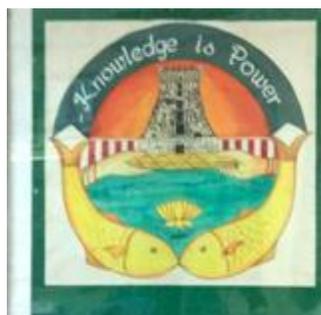


**SRI MEENAKSHI GOVERNMENT ARTS  
COLLEGE FOR WOMEN (AUTONOMOUS),  
MADURAI-02**



**DEPARTMENT OF CHEMISTRY  
CBCS SYLLABUS FOR  
B.Sc., CHEMISTRY  
FROM  
2021  
ONWARDS**

**SRI MEENAKSHI GOVERNMENT ARTS COLLEGE FOR WOMEN (A)**  
**DEPARTMENT OF CHEMISTRY**  
(Academic year 2021 onwards)

### **ABOUT THE DEPARTMENT OF CHEMISTRY**

The department of chemistry was established in the year 1965 for the pre-university course. Bachelor degree of Chemistry was started in the year 1968 with a few staff members. The department has been upgraded to post graduate department in 2017.

### **FACULTY**

The Department comprises of a goal oriented group of highly qualified, experienced and dynamic faculty members. The Department of Chemistry has 17 faculty members, of which 12 are Ph.D., holders. At present, 4 of our staff members are pursuing their Ph.D. degree. Their areas of expertise and research include organic, inorganic, physical, electrochemistry, phytochemistry, nanotechnology and supramolecular chemistry.

### **ACTIVITIES AND ACHIEVEMENTS**

Most of the staff members are actively involved in research and various important decision making committees at the College level and act as expertise in Boards of studies at college as well as University level. The staff members have been serving as NSS & NCC coordinators, Science Forums coordinator, Autonomy-in-charge, remedial/ special coaching coordinators, Sports committee member, Thaatha-paattikuzhu coordinator, Admission committee member, admission coordinator, Career guidance cell coordinator, Controller of examinations, additional controller of examinations, Deputy warden in college hostel, Youth welfare association coordinator, Parent Teacher Association treasurer, Old student's association, Course coordinators, syllabus committee representatives, question paper setters and external examiners at undergraduate as well as postgraduate levels. Faculty members have contributed to academics by publishing books, contributing research articles in journals, presenting papers in conferences and delivering guest lectures. Faculty members have been recognized by national agencies and Universities with awards for their contribution to research.

Four staff members (retired from service) were elevated to the cadre of Principal, Regional Joint Director and have served as efficient administrators at various colleges and regional offices. Some of the staff members are carrying out UGC funded minor research projects, received research awards, awards from All India Radio serial programme and have also served as editors in peer journals like Elsevier.

## **COURSE**

At present our department caters to the needs of 282 (UG - 251 and PG - 31) major chemistry students and 222 Ancillary chemistry students. Our march towards the zeal will continue in the forthcoming years also.

## **DEPARTMENT HIGHLIGHTS**

The Department organizes National Conferences, workshops and faculty Development Programmes for the benefit of students. The Department, with a focus on enhancing the knowledge and skills of the students, has been conducting inter-Departmental and inter-collegiate activities, through the Chemistry Association, Science Forum and Chemistry Club. It has also been actively involved in various outreach programmes for the uplift of society. Equal opportunity centre program has been conducted by our department.

## **RESOURCES**

The Department has three laboratories which are fully equipped with instruments for teaching and research activities. The instruments available in the laboratories include UV-visible spectrophotometer, Conductometer, Potentiometer, pH meter, Polarimeter, etc. The Government has recently sanctioned fund for setting up two new laboratories which are under construction.

The Department has an excellent library for the benefit of students, faculty members and research scholars. Library has a large collection of books covering various branches of Chemistry like organic, inorganic, physical, electrochemistry, greenchemistry and nanochemistry. Internet facility is available in the department.

## **ALUMNI ACTIVITIES**

During 55 years of successful journey, our department has produced flourishing alumni who have occupied various positions in different sectors like academic, administrative, research, innovative scientists, overseas employment, banking and recent blooming fields like information technology.

The alumni of the department, had served as the Principal in Govt Arts College, HOD and eminent professor in the School of chemistry at MKU, Madurai. It is a privilege to specify that, 22 alumni of chemistry department are serving as Associate Professors and Assistant Professors in various esteemed institutions. Alumni meet for the 1991 – 94 batch of B.Sc., Chemistry was organized on 8<sup>th</sup> January, 2017.

We have further goals to enrich our department as research department for the benefits of the students.

**COURSES OFFERED:**

- **UG COURSE:        B.Sc., CHEMISTRY**
- **PG COURSE:        M.Sc., CHEMISTRY**

**VISION**

To create an academically sound environment that nurtures, motivates and inspires excellence in teaching along with concern for society.

**MISSION**

To impart theoretical and practical training in different areas of chemistry which encourages creativity,insight development and a passion for science.

## **B.Sc., CHEMISTRY PROGRAMME OUTCOMES**

*After successful completion of the programme the student is able to*

### **PO1.Exhibit sustained thirst of Knowledge**

Sustained arousal of curiosity and interest to know the basic and amazing facts in chemistry.

### **PO 2.Demonstrate the Understanding.**

Ability to demonstrate the firm foundation in the fundamentals about the basic concepts in Chemistry.

### **PO 3. Show critical thinking and analytical reasoning.**

Ability to think analytically by approaching the reactions through appropriate mechanisms involved in the reactions.

### **PO 4. Display the skill of applying the Gained knowledge**

Ability to apply the theoretical knowledge to laboratory experiments by way of keen observation, inquiring independently, interpreting, documenting the quantitative and qualitative data and analyze them.

Ability to solve the problems.

### **PO 5. Identify the contribution of Chemistry to the society**

Ability to recognize the role of chemistry in various disciplines and assess the key issues in the environment and health.

Ability to handle chemicals safely and display the positive role as an ethical chemist.

### **PO6. Extrapolate Life-long learning.**

Ability to adapt to new changes and updations in the discipline and maintain life-long learning.

**PO 7. Able to communicate**

Ability to communicate effectively in writing and discussing the concepts effectively.

**B.Sc., CHEMISTRY PROGRAMME SPECIFIC OUTCOMES**

*After successful completion of the course the student is able to exhibit the following programme specific outcomes*

**PSO 1.** A platform for employment or self-employment.

With the gained knowledge and acquired skill the student is able to become self-employed or employed.

**PSO 2.** Substantial part of further academic path.

Having acquired the thorough knowledge about the fundamental concepts in Chemistry, enable the students in pursuing higher studies.

**PSO3.** Able to discuss the concepts of chemistry confidently and perform laboratory testing/experiments independently.

**PSO 4.** safety and hygiene

The students is able to be aware of laboratory safety, the safe physical manipulation of materials & Instruments, first-aid, hygiene, method of disposing chemicals, environmental impact of chemical pollutants and exhibit as a socially responsible person.

Able to demonstrate effective time and task management.

**PSO 5.** Able to update day-to-day knowledge in Chemistry.

**PSO 6.** Teamwork and Contribution to the Society

Able to apply and deliver the knowledge gained in the Course to the society, ability to work as a team and contribute service to the society by realizing the perspective of Chemistry as an integral part of it.

PSO 7. Able to adapt to various progression routes in seeking professional career.

**SRI MEENAKSHI GOVERNMENT ARTS COLLEGE FOR WOMEN(A),  
MADURAI-2  
DEPARTMENT OF CHEMISTRY  
SYLLABUS – NEW PATTERN – CBCS FORB.Sc Chemistry  
For those who are admitted from July 2021 onwards.**

Semester	Part	Subject	Hrs/week	Exam hrs	Credits	Int.marks	Ext.marks	Total
I	I	Language	6	3	3	25	75	100
	II	Language	6	3	3	25	75	100
	III	Allied 1- theory	4	3	3	25	75	100
		Allied 1 practicals	3	-	-	--	-	-
		Major paper 1	4	3	4	25	75	100
		Major paper 2	2	-	-	--	-	-
		Major paper 3 practicals-1	4	-	-	-	-	-
	IV	Value Education	1	-	-	-	-	-
		<b>TOTAL</b>	<b>30</b>		<b>13</b>			<b>400</b>
II	I	Language	6	3	3	25	75	100
	II	Language	6	3	3	25	75	100
	III	Allied 1- theory	4	3	4	25	75	100
		Allied 1 practicals	3	3	3	40	60	100
		Major paper 4	4	3	4	25	75	100
		Major paper 2	2	3	4	25	75	100
		Major paper3 practicals-1	4	6	4	40	60	100
	IV	Value Education	1	3	2	25	75	100
		<b>TOTAL</b>	<b>30</b>		<b>27</b>			<b>800</b>
III	I	Language	6	3	3	25	75	100
	II	Language	6	3	3	25	75	100
	III	Allied 2- theory	4	3	3	25	75	100
		Allied 2 practicals	3	-	-	--	-	-
		Major paper 5	4	3	4	25	75	100
		Major paper 6	2	-	-	-	-	-
		Major paper 7 practicals-2	4	-	-	-	-	-

	IV	Skill based elective-1	*	3	2	25	75	100
		Skill based elective 2	1	-	-	-	-	-
	V	Extension activities	-	-	1	100	-	100
		<b>TOTAL</b>	<b>30</b>		<b>16</b>			<b>600</b>
IV	I	Language	6	3	3	25	75	100
	II	Language	6	3	3	25	75	100
	III	Allied 2- theory	4	3	4	25	75	100
		Allied 2 practicals	3	3	3	40	60	100
		Major paper 8	4	3	4	25	75	100
		Major paper 6	2	3	4	25	75	100
		Major paper 7 practicals-2	4	6	4	40	60	100
	IV	Skill based elective-2	1	3	2	25	75	100
	Skill based elective-3	*	3	2	25	75	100	
		<b>TOTAL</b>	<b>30</b>		<b>29</b>			<b>900</b>
<b>Semester</b>	<b>Part</b>	<b>Subject</b>	<b>Hrs/week</b>	<b>Exam hrs</b>	<b>Credits</b>	<b>Int.marks</b>	<b>Ext.marks</b>	<b>Total</b>
V	III	Non major elective 1	2	3	2	25	75	100
		Elective 1	5	3	5	25	75	100
		Elective 2	5	3	5	25	75	100
		Major paper 9	5	3	5	25	75	100
		Major paper 10	5	3	5	25	75	100
		Major paper 11 practicals-3	5	-	-	-	-	-
	IV	Skill based elective 4 GK	2	3	2	25	75	100
		Skill based elective 5	1	-	-	-	-	-
		<b>TOTAL</b>	<b>30</b>		<b>24</b>			<b>600</b>
VI	III	Non major elective 2	2	3	2	25	75	100
		Elective 3	5	3	5	25	75	100
		Major paper 12	5	3	5	25	75	100
		Major paper 13	4	3	4	25	75	100
		Major paper 14	4	3	4	25	75	100
		Major paper 11 practicals-3	5	6	5	40	60	100
	IV	Skill based elective 5	1	3	2	25	75	100
		Skill based elective 6	2	3	2	25	75	100
		Environmental studies	2	3	2	25	75	100
		<b>TOTAL</b>	<b>30</b>		<b>31</b>			<b>900</b>
		<b>GRAND TOTAL</b>			<b>140</b>			<b>4200</b>

[\*For want of hours required for the credits in core subjects, the following skill based elective courses are conducted out of the class hours.

