - Meaning, Features, Trends - Integration of ICT in teaching and learning - ICT applications - Using word processors - spread sheets, Power point slides in the classroom - ICT for Research - Online journals - e books - Courseware, Tutorials - Technical reports - Theses and Dissertations

#### Unit II Communication Skills

Communication: Definitions - Elements of Communication: Sender - Message - Channel - Receiver - Feedback and Noise - Types of Communication: Spoken and written - Non-verbal communication - Intrapersonal, Interpersonal - Group and Mass communication - Barriers to communication - Mechanical, Physical, Linguistic & Cultural - Skills of communication - Listening, Speaking, Reading and writing - Methods of developing fluency in oral and written communication - style, Diction and Vocabulary - Classroom communication - dynamics

### **Unit III Communication Technology**

Communication Technology - Bases, Trends and Developments - Skills of using Communication Technology - Computer Mediated Teaching - Multimedia, E-content - Satellite-based communication - EDUSAT - ETV channels - Communication through web - Audio and Video applications on the Internet - interpersonal communication through the web.

### **Unit IV Pedagogy**

Instructional Technology: Definition - Objectives and Types - Difference between Teaching and Instruction - Lecture Technique: Steps - Planning of a Lecture, Delivery of a lecture - Narration in tune with the nature of different disciplines - Lecture with power point presentation - Versatility of lecture technique - Demonstration, Characteristics - Principles - Planning Implementation and Evaluation - Teaching - Learning Techniques - Team Teaching, Group discussion, Seminar, Workshop, Symposium and Panel Discussion - Models of teaching -CAI - CMI - WBI

### **Unit V Teaching Skills**

Teaching skill: Definition - Meaning and Nature - Types of Teaching skills - Skill of Set Induction - Skill of Stimulus Variation- Skill of Explaining, Skill of Probing Questions - Skill of Black Board writing and Skill of Closure - Integration of Teaching Skills - Evaluation of Teaching Skills.

#### **Text Book:**

1. Mangal, S.K. (2002) Essential of Teaching - Learning and Information Technology, Tandon Publications, Ludhiana

#### **Reference Books:**

1. Bela Rani Sharma (2007), Curriculum Reforms and Teaching Methods, Sarup and sons, New Delhi
2. Don Skinner (2005), Teacher Training, Edinburgh University Press Ltd., Edinburgh
3. Information and Communication Technology in Education: A Curriculum for Schools and programme of Teacher development, Jonathan Anderson and Tom Van Weert, UNESCO, 2002
4. Kumar K.I (2008) Educational Technology, New Age International Publishers, New Delhi

### Question Pattern

<b>Section-A</b>	<b>Two Question For Each Unit</b>	<b>10x 2 = 20</b>
<b>Section-B</b>	<b>Internal Choice and On Set Of Questions From Each Unit</b>	<b>5x 5 = 25</b>
<b>Section-C</b>	<b>Answer Any Three Out Of 5 Questions and One Questions From Each Unit</b>	<b>3x 10= 30</b>

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
77	0	0	0	77	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

**SEMESTER-I  
GUIDE PAPER**

**Hours : 4**  
**Course code: 18MPCH1CC4**

**Credits:4**  
**Max-Marks :100**  
**Internal : 25**  
**External :75**

**SYLABUS PREPARED BY GUIDE THEIR OWN RESEARCH AREAS**

**Question Pattern**

<b>Section-A</b>	<b>Two Question For Each Unit</b>	<b>10x 2 = 20</b>
<b>Section-B</b>	<b>Internal Choice And On Set Of Questions From Each Unit</b>	<b>5x 5 = 25</b>
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**PAPER-IV**

**BACKGROUND PAPER -SYNTHETIC ORGANIC CHEMISTRY**

**OBJECTIVE**

- To understand synthesis through environment friendly by studying green Chemistry
- The course “Synthetic organic Chemistry” provides students with a detailed knowledge of fundamental aspects of the subject,
- To analyze the influence of an on the reactivity of a various reagents-
- To know various analytical technique to summarize the research outcomes

**UNIT I: Green chemistry:**

Introduction - Principles of Green chemistry - Environmental friendly green techniques - Solvent less organic synthesis - supercritical carbondioxide and water as solvents ionic liquids reactions of solid supported catalysts- Biocatalysts.

## **UNIT II: Named Reactions and Strategic Applications in Organic Synthesis**

Bamford Stevens Reaction, Barton McCombie Reaction (Barton Deoxygenation) -Baylis, Hillman Reaction -Enamines and selective alkylation (mono and di) via enamine reactions - Henry Reaction -Hunsdiecker Reaction- Peterson Olefination Prevost Reaction Prins Reaction - Ugi Reaction -Weinreb Ketone Synthesis- Wittig reaction and its modifications- Palladium based reactions: Fukuyama Coupling Heck Reaction- Hiyama Coupling- Sonogashira Coupling- Stille Coupling- Suzuki Coupling.

## **UNIT III: Oxidation and Reduction reactions**

Synthetic uses of the following oxidants: OsO<sub>4</sub>-DDQ- PCC- MnO<sub>2</sub>- SeO<sub>2</sub>- Jones reagent- Chromyl chloride- Lead Tetra Acetate- periodate- peracids- Fetizon's reagent

Synthetic uses of the following reductions: NaNH<sub>2</sub>, Wilkinson's catalyst- LAH- NaBH<sub>4</sub>- (t-BuO)<sub>3</sub>AlH- NaBH<sub>3</sub>CN, R<sub>3</sub>SnH-Me<sub>3</sub>SiCl-hydrazine- Alkali metals- MPV reduction.

## **UNIT IV: Chromatography:**

Principles of chromatography - Thin layer chromatography - R<sub>f</sub> value - column chromatography - principles of Gas - liquid chromatography - Instrumentation - Applications, Principle and applications of HPLC and HPTLC.

## **UNIT V: Advanced NMR Spectroscopy**

IR spectroscopy: Applications of IR in analysis- NMR Spectroscopy: <sup>1</sup>H NMR Spectroscopy – Multiplicity, Coupling constant, Spin spin splitting -Vicinal and geminal coupling constants- <sup>13</sup>C NMR Spectroscopy -Off resonance decoupling and chemical shifts of common functional groups, DEPT spectra- Basic principles of two dimensional correlated NMR spectroscopy- <sup>1</sup>H<sup>13</sup>C COSY, <sup>1</sup>H<sup>1</sup>H COSY, Two dimensional relayed NMR spectroscopy, H relayed (H, C) COSY H relayed (H H) COSY experiments- Two dimensional exchange NMR, NOESY- Total correlation spectroscopy, two dimensional inadequate experiments.

Mass spectroscopy: Mass spectral fragmentation of complex molecules and its applications.

## **References:**

1. Rashmi Sanghi, Green Chemistry - Environment friendly alternatives- Srivastava,

Narosa Publishers, New Delhi-

2. House H-O- Modern Synthetic Reactons, W-A- Benjamin-
3. Norman R-O-C- Modern Methods in organic synthesis- Macmillan- 1967-
4. Corey, E-J- Reaction and reagent in organic synthesis, V-C-H- 1988-
5. Willard and D- Merrit, Instrumental methods of analysis- W-B- Saunder, 1987-
6. Silverstein, R-M- and F-X- Webster, Spectrometric identification of Organic Compounds, John Wiley, 1998-
7. Stothers, J-B-, Carbon-13 NMR Spectroscopy- Academic, 1972-

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
57	0	0	0	57	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									