Skill based elective 1 –Small scale industries (2 hrs in III semester)

Skill based elective 3 – Chemistry for competitive examinations (IV Semester)]

Skill based elective 2 - Analytical chemistry (2 semesters III & IV Semester)

Skill based elective 4 – GK (common for all- V Semester)

Skill based elective 5 – Computer applications in Chemistry ( V & VI semesters)

Skill based elective 6 – Water treatment ( VI Semester)

### CORE

Semester	Paper no.	Code	Title	Lecture hrs / week	Credits	Exam at the end of
I	1	C11	General Chemistry – 1	4	4	I
I & II	2	C21	General chemistry – 2	2+2	4	II
I & II	3	PC1	Practicals -1(Qualitative analysis & organic preparation)	4+4	4	II
II	4	C22	General chemistry – 3	4	4	II
III	5	C31	General chemistry – 4	4	4	III
III & IV	6	C41	Applied Chemistry	2+2	4	IV
III & IV	7	PC2	Practicals 2 (Volumetric analysis and organic estimation)	4+4	4	IV
IV	8	C42	Physical and Inorganic chemistry	4	4	IV
V	9	C51	Organic Chemistry – 1	5	5	V
V	10	C52	Physical Chemistry – 1	5	5	V
V & VI	11	PC3	Practicals -3 (Gravimetric analysis, Organic analysis and Physical Chemistry)	5+5	5	VI
VI	12	C61	Inorganic Chemistry	5	5	VI
VI	13	C62	Organic Chemistry – 2	4	4	VI
VI	14	C63	Physical Chemistry – 2	4	4	VI
<b>TOTAL</b>	<b>14</b>				<b>60</b>	

### ELECTIVE

V	1	EC51	Elective-1 Analytical Techniques	5	5	V
V		EC54	Elective-1 Biochemistry			
V	2	EC52	Elective -2 Food Chemistry	5	5	V
V		EC55	Elective-2 Polymer Chemistry			
VI	3	EC63	Elective-3 Pharmaceutical Chemistry	5	5	VI
VI		EC66	Elective-3 Agricultural Chemistry			

### SKILL BASED ELECTIVE & NON-MAJOR ELECTIVE

Semester	Paper no.	Code	Title	Lecture hrs / week	Credits	Exam at the end of
III	1	SC31	SBE -1 (Small scale industries)	2	2	III
III&IV	2	SC42	SBE -2 (Analytical Chemistry)	1+1	2	IV

IV	3	SC43	SBE -3 (Chemistry for competitive examinations)	2	2	IV
V	4	SGK4	SBE -4 (GK)	2	2	V
V & VI	5	SC65	SBE -5 (Computer applications in Chemistry)	1+1	2	VI
VI	6	SC66	SBE -6 ( Water treatment)	2	2	VI
V		NMC1	NME -1 Chemistry in life	2	2	V
VI		NMC2	NME – 2 Day to day Chemistry	2	2	VI

**ALLIED CHEMISTRY**

III		AC1	Allied-1 Ancillary Chemistry -1	4	3	III
IV		AC2	Allied-1 Ancillary Chemistry -2	4	4	IV
III & IV		CPA	Allied Practicals	3+3	3	IV

**VALUE ADDED COURSES FOR B.Sc. CHEMISTRY MAJOR**

1. CHEMISTRY OF HEALTH AND HERBS
2. INDUSTRIAL CHEMISTRY

**VALUE ADDED COURSE COMMON FOR ALL THE MAJORS**

1. INTRODUCTION TO CHEMICAL PRODUCTS AROUND US

**SRI MEENAKSHI GOVERNMENT ARTS COLLEGE FOR WOMEN (A),  
MADURAI -2.**

**BLUE PRINT (For CORE & SBETheory Paper)**

**For students admitted from June 2021**

**Course : B.Sc Chemistry**

**Max Marks : 75(External)**

**Title of the Paper :**

**Total Marks: 100 (Internal(25) +External(75))**

**Semester:**

**Paper Code:**

**Exam Duration : 3 Hrs**

SECTION	UNIT					Question Paper Pattern	Marks
	I	II	III	IV	V		
Section A	2	2	2	2	2	10 Questions (Answer all the questions)	10×1=10
Section B	2	2	2	2	2	5 Questions (Open choice)	5×7=35
Section C	1	1	1	1	1	3 Questions (open choice)	3×10 = 30

**Practicals :**

**Internal: 40**

**External: 60**

**Programme: B.Sc CHEMISTRY  
Semester : I**

**Part III:(Core) major paper I  
Hours: 4 / W, 60 / S**

**Code: C11**

**Credit– 4**

**TITLE OF THE PAPER: GENERAL CHEMISTRY- I**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/ProblemsolvingQuiz/videos/Demonstration class (Lab / Library session is conducted after the class hours)	ICT	
	5	3	1	1	
<b>PREAMBLE: The objective of the course is emphasizing the fundamental concepts of chemistry and applying them and make the students to understand the chemistry of alkanes, alkenes and alkynes, explaining the atomic models,theory of gases, periodicity,discussing the principles of metallurgy and the chemistry of hydrides.</b>					
<b>COURSE OUTCOME</b>				Unit	Hrs /S
At the end of the Semester, the students will be able to					
<b>UNIT 1 CO1:</b> discuss the tetrahedral arrangement of valency of carbon, types of cleavage of bonds, the different types of reaction intermediates, the different types reactions. demonstrate the polar effects and apply them to suitable examples. Analyze the aromaticity with the help of Huckel's rule				1	12

<b>UNIT 2 CO2:</b> explain the petroleum products, the reactions of alkenes, the Markownikoff's rule, peroxide effect, the Diels alder reactions and 1,4 addition mechanism and the reactions of alkynes and preparation, properties and reactions acetylene.	2	12
<b>UNIT 3 CO3:</b> describe the atomic structure and theories associated with it.	3	12
<b>UNIT 4 CO4:</b> explain the periodic properties and discuss metallurgy and hydrides.	4	12
<b>UNIT 5 CO5:</b> explain the kinetic theories of gases.	5	12

**UNIT – I (ORGANIC CHEMISTRY):****(12 Hrs)**

- **IUPAC nomenclature** – homologous series.
- **Fundamental Concepts:**
  - Tetrahedral arrangement of valencies of carbon atom.
  - Cleavage of bonds: Homolytic and heterolytic cleavage of carbon bond
  - Reaction intermediates: carbenes, carbonium ion and carbanion – their generation and stability. Nucleophilic and electrophilic reagents.
  - Types of reactions: Substitution, addition, elimination, rearrangement and polymerisation with suitable examples. [No mechanism needed].
  - Inductive effect, electromeric effect, resonance, hyperconjugation, aromaticity and Huckel's (4n+2) rule with examples.

**UNIT – II (ORGANIC CHEMISTRY):****(12 Hrs)****Aliphatic hydrocarbons:**

**Alkanes:** Preparation – Hydrogenation of alkenes or alkynes, reduction of alkyl halides, decarboxylation of carboxylic acids, hydrolysis of Grignard reagent, Wurtz synthesis. Isomerism in alkanes (more than 4 carbon atoms) – petroleum products, cracking and pyrolysis, octane number and flash points.

**Alkenes: Preparation** - By dehydrogenation of alcohols, dehydrohalogenation of alkyl halides, dehalogenation of vicinal dihalides by controlled hydrogenation of alkynes, by cracking of alkanes. Isomerism in alkenes – dehydrohalogenation of alkyl bromides – electrophilic addition reactions – Markownikoff's rule and peroxide effect. Dienes and their classification – butadiene – Diels- Alder reaction – 1,4 addition mechanism – Thiele's theory of partial valency.

**Alkynes:** Preparation- dehydrohalogenation of vicinal halides, dehalogenation of tetrahalides, reaction of sodium acetylides with primary alkyl halides, reaction of calcium carbide with water. Nature of triple bond in alkynes – acidity – electrophilic addition reactions. Preparation, Properties and reactions of acetylene

**UNIT- III (INORGANIC CHEMISTRY)****(12 Hrs)****Atomic structure:**

Rutherford's atom model – Bohr's atom model – derivation of radius of orbit – Energy level-spectra of hydrogen atom – quantum numbers – Pauli's exclusion principle – Hund's rule – Electronic configuration of element – Aufbau principle - Shapes of atomic orbitals.

**UNIT-IV (INORGANIC CHEMISTRY):**

**(12 Hrs)**

*Periodic properties* – atomic radii, ionic radii, covalent radii, ionization potential – electronegativity – Pauling scale and Mullikan's scale.

*Metallurgy*: Principles involved in Van-Arkel-deBoer's process and aluminothermite process.

*Hydrides*- – Classification, preparation, properties and uses.

**UNIT- V (PHYSICAL CHEMISTRY):**

**(12 Hrs)**

***Kinetic Theory of gases:***

Maxwell-Boltzmann law of distribution of molecular velocities (Derivation not necessary) – Graphical representation –Effect of Temperature on velocity distribution- Experimental verification of Maxwell velocity distribution [Stern method] – Mean free path – Viscosity of gases and determination of molecular diameter – collision frequency – collision number – Brownian movement and determination of Avogadro Number – Loschmidt number – Principle of equipartition of energy.

**TEXTBOOKS**

1. Text book of Organic Chemistry by P.L.Soni- SultanChand & Sons; 29<sup>th</sup> edition (2012).
2. Sathyaprakash's Modern Inorganic Chemistry by R.D.Madan; S. Chand Publishing 3<sup>rd</sup> ed. reprint (2016).
3. Principles of Physical Chemistry- Puri, Sharma and Pathania - Vishal Publishing Co.; 46<sup>th</sup> edition (2012).
4. Arimurai Karima Vethiyal by R. Saraswathi, N. Subbulakshmi, R. Santhanalakshmi, N. Vijayathara, M. Thilagavathi, Published by Madurai Kamaraj University, Madurai, 1998.
5. Kanima Vethiyal by L. Anjana, S.K. Santha, R. Santhanalakshmi, R. Saraswathi N. Vijayathara, Sudhasoundirapandian, D.SaralaThambavani, Published by Madurai Kamaraj University, Madurai, 1998.
6. Arimurai Iyarpu Vethiyal by Sudha soundirapandin, & T.R. Visalakshi, Published by Madurai Kamaraj University, Madurai, 1998.

**References**

1. Textbook of Organic Chemistry by Arun Bahl, B.S. Bahl, S. Chand & Company, 22<sup>nd</sup> edition.
2. Organic Chemistry by Morrison & Boyd, Pearson Publishers, 7<sup>th</sup> edition.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT 1: (ORGANIC CHEMISTRY)</b>			
	tetrahedral arrangement of valency of carbon	3	ICT
	cleavage of bonds, polar effects, different types of reaction intermediates, different types reactions. Aromaticity and Huckel's rule	9	Lecture Problem solving
<b>UNIT II (ORGANIC CHEMISTRY)</b>			
	petroleum products	1	Assignment
	Markownikoff's rule and peroxide effect	2	ICT
	Diels alder reactions and 1,4 addition mechanism, reactions of alkene, reactions of alkynes, preparation, properties and reactions acetylene.	9	Lecture
<b>UNIT III (INORGANIC CHEMISTRY)</b>			
	Atomic model	3	ICT
	Energy level spectra	7	Lecture
	Electronic configuration	2	Lecture, Tutorial & Problem solving.
<b>UNIT IV (INORGANIC CHEMISTRY)</b>			
	metallurgy	2	ICT
	periodic properties	7	Lecture & Quiz.
	Hydrides	3	Lecture & Tutorial.
<b>UNIT V (PHYSICAL CHEMISTRY)</b>			
	Distribution of molecular velocities	3	ICT
	Viscosity of gases, Collision properties	6	Lecture
	Principle of equipartition of energy	3	Lecture

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	4	3	3	4	3	3	3	5	5	4	4	3	3	3.71
CO2	5	5	3	4	4	4	3	3	5	3	5	4	4	3	3.93
CO3	4	3	4	4	4	3	4	3	4	4	4	4	3	4	3.6

CO4	3	4	4	4	4	4	4	3	4	3	3	4	4	4	3.7
CO5	4	4	3	4	3	3	4	4	3	4	4	4	3	4	3.6
Mean Overall Score															3.71

Result: The Score for this Course is 3.71 (High Relationship)

**Programme :B.Sc Chemistry**  
**Semester : I & II**

**Part III: (Core)Major paper 2**  
**Hours : 4 /W, 60/S**  
**Credits : 4**

**Code: C21**

**TITLE OF THE PAPER: GENERAL CHEMISTRY- 2**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/ /videos/Demonstration class (Lab / Library session is conducted after the class hours).	ICT	
	2	3	1	1	
<b>PREAMBLE: The objective of the course is to make the student understand the basic concepts of different types of liquid crystals, adsorptions and their applications, the basic principles of electrophilic, nucleophilic substitution reactions, Organometallic compounds, Group IA and Group IIA members of the periodic table.</b>					
<b>COURSE OUTCOME</b>				Unit	Hrs / S
At the end of the Semester, the students will be able to					

<b>UNIT 1 CO1:</b> demonstrate the fundamentals of liquid crystals, colloids and their types as well as their applications.	1	12
<b>UNIT 2 CO2:</b> categorize the types of adsorption and explain the principles of adsorption and catalysis along with their applications.	2	12
<b>UNIT 3 CO3:</b> demonstrate the mechanism of substitution and reactivity of alkyl halides, polyhalogen derivatives and aromatic halogen compounds.	3	12
<b>UNIT 4 CO4:</b> describe the chemistry of organometallic compounds along with their synthetic applications and the various aromatic substitution reactions along with their mechanisms.	4	12
<b>UNIT 5 CO5:</b> discuss the extraction methods, properties and uses Group I A and Group II A elements.	5	12

**UNIT- I (PHYSICAL CHEMISTRY):****(12 Hrs)**

- **Liquid Crystals** –Theory of different types of liquid crystals and their applications – glassy state – swarm theory of liquid crystals.
- **Colloids:** Colloidal state of matter – various types of classification.
  - Solids in Liquids – (Sol) properties, kinetic, optical and electrical stability of colloids and protective action – Hardy-Schulz law – Gold number – Hofmeister series.
  - Liquids in liquids – (Emulsion) Types of emulsion – emulsifier with suitable examples- demulsification.
  - Liquids in solids – (Gels) Classification – preparation and properties – thixotropy – syneresis and imbibition – Donnan Membrane Equilibrium.
  - Applications of colloids

**UNIT- II (PHYSICAL CHEMISTRY):****(12 Hrs)**

- **Adsorption:** Definition of the various terms – adsorption of gases on solids – characteristics of adsorption of gases on solids – physisorption and chemisorption – factors influencing adsorption – adsorption isotherms – Freundlich and Langmuir adsorption isotherms – BET theory – elementary idea – Applications of adsorption.
- **Catalysis:** Definition – characteristics – Theories of catalysis – promoters and poisons – enzyme catalysis – acid-base catalysis – auto catalysis with suitable examples – applications

**UNIT – III (ORGANIC CHEMISTRY):****(12 Hrs)**

- **Halogen derivatives of aliphatic hydrocarbons:**

- **Alkyl halides:** (mechanism only) mechanism of substitution –  $S_N^1$  and  $S_N^2$  – mechanism of elimination –  $E_1$  and  $E_2$ . Elementary treatment of Hofmann and Saytzeff rule – relative reactivity of alkyl halides.
- **Poly halogen derivatives:** Chlorofluoro carbons – Westron and Freon – preparation and uses.
- **Halogen derivatives of unsaturated hydrocarbons** – Vinyl chloride – Allyl chloride, Allyl iodide and Chloroprene – preparation and properties.

***Aromatic Halogen Compounds:***

Halogen compounds of Benzene: Preparation, properties and uses of chlorobenzene, bromobenzene and benzyl chloride. Reactivity of aryl halides

**UNIT – IV (ORGANIC CHEMISTRY):**

**(12 Hrs)**

- ***Organometallic compounds:*** Alkyl and aryl Grignard reagents – preparation, synthetic applications (structure not necessary) Tetra ethyl lead
- ***Aromatic Substitution:***
  - Electrophilic, nucleophilic and free radical substitution.
  - Mechanism of aromatic electrophilic monosubstitution (electronic interpretation) – halogenation, nitration, sulphonation and Friedel – Craft’s reaction.
  - Nucleophilic substitution – unimolecular, bimolecular and benzyne mechanism – free radical substitution in benzene.

**UNIT-V (INORGANIC CHEMISTRY):**

**(12Hrs)**

***Group 1/ I A elements:*** Group discussion – Lithium: diagonal relationship with magnesium and comparison with other members of the family – justification of its position – extraction, properties and uses.- Lithium compounds- peroxide, carbonate, bicarbonate and carbide of lithium.

***Group 2/ II A elements:*** Group discussion – Beryllium: Diagonal relationship with aluminium and comparison with magnesium – justification of its position- extraction, properties and uses – Oxide, hydroxide, halides of Beryllium – preparation and properties. Plaster of Paris, barites, lithopone - preparation, properties and uses.

**TEXT BOOKS**

1. Text book of Organic Chemistry by P.L.Soni- SultanChand & Sons; 29<sup>th</sup> edition (2012).
2. Sathyaprakash’s Modern Inorganic Chemistry by R.D.Madan ; S. Chand Publishing 3<sup>rd</sup> ed. reprint (2016).
3. Principles of Physical Chemistry- Puri, Sharma and Pathania - Vishal Publishing Co.; 46<sup>th</sup> edition (2012).

4. Arimurai Karima Vethiyal by R. Saraswathi, N. Subbulakshmi, R. Santhanalakshmi, N. Vijayathara, M. Thilagavathi, Published by Madurai Kamaraj University, Madurai, 1998.
5. Kanima Vethiyal by L. Anjana, S.K. Santha, R. Santhanalakshmi, R. Saraswathi N. Vijayathara, Sudha soundirapandian, D.SaralaThambavani, Published by Madurai Kamaraj University, Madurai, 1998.
6. Arimurai Iyarpu Vethiyal by Sudha soundirapandian, & T.R. Visalakshi, Published by Madurai Kamaraj University, Madurai, 1998.

**References:**

1. Textbook of Organic Chemistry by Arun Bahl, B.S. Bahl, S. Chand & Company, 22<sup>nd</sup> edition.
2. Organic Chemistry by Morrison & Boyd, Pearson Publishers, 7<sup>th</sup> edition.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT 1: Physical Chemistry</b>			
	Theory of different types of liquid crystals and their applications, glassy state, swarm theory of liquid crystals.	2	ICT
	Colloids, Emulsions, Gels	9	Lecture & Quiz.
	Applications of colloids.	1	Seminar
<b>UNIT 11: Physical Chemistry</b>			
	Adsorption of gases on solids, characteristics of adsorption of gases on solids, physisorption and chemisorption.	2	ICT
	Factors influencing adsorption, adsorption isotherms, Freundlich and Langmuir adsorption isotherms, BET theory, applications of adsorption. Catalysis- Principles and theories.	9	Lecture
	Applications of adsorption. Applications of catalysts.	1	Seminar
<b>UNIT III: Organic Chemistry</b>			
	Mechanism of substitution – $S_N^1$ and $S_N^2$ , mechanism of elimination – $E_1$ and $E_2$ . Hofmann and Saytzeff rule.	3	ICT
	Relative reactivity of alkyl halides, Poly halogen derivatives: Halogen derivatives of unsaturated hydrocarbons Halogen compounds of Benzene, reactivity of aryl halides.	9	Lecture
<b>UNIT IV : Organic Chemistry</b>			
	Mechanism of aromatic electrophilic monosubstitution Electrophilic, nucleophilic and free radical substitution	3	ICT
	Organometallic compounds, synthetic applications Tetra ethyl lead, Nucleophilic substitution, benzyne mechanism, free radical substitution in benzene.	9	Lecture

UNIT-V : Inorganic chemistry			
	Group discussion, Lithium: diagonal relationship with magnesium and comparison with other members of the family	3	ICT
	extraction, properties and uses of Lithium compounds Group discussion – Beryllium: Diagonal relationship with aluminium and comparison with magnesium.	7	Lecture, Quiz & Discussion.
	Plaster of Paris, barites, lithopone.	2	Tutorial

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	5	4	3	3	4	4	4	5	3	3	4	4	3	3.79
CO2	4	5	4	3	3	4	4	4	5	3	3	4	4	3	3.79
CO3	4	5	4	3	4	4	4	4	5	3	3	4	4	4	3.92
CO4	4	5	4	3	4	4	4	4	5	3	3	4	4	4	3.92
CO5	4	5	4	3	4	4	4	4	5	3	3	4	4	3	3.86
Mean Overall Score														3.86	

Result: The Score for this Course is 3.86 (High Relationship)

Programme : B.Sc Chemistry  
Semester : I & II

Part III: (Core) Major paper 3  
Hours : 4 /W, 60/S

Sub. Code : PC1

Credits : 4

TITLE OF THE PAPER: PRACTICALS-1  
QUALITATIVE ANALYSIS & ORGANIC PREPARATION

Pedagogy	Hours	Lab session//Demonstration class/Viva voce
	4	4
<b>PREAMBLE: The objective of the course is to make the student analyse the mixture containing two cations and anions and prepare some important organic compounds in the laboratory.</b>		
<b>COURSE OUTCOME</b>		Unit   Hrs

At the end of the Semester, the students will be able to		
<b>UNIT 1 CO1:</b> analyse the mixture containing two cations and two anions.	1	90
<b>UNIT 2 CO2:</b> prepare a few important organic compounds	2	30

### Unit- I :QUALITATIVE ANALYSIS

Analysis of a mixture containing two cations and two anions (one being an interfering radical)

**Acid radicals:** Interfering – oxalate, borate, fluoride, phosphate, chromate

Non-interfering – carbonate, sulphate, nitrate, chloride, bromide.

**Basic radicals:**

I group – lead,

II group – bismuth, copper, cadmium, antimony

III group - Iron, manganese, aluminium, chromium

IV group – cobalt, nickel, manganese, zinc

V group – barium, strontium, calcium

VI group – magnesium and ammonium.

### Unit - II : ORGANIC PREPARATION

Hydrolysis – Ester hydrolysis, Amide hydrolysis

Benzoylation of beta naphthol

Acetylation of an amine

Bromination of acetanilide

Oxidation : Benzoic acid from benzaldehyde

**Internal =40 marks, 40marks = Unit-I-20 + Unit 2 -20 {Preparation 15+Viva-5}**

**External = 60 marks**

**Qualitative analysis –25 marks (acid radicals with correct procedure 10marks+ basic radicals with correct procedure 10 + elimination and original solution preparation - 05)**

**Organic Preparation- 25 marks {Procedure- 5+ Crude Quantity-10+ Recrystallisation-10}**

**Record - 5 marks**

**viva voce - 5 marks**

UNITS	TOPIC	LAB HOURS	MODE OF TEACHING
<b>UNIT 1: QUALITATIVE ANALYSIS</b>			
	Analysis of mixture	75	Lab session
	Analysis of mixture	10	Demonstration
	Analysis of mixture	5	Viva-Voce
<b>UNIT 11: ORGANIC PREPARATION</b>			
	Organic preparation	20	Lab session
	Organic preparation	5	Demonstration
	Organic preparation	5	Viva-Voce

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	5	5	4	5	5	4	4	4	4	4	4	4	4	3	4.21
CO2	5	5	4	5	4	4	4	4	4	4	4	4	4	3	4.14
Mean Overall Score														4.18	

Result: The Score for this Course is 4.18 (Very High Relationship)

**Programme : B.Sc Chemistry**  
**Semester : II**  
**Sub. Code : C22**

**Part III: (Core) Major paper 4**  
**Hours : 4 /W,60 Hrs /S**  
**Credits: 4**

**TITLE OF THE PAPER: GENERAL CHEMISTRY 3**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/ /videos/Demonstration class (Lab / Library session is conducted after the class hours).	ICT
	4	2	1	1

<b>PREAMBLE: The objective of the course is to make the student understand the types of chemical bonds, oxidation reduction, Acids and bases, Solid state, Hydroxy compounds, Ethers sulfur compounds and phosphorous compounds</b>		
<b>COURSE OUTCOME</b>	Unit	Hrs/S
At the end of the Semester, the Students will be able to		
<b>UNIT 1 CO1:</b> demonstrate chemical bonding including ionic, covalent and metallic bonds with suitable examples.	1	12
<b>UNIT 2 CO2:</b> discuss the concepts of oxidation and reduction and the theories of acids and bases.	2	12
<b>UNIT 3 CO3:</b> demonstrate the fundamentals of crystallography and the types of crystals.	3	12
<b>UNIT 4 CO4:</b> discuss the chemistry of alcohols.	4	12
<b>UNIT 5 CO5:</b> discuss the preparation and properties of aliphatic/aromatic ethers and demonstrate the role of free radicals.	5	12

**UNIT-I:(INORGANIC CHEMISTRY)(12 Hrs)****Chemical Bonding**

**Ionic bond** – Introduction, characteristics of Ionic compounds, Lattice energy, Born-Haber cycle

**Covalent bond** – valence bond concept, –  $\sigma$  bonds and  $\pi$  bonds, types of hybridization – illustrations with suitable examples  $sp$ ,  $sp^2$ ,  $sp^3$ ,  $sp^3d^2$  and  $sp^3d^3$  and shapes of molecules VSEPR theory, Shapes of molecules-  $H_2O$ ,  $NH_3$ ,  $PCl_3$ ,  $PCl_5$ ,  $IF_5$  and  $SF_6$ . MO theory. Examples –  $H_2$ ,  $He_2$ ,  $Li_2$ ,  $N_2$ ,  $O_2$ ,  $F_2$ ,  $HF$ ,  $NO$ ,  $CO$  – Bond order.

**Metallic bond:** nature – Band theory – explanation of properties by metallic bond – conductors, insulators, semiconductor and superconductors (conditions and example).

**Hydrogen bond:** Types of hydrogen bond – Conditions for the formation of hydrogen bond – effects of hydrogen bonding.

**Van der Waal's forces:** Types – factors affecting the strength of the Van der Waal's forces – applications.

**UNIT-II : (INORGANIC CHEMISTRY) (12 Hrs)**

**Oxidation – Reduction** – Modern concept – oxidation number – calculation of oxidation number – redox reactions – oxidizing agents – reducing agents – auto-oxidation. Balancing redox equations by oxidation number and ion-electron methods.

**Acids and Bases** – Modern concept of acids and bases – Arrhenius theory – Bronsted and Lowry concept - Lux-Flood concept - Lewis theory and Usanovich concept – leveling effect of water.

**Principles of qualitative analysis:** Solubility principle – Sodium Carbonate extract – elimination principle- complex formation – complexes of Cu, Cd, Ni, Co, Fe, Zn.

**UNIT III:(PHYSICAL CHEMISTRY) (12 Hrs)****SolidState:**

**Crystallography:** Definition – unit cell – face and edge of a crystal - interfacial angle – crystal lattice

**Laws of crystallography:** i) Law of constancy of interfacial angle ii) Law of rationality of indices iii) Law of symmetry – symmetry elements – plane, axis and center of symmetry.

**Crystallographic system** – Bravais lattices – simple cubic, face centered cubic and body centered cubic systems.

**Applications of X-rays** to the study of crystal structure – Bragg's equation - determination of inter-planar distance and wavelength of X-ray.

**Types of crystals:** Ionic, molecular, covalent and metallic crystals.

- i. Ionic crystals: Analysis of NaCl, KCl and CsCl – Determination of Avogadro number
- ii. Molecular crystals: Water and ammonia.
- iii. Covalent crystals: Diamond and Graphite.
- iv. Metallic crystals: geometrical arrangements in metallic crystals –examples.
- v.

**UNIT – IV (ORGANIC CHEMISTRY): (12 Hrs)**

**Hydroxy Compounds:**

**Alcohols:**

Classification according to the number of hydroxy groups and the nature of carbon atom with suitable examples – preparation of primary alcohols by hydroboration method.

Unsaturated monohydric alcohols – Allyl alcohol – preparation and properties.

Estimation of number of hydroxyl groups.

**Phenols:**

Acidity of phenols – substitution reactions of phenol – mechanism of Kolbe's reaction, Reimer-Tiemann reaction – Test for phenol – Estimation of phenol.

Nitrophenol- picric acid – preparation and properties.

Aminophenol – preparation and properties.

Dihydric Phenol – catechol, resorcinol and quinol – preparation and properties.

Trihydric phenol – pyrogallol – preparation and properties.

**Aromatic Alcohol:**

Benzyl alcohol – Preparation and properties of benzyl alcohol - distinction between phenol and benzyl alcohol.

**UNIT – V (ORGANIC CHEMISTRY): (12 Hrs)**

**Ethers:**

**Aliphatic ethers:** classification – preparation, properties – isomerism (metamerism) – estimation of alkoxy groups.

**Aromatic ethers:** Preparation of anisole and phenetole.

**Sulphur Compounds:**

**Thio alcohols** – preparation and properties of ethyl mercaptan.

**Thio ethers** – preparation and properties – mustard gas.

**Aromatic sulphonic acids** – Preparation, properties and uses – saccharin, chloramine –T, dichloramine – T.

**Phosphorus Compounds: Ylides** –preparation, properties – Wittig reaction – examples with mechanism.

**Free Radicals:** Definition – preparation and reactions of short lived and long-lived free radicals– role of free radicals in chain reactions, substitution, addition and rearrangement reactions.

## TEXTBOOKS

1. Text book of Organic Chemistry by P.L.Soni- SultanChand & Sons; 29<sup>th</sup> edition (2012).
2. Sathyaprakash's Modern Inorganic Chemistry by R.D.Madan ; S. Chand Publishing 3<sup>rd</sup> ed. reprint (2016).
3. Principles of Physical Chemistry- Puri, Sharma and Pathania - Vishal Publishing Co.; 46<sup>th</sup> edition (2012).

4. Arimurai Karima Vethiyal by R. Saraswathi, N. Subbulakshmi, R. Santhanalakshmi, N. Vijayathara, M. Thilagavathi, Published by Madurai Kamaraj University, Madurai, 1998.
5. Kanima Vethiyal by L. Anjana, S.K. Santha, R. Santhanalakshmi, R. Saraswathi N. Vijayathara, Sudhasoundirapandian, D.SaralaThambavani, Published by Madurai Kamaraj University, Madurai, 1998.
6. Arimurai Iyarpu Vethiyal by Sudha soundirapandian, & T.R. Visalakshi, Published by Madurai Kamaraj University, Madurai, 1998.

### References

1. Organic Chemistry by Morrison & Boyd, Pearson Publishers, 7<sup>th</sup> edition.
2. Inorganic Chemistry by J. D. Lee, Wiley publishers.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT I: (Inorganic chemistry)</b>			
	Types of hybridisation	2	ICT
	Chemical bonding (Ionic bond, Covalent bond, Metallic bond and Hydrogen bond).	8	Lecture
	Applications of Vander Waals forces and H- bonding	2	Seminar, Assignment
<b>UNIT II (Inorganic chemistry)</b>			
	Redox reactions with examples	2	ICT
	Concepts of acid bases, Principles of qualitative analysis	10	Lecture with interactive discussion.
<b>UNIT III (Physical chemistry)</b>			
	crystallographic systems	2	ICT
	Laws of crystallography and Applications of X-ray to study the crystal systems. Types of crystals	10	Lecture
<b>UNIT IV (Organic chemistry)</b>			
	Study the mechanism of Kolbe's reaction and Reimer-Tiemann reaction.	2	ICT
	Alcohols, phenols and Benzyl alcohol.	9	Lecture
	Distinction between phenols and Benzyl alcohol	1	Quiz
<b>UNIT V (Organic chemistry)</b>			
	Wittig reaction and free radicals	2	ICT
	Preparation and properties of sulphur compounds and phosphorous compounds, preparation of aliphatic & aromatic ethers, estimation of alkoxy groups	9	Lecture

	Preparation of anisole and phenetole, ethyl mercaptan and mustard gas.	1	Tutorial& Assignment.
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course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	3	4	4	3	3	4	5	3	4	4	4	4	3	3.71
CO2	5	4	3	3	4	4	4	4	4	3	3	4	4	4	3.86
CO3	5	3	3	4	4	3	4	3	5	4	4	3	4	4	3.71
CO4	5	4	3	4	3	3	4	4	5	4	4	4	4	3	3.86
CO5	5	5	4	3	3	3	4	4	5	4	4	4	3	4	3.92
Mean Overall Score														3.81	

Result: The Score for this Course is 3.81 (High Relationship)

**Programme : B.Sc Chemistry**  
**Semester : III**  
**Sub. Code : C31**

**Part III: Core, Major paper 5**  
**Hours : 4 /W, 60 Hrs /S**  
**Credits: 4**

**TITLE OF THE PAPER: GENERAL CHEMISTRY – 4**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class (Lab / Library session is conducted after the class hours).	ICT	
	4	2	1	1	
<b>PREAMBLE: The objective of the course is to make the student understand the importance of aliphatic and aromatic carbonyl compounds, their preparations and properties along with mechanisms, the principles and theory behind volumetric analysis, different phase transitions and fundamentals of quantum mechanics.</b>					
<b>COURSE OUTCOME</b>				Unit	Hrs/S
At the end of the Semester, the students will be able to					
<b>UNIT 1 CO1:</b> demonstrate the chemistry of aliphatic aldehydes and ketones.				1	12
<b>UNIT 2 CO2:</b> demonstrate the chemistry of aromatic aldehydes and ketones.				2	12
<b>UNIT 3 CO3:</b> explain the theory behind the volumetric analysis and perform calculations based on it.				3	12
<b>UNIT 4 CO4:</b> explain phase rule, construct phase diagram to represent and interpret heterogeneous phase equilibrium as a function of pressure and temperature.				4	12
<b>UNIT 5 CO5:</b> demonstrate the fundamentals of quantum mechanics.				5	12

**Unit I: ORGANIC CHEMISTRY****(12 Hrs)*****Aliphatic aldehydes and ketones:***

Chemical reactivity of carbonyl group – mechanism of important carbonyl addition and condensation of aldehydes and ketones - nucleophilic addition reactions – relative reactivities of aldehydes and ketones – acidity of hydrogen atom in carbonyl compounds. Difference in properties between acetone and ethyl methyl ketone.

Unsaturated aldehyde: Acrolein, crotonaldehyde – preparation and properties.

Halogen substituted aldehyde: chloral – preparation, properties and structure.

Hydroxy aldehyde and ketones: Glycolaldehyde – aldol – hydroxy acetone and diacetone alcohol – preparation and properties.

Dialdehyde and diketones: Glyoxal, succinaldehyde, dimethyl glyoxal, acetyl acetone and acetyl acetone – preparation and properties.

**Unit-II: ORGANIC CHEMISTRY****(12 Hrs)*****Aromatic aldehydes and ketones:***

Benzaldehyde: Mechanism of Cannizzaro's, Perkin, Claisen, Knoevenagel reactions and benzoin condensation.

Unsaturated aldehyde: Cinnamaldehyde – preparation and properties.

Phenolic aldehyde: salicylaldehyde and Vanillin – preparation and properties.

Ketones: Acetophenone, benzophenone – preparation by Friedel Craft's acylation – properties – comparison and reactivities, phenacyl chloride.

Diketones: o & p-benzoquinones – preparation and properties.

Phenolic ketones: phloracetophenone – preparation by Houben-Hoesch synthesis.

**Unit III – ANALYTICAL CHEMISTRY****(12 Hrs)****Principles of Volumetric analysis:**

Expression of concentrations of a solution

Calculation of equivalent weight for various substances involved in volumetric analysis.

Classification of reactions in titrimetric analysis.

Primary and secondary standards: selection of primary standards.

Principle involved in acid-base, precipitation and complexometric titrations [EDTA titrations].

Indicators: Theory of indicators – choice of indicators – use of titration curves for the proper choice of indicators in acid-base titration – calculation of pH during and at the end of the titration - determination of end points in precipitation and complexometric titrations – metal ion – adsorption and fluorescence indicators.

#### **Unit-IV: PHYSICAL CHEMISTRY**

**(12 Hrs)**

##### ***Phase Rule:***

**Statement and significance of the terms involved** – thermodynamic derivation of phase rule.

One-component system – water, sulphur and carbon dioxide.

Two-component system – Ag-Pb system and Bi-Cd system

Condensed systems and reduced phase rule: reduced phase rule – statement and reasons.

Solids in solid: Simple eutectic with suitable examples - Compound formation with congruent [Zn-Mg system and Sn-Mg system] and incongruent melting points [sodium – potassium system] with suitable examples.

Two components systems involving salt and water: Simple eutectic systems: sodium chloride – water system and KI – water system – Principle of freezing mixtures - Compound formation with congruent melting point – ferric chloride-water system and sodium sulphate-water system.

Salt hydrates: Efflorescence, deliquescence and hygroscopic – dehydration of copper sulphate crystal – Transition temperature.

#### **Unit-V: PHYSICAL CHEMISTRY**

**(12 Hrs)**

***Quantum Mechanics*** - Particle and wave character of electron – de Broglie's theory – equation – Davisson-Germer experiment – photoelectric effect – Compton Effect – Heisenberg's uncertainty principle. The Schrodinger wave equation – derivation – postulates of quantum theory – Eigen values and eigen functions – significance of  $\psi$  and  $\psi^2$  – solutions of Schrödinger wave equation – particle in one-dimensional box – atomic orbital, Probability distribution curves – radial probability distributions – shapes of orbitals – representation of angular and radial parts – nodal planes and spheres – 'g' & 'u' character.

#### **TEXT BOOKS**

1. Text book of Organic Chemistry by P.L.Soni- SultanChand & Sons; 29<sup>th</sup> edition (2012).
2. Principles of Physical Chemistry- Puri, Sharma and Pathania - Vishal Publishing Co.; 46<sup>th</sup> edition (2012).
3. Arimurai Karima Vethiyal by R. Saraswathi, N. Subbulakshmi, R.Santhanalakshmi, N. Vijayathara, M.Thilagavathi, Published by Madurai Kamaraj University, Madurai, 1998.
4. ArimuraiIyarpuVethiyal by Sudha soundirapandian, & T.R. Visalakshi, Published by Madurai Kamaraj University, Madurai, 1998.
5. Elements of Analytical chemistry -R.Gopalan, P.S.Subramanian and K.Rangarajan,Sultan Chand and Sons (2004).

#### **References**

1. Inorganic qualitative Analysis by Vogel.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT I: ORGANIC CHEMISTRY: ALIPHATIC ALDEHYDES AND KETONES</b>			
	Chemical reactivity of carbonyl group – mechanism of important carbonyl addition and condensation of aldehydes and ketones - nucleophilic addition reactions	3	Lecture
	Relative reactivities of aldehydes and ketones – acidity of hydrogen atom in carbonyl compounds. Difference in properties between acetone and ethyl methyl ketone.	2	ICT
	Preparation and properties of acrolein, crotonaldehyde and chloral	2	Seminar& Peer teaching
	Preparation and properties of : Glycolaldehyde – aldol – hydroxy acetone and diacetone alcohol	2	Lecture & Assignment
	Preparation and properties of glyoxal, succinaldehyde, dimethyl glyoxal, acetyl acetone and acetyl acetone	3	Lecture& tutorial.
<b>UNIT II: ORGANIC CHEMISTRY : AROMATIC ALDEHYDES AND KETONES</b>			
	Benzaldehyde: Mechanism of Cannizzaro's, Perkin and Claisen reactions	3	ICT
	Mechanism of Knoevenagel reactions and benzoin condensation. Preparation and properties of Cinnamaldehyde, salicylaldehyde and Vanillin, Preparation and properties of o & p-benzoquinones, preparation of phloracetophenone by Houben-Hoesch synthesis. Preparation and properties of Acetophenone and benzophenone by Friedel Craft's acylation comparison and reactivities, phenacyl chloride.	8	Lecture
	Preparation and properties of o & p-benzoquinones, preparation of phloracetophenone by Houben-Hoesch synthesis	1	Tutorial / Assignment
<b>UNIT III: ANALYTICAL CHEMISTRY: PRINCIPLES OF VOLUMETRIC ANALYSIS</b>			
	Expression of concentrations of a solution, Calculation of equivalent weight for various substances involved in volumetric analysis	3	Lecture Quiz&problem solving
	Classification of reactions in titrimetric analysis, Primary and secondary standards: selection of primary standards Principles involved in acid-base, precipitation and complexometric titrations [EDTA titrations].	5	Lecture
	Indicators: Theory of indicators – choice of indicators, use of titration curves for the proper choice of indicators in acid-base titration	2	ICT
	calculation of pH during and at the end of the titration - determination of end points in precipitation and complexometric titrations – metal ion – adsorption and fluorescence indicators	2	Seminar/ Group discussion

<b>UNIT IV: PHYSICAL CHEMISTRY: PHASE RULE</b>			
	Statement and significance of the terms involved – thermodynamic derivation of phase rule. One-component systems – water and carbon dioxide	3	Lecture
	Phase diagram of Sulphur and Ag-Pb system and Bi-Cd system	1	chart preparation
	Phase diagram of Sulphur and Ag-Pb system and Bi-Cd system. Condensed systems and reduced phase rule, Solids in solid: Simple eutectic with suitable examples. Two components systems involving salt and water: sodium chloride – water system, KI – water system, ferric chloride-water system and sodium sulphate-water system.	5	Lecture
	Compound formation with congruent [Zn-Mg system and Sn-Mg system] and incongruent melting points [sodium – potassium system]	2	ICT
	Salt hydrates: Efflorescence, deliquescence and hygroscopic – dehydration of copper sulphate crystal – Transition temperature	1	Peer teaching/ tutorial
<b>UNIT V: PHYSICAL CHEMISTRY: QUANTUM MECHANICS</b>			
	Particle and wave character of electron – de Broglie's theory – equation – Davisson-Germer experiment	3	Lecture
	Photoelectric effect, Compton effect, Heisenberg's uncertainty principle.	1	Group discussion
	The Schrodinger wave equation – derivation, significance of $\psi$ and $\psi^2$ , postulates of quantum theory – Eigen values and eigen functions. Particle in one-dimensional box – atomic orbitals Probability distribution curves – radial probability distributions, representation of angular and radial parts.	6	Lecture
	Shapes of orbitals, nodal planes and spheres – 'g' & 'u' character	2	ICT

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	4	5	3	2	3	3	3	5	4	2	3	3	4	3.42
CO2	4	5	4	4	3	3	3	3	5	4	3	4	3	4	3.71
CO3	4	5	4	5	4	3	3	4	4	5	5	3	3	3	3.92
CO4	4	4	3	4	4	3	3	3	4	3	3	3	3	3	3.36
CO5	5	5	3	3	3	3	3	3	5	4	3	4	3	4	3.64
Mean Overall Score															3.61

Result: The Score for this Course is 3.61 (High Relationship)

Programme : B.Sc Chemistry  
Semester : III & IV  
Sub. Code : C41

Part III: (Core) Major paper 6  
Hours : 2 /W, 60 Hrs /two Sem  
Credits: 4

**TITLE OF THE PAPER: APPLIED CHEMISTRY**

Pedagogy	Hours	Lecture	Peer Teaching/ Role play Seminar/Discussion/Tutorial/Problem Solving session/Quiz/Videos/ Demonstration class(Lab / Library session is conducted after the class hours).	ICT	
	5	3	1	1	
<b>PREAMBLE: The objective of the course is to understand the different types of fuels and its uses, fire prevention, preparation of organic dyes, photographic process, basic clinical tests, chemotherapy and to know about insecticides, fertilizers, construction chemistry and oils, fats, soaps and detergent.</b>					
<b>COURSE OUTCOME</b>				Unit	Hrs
At the end of the Semester, the Students will be able to					
<b>UNIT 1 CO1:</b> demonstrate the knowledge about fuels and fire prevention				1	12
<b>UNIT 2 CO2:</b> discuss the preparation and uses of various dyes and process involved in photography.				2	12
<b>UNIT 3 CO3:</b> demonstrate the clinical tests for detection of sugar in serum & urine and cholesterol in blood, estimation of hemoglobin and the various chemotherapeutic drugs and their uses.				3	12
<b>UNIT 4 CO4:</b> discuss the classification of insecticides, fungicides, pesticides and fertilizers and their applications and explain the chemistry behind setting of cements and paints and discuss about PVC, varnishes and refractories.				4	12
<b>UNIT 5 CO5:</b> discuss the manufacturing process of soya bean oil, candles, soaps, shampoo and understand the classification of detergents.				5	12

**Unit – I (12 hours)**

**Fuels:** Definition - requirements of a good fuel – classification – characteristics of fuels – properties – ignition temperature – calorific value – units of heat – solid fuels (wood, coal) - liquid fuels – mining of petroleum and its fractional distillation – knocking, octane number, antiknocking agents, unleaded petrol – kerosene, alcohol - merits and demerits of liquid fuels, gaseous fuels – advantages and disadvantages of gaseous fuels - (LPG, Gobar gas, producer gas, water gas)

**Fire prevention:** and protection in homes: Major causes of fire in homes, types of fire protection and fire fighting in homes, methods of extinguishing fire, chemical fire extinguisher, their relative merits and demerits.

**Unit – II (12 hours)**

**Organic Dyes:** Definition – theory of colour and constitution – classification of dyes according to structure and applications:

- Azo dyes: Preparation of methyl orange, Congo red and Bismark brown.
- Triphenyl methane dyes: Preparation of malachite green, rosaniline and crystal violet.
- Phthalein dyes: phenolphthalein, fluorescein and eosin – preparation and uses.
- Vat dyes: preparation and structure of indigo.
- Anthraquinone dye: preparation and structure of alizarin.

**Photography:** Photographic process – preparation of sensitive plates – exposure – developing – fixing – printing – toning – colour photography.

**Unit – III (12 hours)****Clinical Chemistry:**

Diagnostic test for cholesterol in serum and urine – standard value of cholesterol – heart diseases.

Diagnostic test for sugar in serum and urine – standard value of sugar- Benedict's test for glucose – Glucose Tolerance test – hypoglycemia and diabetes.

Estimation of hemoglobin – standard value – anaemia

**Chemotherapy:** (Elementary study only – structure elucidations not included) – sulpha drugs (sulphanilamide, sulphadiazine, prontosil) – antimalarials (quinine, plasmoquin) – arsenical drugs (salvarsan, seosalvarsan) – antibiotics: definition – penicillin, Streptomycin, Tetracyclin, chloromycetin – structure and uses – antipyretics and analgesics, anaesthetics, tranquilisers, sedatives.

**Unit – IV (12 hours)**

**Insecticides, fungicides and pesticides:** Definition – classification according to method of application and actions – DDT, BHC, Lead arsenate, Bordeaux mixture and dithiocarbamate.

**Fertilizers:** Definition – nutrients for plants – role of various elements in plant growth - natural and chemical fertilizers – classification of chemical fertilizers -urea – super phosphate and potassium nitrate – mixed fertilizers – fertilizer industry in India.

**Construction chemistry**

Cement: Composition-chemistry of setting – Concrete – Reinforced concrete – (Manufacture of cement not necessary)

Paints: Definition, Classification, constituents – setting of paints, requirements of good paint.

PVC – Significance of PVC.

Varnishes: Definition – Types – Raw materials.

Refractories – Definition – Chemical Classification – Fire Clay bricks, Properties and uses of Fire Clay bricks

### Unit V (12 hours)- Oils, Fats, Waxes, Soaps and Detergents

Introduction – Distinction between oils and fats

Vegetable oil: Manufacture of Soya bean oil by solvent Extraction Method

Animal fats and oil – processing of animal fats and oil

Waxes – classification – Manufacture of candles.

Soaps: Manufacture of Soaps (Continuous process) – Toilet and transparent soaps ((Manufacture not necessary)

Detergents: Principal groups of detergents – Classification of surface active agents –anionic detergents - Cationic detergents – andnon-ionic detergents- aggregation and Preparation and manufacture of Shampoo.

### TEXT BOOKS

1. Ancillary Chemistry for Home science students by Thankamma Jacob.
2. Text book of Organic Chemistry by P.L.Soni- SultanChand & Sons; 29<sup>th</sup> edition (2012).
3. Fundamentals of Biochemistry for medical students by Ambika Shunmugam ;Wolters Kluwer; 8<sup>th</sup> edition.
4. Text Book of Biochemistry for medical students by D.M.Vasudeva and S.Sreekumari ; Jaypee Brothers Medical Publishers; 8<sup>th</sup> edition.

### References:

1. Pharmaceutical Chemistry by Dr.S.Lakshmi
2. Industrial Chemistry by B.K.Sharma; Krishna Prakashan Media (P) Ltd. (2011)
3. Engineering Chemistry by S.S.Dara;S. Chand & Company

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1:			
	Various types of fuels and their Characteristics, merits and demerits. Calorific value, ignition temperature, Knocking, octane number, Antiknocking agents, unleaded petrol, Composition and uses of LPG, gobar gas, producer gas and water gas.	9	Lecture
	Fire prevention at home, methods of extinguishing fires	2	ICT
	Fire prevention at home, methods of extinguishing fires	1	Role play
UNIT II			
	Theory of colour and constituents, Preparation and uses of azo, triphenyl methane dyes	6	Lecture
	Classification of dyes	1	Seminar
	Preparation and uses of Phthalein, vat and anthraquinone dyes	2	Lecture & Demonstration
	Photographic process	3	ICT
UNIT III			

	Diagnostic test for cholesterol in serum and urine Diagnostic test for sugar in serum and urine	2	ICT& Lab session.
	Glucose tolerance test	1	Discussion
	Estimation of hemoglobin and anemia Chemotherapeutic drugs- sulpha drugs,arsenical drugs, antibiotics, antimalarials, antipyretics, anesthetics, analgesics, sedatives.	9	Lecture
UNIT IV			
	Definition and classification of insecticides, fungicides, pesticides.DDT,BHC, lead arsenate, Bordeaux mixture, dithiocarbonate.	3	Seminar / Assignment
	Nutrients for plants, role of various elements in plant growth, chemistry of setting of cement.	2	ICT
	Classification of chemical fertilizers. Urea, super phosph Classification of paints, setting of paints, requirement of good paint. PVC. Varnishes- types, raw materials. Refractories – Classification, Properties and uses of fire claybricks.ate, potassium nitrate. Fertilizer industry in India.	6	Lecture
	Cement composition, concrete and reinforced concrete.	1	Lecture &Discussion
UNIT V			
	Difference between oils and fats. Manufacturing process of soyabean oil, candles, soaps, shampoo	10	ICT with Lecture and Discussion
	Classification of detergents	2	Peer teaching / Assignment

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	4	4	4	3	3	5	3	4	2	4	4	4	3	3.64
CO2	5	4	3	4	4	5	5	5	4	4	4	4	4	4	4.21
CO3	4	4	4	4	4	5	5	4	4	5	4	4	3	3	4.07
CO4	4	4	3	4	3	4	3	3	4	4	5	4	4	3	3.71
CO5	4	3	4	4	4	3	4	5	4	4	4	3	4	4	3.85
Mean Overall Score															3.89

Result: The Score for this Course is 3.89 (High Relationship)

**Programme :B.Sc Chemistry**  
**Semester : III & IV**

**Part III: (Core) Major Paper 7**  
**Hours: 4 / W, 60 / S**

**4 hours in III semester and 4 hours in IV semester**  
**Sub. Code : PC2**

**Credits : 4**

**TITLE OF THE PAPER:**

**PRACTICAL – 2 VOLUMETRIC ANALYSIS AND ORGANIC ESTIMATION**

Pedagogy	Hours	Lab session//Demonstration class/Viva voce
	4	4
<b>PREAMBLE: The objective of the course is to make the student to prepare standard solution, estimate the given inorganic/ organic solution using suitable standard and link solution and to understand the theory behind the practical classes involved.</b>		
<b>COURSE OUTCOME</b>		Unit
At the end of the Semester, the students will be able to		Hrs
<b>UNIT 1 CO1:</b> estimate the given inorganic solution, volumetrically		1
<b>UNIT 2 CO2:</b> estimate the given organic solution, volumetrically		2
		80
		40

**Unit –I : VOLUMETRIC ANALYSIS**

A double titration involving the making up of the solution to be estimated and the preparation of a primary standard.

**Acidimetry and alkalimetry: titrations**

Acids used: hydrochloric acid, sulphuric acid and oxalic acid  
 Bases used: sodium carbonate, sodium hydroxide.  
 Standard solutions prepared: sodium carbonate and oxalic acid.

**Oxidation and reduction titrations**

Oxidising agents: Potassium permanganate (permanganometry)  
 Reducing agents: ferrous sulphate, ferrous ammonium sulphate, oxalic acid  
 Standard solutions prepared: ferrous sulphate, ferrous ammonium sulphate and oxalic acid  
 Iodimetry titrations  
 Titrations of liberated iodine against sodium thiosulphate using acidified potassium

permanganate, potassium dichromate and copper sulphate solutions.  
 Standard solutions: potassium dichromate, copper sulphate.  
 Arsenious oxide against iodine solution.

### Unit – II : ORGANIC ESTIMATION

Estimation of aniline  
 Estimation of phenol  
 Estimation of glucose(Lane Eynon Method-Demo only)

**Internal =40 (unit I -20+ Unit II – 20]**

**External = 60 mark**

**Volumetric analysis–25 marks (procedure–8,exp–17, 1% -17, 2% - 15, 3% - 13 4%-10, above 4% - 7 )**

**Organic estimation -25 marks(procedure-8,exp- 17, 2% -17, 3% - 15, 4% - 13 above 4% - 7)**

**Viva voce - 5 marks,**

**Record - 5 marks.**

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT 1: VOLUMETRIC ANALYSIS</b>			
	Volumetric Estimation	60	Lab session
	Volumetric Estimation	10	Demonstration
	Volumetric Estimation	10	Viva-Voce
<b>UNIT 11: ORGANIC ESTIMATION</b>			
	Organic Estimation	30	Lab session
	Organic Estimation	6	Demonstration
	Organic Estimation	4	Viva-Voce

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	5	5	4	5	4	4	4	4	4	5	4	3	4	3	4.14
CO2	5	5	4	5	4	4	4	4	4	4	4	3	4	3	4.07
Mean Overall Score															4.11

Result: The Score for this Course is 4.11 (Very High Relationship)

Programme : B.Sc Chemistry  
Semester : IV  
Sub. Code : C42

Part III: (Core) Major paper -8  
Hours : 4 / W, 60 Hrs /S  
Credits: 4

**TITLE OF THE PAPER: PHYSICAL AND INORGANIC CHEMISTRY**

Pedagogy	Hours	Lecture	PeerTeaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class /(Lab / Library session is conducted after the class hours).	ICT	
	4	2	1	1	
<b>PREAMBLE: The objective of the course is to educate the students about the importance of nuclear chemistry and radioactivity, provide the scientific knowledge about solutions and distribution law, understand the chemistry of important compounds of Group IIIA, IVA and VA elements</b>					
<b>COURSE OUTCOME</b>				Unit	Hrs /S
At the end of the Semester, the students will be able to					
<b>UNIT 1 CO1:</b> describe the fundamental issues in nuclear chemistry, explain the different kinds of radioactive decay and calculate kinetic parameters related to it.				1	12
<b>UNIT 2 CO2:</b> identify and define various types of nuclear transmutation including fission, fusion reactions, and explain the fundamental concepts involved in nuclear weapons				2	12
<b>UNIT 3 CO3:</b> recognize the binary solutions and the types of distillation to purify those binary liquids, illustrate the laws governing the distribution of solute between two immiscible solvents				3	12
<b>UNIT 4 CO4:</b> discuss the periodic trends in group IIIA and IVA, preparation and properties of industrially important compounds				4	12
<b>UNIT 5 CO5:</b> discuss the preparation properties and uses of compounds of group VA elements				5	12

**Unit – I: PHYSICAL CHEMISTRY**

**(12 Hrs)**

***Nuclear Chemistry:***

Nuclear spin and magnetic moments – ortho and para states of molecules with hydrogen as an example.

Constitution of the nucleus: stable and unstable nuclei and their relationship. n-p ratio – magic number – mass defect and binding energy – whole number rule and packing fraction – mass energy relationships – shell model and liquid drop model.

***Radioactivity:***

Theory of radioactivity – laws of radioactivity – Soddy's Group Displacement law. Radioactive equilibrium – rate of radioactive disintegration – half-life period – average life. Radioactive

series – mode of decay – alpha, beta and gamma particle emissions - orbital electron capture – nuclear isomers and internal conversion.

## Unit – II: PHYSICAL CHEMISTRY

(12 Hrs)

### **Radioactivity:**

**Artificial radioactivity:** Definition – different types of artificial radioactivity brought about by accelerated particles.

**Artificial transmutation:** of atoms by projectiles- spallation.

**Nuclear fission and fusion:** Theories of fission – application of fission and the principle of atom bomb – nuclear reactors – nuclear fusion and emission of energy – stellar energy and hydrogen bomb.

**Application of radioactivity:** radioactive isotopes as tracer elements - applications in medicine , agriculture and industry –in the elucidation of structure and in the investigation of reaction mechanisms in analytical chemistry – activation analysis – carbon dating.

**Particle accelerators:** Linear accelerators – cyclotron and synchrotron

## Unit – III: PHYSICAL CHEMISTRY

(12 Hrs)

### **Solutions:**

**Gases in liquid** –Bunsen adsorption coefficient – solubility – factors affecting the solubility of gas in a liquid – Henry’s law and its applications – deviations from Henry’s law.

**Liquids in liquids:** i) completely miscible liquid system: ideal and non-ideal systems – Raoult’s law and Konowalaff’s rule – distillation of homogeneous binary liquid mixtures - theory of fractional distillation - azeotropes and azeotropic distillation.

ii) Partially miscible liquid systems: Variation of solubility with temperature – critical solution temperature (consolute temperature) – lower, upper, lower and upper critical solution temperature – influence of impurities on CST and application.

iii) Immiscible liquid systems: Theory of steam distillation and its applications.

### **Distribution Law:**

Statement – mathematical formulation – experimental verification – conditions under which the distribution law is obeyed – deviations from distribution law- derivation from the kinetic theory and application of the law of solvent extraction.

## Unit IV: INORGANIC CHEMISTRY

(12 Hrs)

**Group 3/III A elements:** Group discussion – Diagonal relationship between boron and silicon – comparison of boron and aluminium – Isolation of boron – borax, diborane, boron nitride – preparation, properties, structure.

**Group 4 /IVA:** Group discussion

**Carbides** – General methods of preparation, properties; classification with examples– uses and structure of calcium carbide, boron carbide and silicon carbide

**Silicates:**Structure and types of silicates –orthosilicates, pyrosilicates, chain silicates, cyclic or ring silicates, sheet silicates, feldspars, zeolites and ultramarines.

## Unit V: INORGANIC CHEMISTRY

(12 Hrs)

### **Group 5 / VA elements:**

Group discussion

Extraction of Arsenic

Arsine and stilbene – comparisonof their properties with ammonia and phosphine

Preparation, properties and uses of the following compounds: hydrazine, hydroxylamine, hydrazoic acid, tartar emetic and sodium bismuthate.

Nitrides – general methods of preparation, properties, classification with examples – uses and structure.

Volumetric estimation of  $As_2O_3$ .

### TEXT BOOKS

1. Principles of Physical Chemistry- Puri, Sharma and Pathania - Vishal Publishing Co.; 46<sup>th</sup> edition
2. Advanced Inorganic Chemistry by Tuli, Basu and Madan, S.Chand publishing; 19<sup>th</sup> edition.
3. Arimurai Iyarpu Vethiyal by Sudha soundirapandian, & T.R. Visalakshi, Published by Madurai Kamaraj University, Madurai, 1998.
4. Kanima Vethiyal by L. Anjana, S.K. Santha, R. Santhanalakshmi, R. Saraswathi N. Vijayathara, Sudhasoundirapandian, D.SaralaThambavani, Published by Madurai Kamaraj University, Madurai, 1998.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT I : PHYSICAL CHEMISTRY: NUCLEAR CHEMISTRY</b>			
	Nuclear spin and magnetic moments – ortho and para states of molecules with hydrogen as an example. Constitution of the nucleus: stable and unstable nuclei and their relationship	2	ICT
	n-p ratio, magic number, mass defect and binding energy mass energy relationships, whole number rule and packing fraction	2	Lecture
	Shell model and liquid drop model.	2	Lecture
	Theory of radioactivity – laws of radioactivity – Soddy's Group Displacement law.	2	Lecture
	Rate of radioactive disintegration, half-life period, average life and Radioactive equilibrium	2	problem solving
	Radioactive series, orbital electron capture, nuclear isomers and internal conversion.	2	Lecture
<b>UNIT II: PHYSICAL CHEMISTRY: ARTIFICIAL RADIOACTIVITY</b>			
	Theories of Nuclear fission and fusion: principle of atom bomb – nuclear reactors, stellar energy and hydrogen bomb Artificial radioactivity: Definition, types of artificial radioactivity brought about by accelerated particles, spallation. Application of radioactivity in the elucidation of structure	6	Lecture
	Application of radioactivity: radioactive isotopes as tracer elements - applications in medicine, agriculture and industry, carbon dating	2	Peer teaching / Lecture
	Application of radioactivity in the investigation of reaction mechanisms in analytical chemistry	2	Lecture
	Particle accelerators: cyclotron and synchrotron	2	ICT
<b>UNIT III: PHYSICAL CHEMISTRY: SOLUTIONS</b>			



CO1	5	5	4	3	4	3	3	3	5	4	4	5	3	3	3.17
CO2	4	4	5	3	5	4	3	3	5	4	4	5	3	3	3.23
CO3	4	5	4	5	4	4	4	4	5	5	5	4	4	4	3.58
CO4	4	4	3	3	4	4	3	3	4	4	3	4	3	3	3.50
CO5	4	4	3	3	4	3	3	4	3	3	3	4	3	4	3.43
Mean Overall Score															3.38

Result: The Score for this Course is 3.38 (High Relationship)

**Programme : B.Sc Chemistry**  
**Semester : V**  
**Sub. Code : C51**

**Part III: Core, Major paper 9**  
**Hours : 5 /W, 75/S**  
**Credits : 5**

**TITLE OF THE PAPER: ORGANIC CHEMISTRY- 1**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/roleplay/ Discussion/Tutorial/Problem solving session/Quiz/Videos/ Demonstration Class(Lab / Library session is conducted after the class hours).	ICT
	5	3	1	1

**PREAMBLE:** The objective of the course is making the student understand and learn the stereochemistry of organic compounds, Chemistry of Carbohydrates, estimation methods of glucose, aliphatic and aromatic nitrogen containing compounds, aliphatic and aromatic acids, Chemistry of Alicyclic compounds and conformational analysis of simple aliphatic and alicyclic compounds.

<b>COURSE OUTCOME</b> At the end of Semester V, the students will be able to demonstrate thorough and clear knowledge of the following given below.	<b>Unit</b>	<b>Hrs /S</b>
<b>Unit 1 CO1:</b> Stereochemistry of organic compounds	1	15
<b>Unit 2 CO2:</b> Chemistry of Carbohydrates	2	15
<b>Unit 3 CO3:</b> Chemistry of Aliphatic and Aromatic Nitrogen compounds	3	15
<b>Unit 4 CO4:</b> Chemistry of Aliphatic and Aromatic Carboxylic acids	4	15
<b>Unit 5 CO5:</b> Chemistry of Alicyclic compounds and Conformational analysis of Acyclic and Cyclic systems	5	15

**Unit – I (15 hrs)**

**Isomerism:****Stereoisomerism:**

**Geometrical isomerism** - definition - geometrical isomerism of maleic and fumaric acids – aldoximes and ketoximes – determination of configuration of geometrical isomers – E-Z notations, Beckmann transformations

**Optical isomerism:**

- i) **optical activity** – specific rotation and its polarimetric determination – definition of optical isomerism – elements of symmetry.
- ii) Optical isomerism of compounds containing asymmetric carbon atom – lactic and tartaric acids, enantiomers and diastereo isomers – racemic and mesoforms – racemisation and resolution of racemic mixtures, Walden inversion – asymmetric synthesis, chirality – specifications of absolute configuration by R and S notations using Cahn-Ingold and Prelog nomenclature.
- iii) **Optical activity of compounds without asymmetric carbon atoms:** allenes, spiranes and biphenyl compounds.
- iv) **Optical activity of compounds containing elements other than carbon atoms [Nitrogen]:** quaternary ammonium compounds and tertiary amine oxides.
- v) **Stereospecific addition** to double and triple bonds – definition of stereospecific and stereoselective reactions – addition of Br<sub>2</sub> to E and Z Butene-2

**Unit – II: (15 hrs)****Carbohydrates:**

**Monosaccharides:** Introduction and classification of carbohydrates and chemistry of monosaccharides-glucose and fructose, reducing and non-reducing sugars – structure and configuration – mutarotation and epimerisation – interconversion of glucose and fructose – methods of descending and ascending sugar series – estimation of glucose by Lane Eynon method and Bertrand's method.

**Disaccharides:** structure and properties of sucrose

**Polysaccharides:** structure of starch and cellulose [structural discussion not needed]– applications of cellulose derivatives.

**Unit – III: (15 hrs)****Nitrogen Compounds:**

**Aliphatic nitrogen compounds:** cyanides and isocyanides – general methods of preparation, properties – distinction between ethyl cyanide and isocyanide

**Alkyl nitrites and nitro alkanes:** General methods of preparation and properties, distinction between ethyl nitrite and nitroethane.

**Aliphatic diazo compounds-** preparation, properties and structure of diazomethane and diazoacetic ester.

**Derivatives of carbonic acids:** Manufacture, properties, structure and uses of urea. Estimation of urea.

**Aromatic nitro compounds:** preparation and properties of nitro Toluene. Reduction products of nitrobenzene – TNT and TNB.

**Aromatic amino compounds:** Effect of substituents on the basic character of aromatic amino compounds. Preparation and properties of isomers of toluidines. Estimation of aniline.

Diazotization - preparation and synthetic uses of Benzene diazonium chloride.

**Unit – IV(15 hrs)*****Aliphatic acids:***

**Monocarboxylic acid:** General methods of preparation and properties of monocarboxylic acids. Resonance of carboxylate ion.

Effect of substituents on acidity – Inductive effect.

**Halogen substituted acids:** preparation, properties of mono chloro acetic acid –di and trichloro acetic acids – HVZ reaction mechanism - overall reactivity of halogen atom and the influence of halogen atom on the strength of acids.

**Hydroxy acids:** General methods of preparation and properties of hydroxy acids – glycollic, lactic and tartaric acids. Action of heat on  $\alpha$ ,  $\beta$ ,  $\gamma$  and  $\delta$  hydroxy acids.

**Aldehydic and ketonic acids:** Preparation and properties of glyoxalic acid, pyruvic acid.

**Dicarboxylic acids:** Preparation and properties – action of heat on dicarboxylic acids - Blanc's rule. Preparation and properties of maleic and fumaric acids.

**Active methylene compounds:** Ethyl acetoacetate and diethyl malonate.

***Aromatic acids:***

**Benzoic and toluic acids,** effect of substituents on acidic character.

**Substituted benzoic acid** – salicylic acid and anthranilic acid – preparation and properties.

**Dicarboxylic acids:** Preparation and properties of phthalic acid – derivatives of phthalic acid – phthalic anhydride and phthalimide – NBS – preparation and uses.

**Side chain carboxylic acid:** preparation, properties of phenyl acetic acid. Mandelic acid, cinnamic acid – coumarin.

**Unit – V(15hrs)*****Alicyclic compounds:***

**General methods of preparation, properties of cycloparaffins** - Baeyer's strain theory and its modification.

**Conformation** – definition – differences between conformation and configuration - Fischer's plane projection formula, Newmann projection formula and Saw horse formula of ethane, Butane, 1,2-dichloro ethane, cyclohexane and mono substituted cyclohexane.

**TEXT BOOKS**

1. Text book of Organic Chemistry by P.L.Soni-SultanChand & Sons; 29<sup>th</sup> edition (2012)
2. Advanced Organic Chemistry by B.S.Bahl and Arun Bahl ; S. Chand Publishing 20<sup>th</sup> edition
3. Organic Chemistry by Morrison and Boyd; Pearson Education India; 7<sup>th</sup> edition (2010)
4. Organic Chemistry Vol. 1 by I. L. Finar; Pearson Education India; 6<sup>th</sup> edition (2002)
5. Arimurai Karima Vethiyal by R. Saraswathi, N. Subbulakshmi, R. Santhanalakshmi, N. Vijayathara, M. Thilagavathi, Published by Madurai Kamaraj University, Madurai, 1998.

**References**

1. Stereochemistry, Conformation and mechanism by P S Kalsi, 8<sup>th</sup> edition (2015)
2. Modern Organic Chemistry by M K Jain and S C Sharma, 4<sup>th</sup> edition (2014).

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT 1: Stereoisomerism</b>			
	Definition and Classification of stereoisomerism and elements of symmetry	3	ICT
	Enantiomers, Diastereoisomers, Racemisation, Resolution, Walden Inversion, Asymmetric Synthesis and Stereospecific addition to double and triple bonds	9	Lecture
	Allenes, Spiranes, Biphenyl compounds, Quaternary ammonium compounds and tertiary amine oxides	2	Seminar, Tutorial and Assignment
	Assignment of E/Z nomenclature for alkenes and syn/anti nomenclature for oximes and R/S configuration with examples	1	Problem solving with the aid of teacher.
<b>UNIT II Carbohydrates</b>			
<b>Monosaccharides</b>	Study of Glucose and Fructose - Structure and Configuration, Concept of Mutarotation and Epimerisation Interconversion of Glucose and Fructose Methods of Descending and Ascending Sugar series. Estimation of Glucose by Lane Eynon and Bertrand's method.	11	Lecture, Demonstration class, ICT, Videos & Problem Solving
<b>Disaccharides</b>	Structure and Properties of Sucrose	2	Lecture & videos
<b>Polysaccharides</b>	Structure of Starch and Cellulose, Applications of Cellulose derivatives.	2	Lecture & Seminar Library class
<b>UNIT III Nitrogen Compounds</b>			
<b>Aliphatic Nitrogen Compounds</b>	General methods of preparation, properties of Cyanides and Isocyanides. Distinction between Ethyl Cyanide and Isocyanide	3	Lecture & Demonstration class

<b>Alkyl nitrites and nitroalkanes</b>	General methods of preparation and properties of Ethyl Nitrite and Nitroethane. Distinction between Ethyl Nitrite and Nitroethane.	3	Lecture & Discussion
<b>Aliphatic diazo compounds</b>	Preparation, Properties and Structure of Diazomethane and Diazoacetic Ester.	2	Lecture & Discussion
<b>Derivatives of carbonic acids</b>	Manufacture, properties, structure, estimation and uses of Urea.	3	Lecture & Videos. Library class
<b>Aromatic nitro compounds</b>	Preparation and Properties of Nitro Toluene. Reduction products of Nitrobenzene - TNT and TNB.	1	Tutorial and Seminar.
<b>Aromatic amino compounds</b>	Effect of substituents on the basic character of aromatic aminocompounds. Preparation and properties of isomers of toluidines. Estimation of aniline. Diazotization - preparation and synthetic uses of Benzene Diazonium Chloride	3	Lecture, ICT, Problem Solving
<b>UNIT IV : Aliphatic acids</b>			
	Resonance of carboxylate ion, Inductive effect, Influence of halogen atom on the strengths of acids, HVZ reaction mechanism, Blanc's rule, synthetic applications of active methylene compounds	7	Lecture
	Effect of substituents on acidity in monocarboxylic, halogen substituted acids and aromatic carboxylic acids	2	ICT
	Nomenclature of carboxylic acids, Order of acidity in monocarboxylic and aromatic carboxylic acids	2	Problem solving
	Preparation, properties and uses of aliphatic and aromatic carboxylic acids	4	Tutorial, seminar and assignment
<b>UNIT V : Alicyclic compounds and Conformation</b>			

<b>Alicyclic compounds</b>	General methods of preparation, properties of Cycloparaffins. Baeyer's strain theory and its Modification.	7	Lecture, Video and assignment
<b>Conformation</b>	Definition, difference between configuration and conformation, Conformational analysis of Ethane, Butane, 1,2-dichloroethane and Cyclohexane.	3	Lecture
	Fischer, Newmann and Sawhorse projection Formulae and Chair and boat conformation of acyclic and cyclic organic compounds	3	ICT
	Ball and Stick models for conformational analysis	2	Demonstration with the help of teacher

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	5	4	4	3	4	4	3	4	4	3	4	4	4	3.85
CO2	4	4	3	3	4	3	3	3	4	4	3	3	4	4	3.50
CO3	4	4	3	3	4	3	3	3	4	4	3	3	4	4	3.50
CO4	4	4	4	4	4	4	4	4	3	4	4	3	4	4	3.86
CO5	4	4	3	3	4	3	3	4	4	4	3	3	4	4	3.57
Mean Overall Score														3.66	

Result: The Score for this Course is 3.66 (High Relationship)

Programme : B.Sc Chemistry  
Semester : V  
Sub. Code : C52

Part III: (Core) Major paper 10  
Hours : 5 /W, 75 /S  
Credits : 5

**TITLE OF THE PAPER: PHYSICAL CHEMISTRY I**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class (Library session is conducted after the class hours).	ICT	
	5	3	1	1	
<b>PREAMBLE: The objective of the course is to make the student to recognize the significance of Thermodynamics and laws associated with it, decipher the importance of entropy, free energy and real life applications of thermodynamics such as Joule Thomson effect, the role of chemical kinetics in studying the rate of the reaction, the relationship between chemical constitution and physical properties.</b>					
<b>COURSE OUTCOME</b>				Unit	Hrs /S
At the end of the Semester, the students will be able to					
<b>UNIT 1 CO1:</b> explain the basic terminologies and laws of thermodynamics and calculations of enthalpy, entropy and free energies.				1	15
<b>UNIT 2 CO2:</b> demonstrate the different ways of stating II law of thermodynamics and its significance, Entropy, free energy function and Partial molar quantities.				2	15
<b>UNIT 3 CO3:</b> explain the III law of thermodynamics				3	15
<b>UNIT 4 CO4:</b> derive the rate constants for 1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> and zero order reactions				4	15
<b>UNIT 5 CO5:</b> discuss the theories of reaction rates and the influence of temperature on rate of the reaction and correlating the physical properties and chemical constitution.				5	15

**Unit- I**

**(15 Hrs)**

***Thermodynamics –I***

**Introduction:** Scope and importance of thermodynamics – energy and its units – mechanical work and heat and their relation – thermodynamic systems and their characteristics – state of a system – state function and path function and their characteristics – thermodynamic functions – exact and inexact differentials.

**First Law:** Statement – mathematical formulation – change in internal energy and enthalpy – heat changes at constant volume and constant pressure –  $C_p$ - $C_v$  relationship – work done in isothermal, reversible expansion and compression of an ideal gas – work done in isothermal irreversible expansion of an ideal gas. Calculation of  $\Delta E$ ,  $\Delta H$  and  $w$  for adiabatic expansion – reversible adiabatic expansion ( $P$ ,  $V$  and  $T$  relationship) – comparison of isothermal and adiabatic

reversible expansion. Reversible isothermal expansion of a real gas – calculation of  $\Delta E$ ,  $q$ ,  $w$  and  $\Delta H$  for a van der Waal's gas – Joule-Thomson effect  $(\delta E/\delta V)_T$  value for ideal gas - Joule – Thomson coefficient in ideal and real gases. Inversion temperature, calculation and significance.

**Thermochemistry:** Variation of enthalpies with temperature – Kirchoff's equation – Laws of thermochemistry – i) Lavoisier and Laplace's law, ii) Hess's law of constant heat summation – statement and applications. Bond enthalpies –definition–calculation from the thermochemical data and applications.

**Zeroth law** of thermodynamics and its significance.

## Unit – II

(15Hrs)

### *Thermodynamics – II*

II law of thermodynamics – objective of the II law – different ways of stating II law and its significance.

Conversion of heat into work – Carnot's theorem and cycle – Thermodynamic efficiency – thermodynamic scale of temperature.

Entropy – definition and significance –the concept of entropy – entropy changes in isolated systems – entropy as a thermodynamic function – dependence of entropy on variables of the system. Entropy changes - in ideal gas, in mixing of gases, physical transformations and in chemical reactions. Entropy and probability

Free energy functions: Helmholtz free energy (A) – definition and temperature dependence – Gibb's free energy (G) – definition. Variation of Gibb's free energy with temperature and pressure – Gibb's-Helmholtz equation and its applications – Maxwell's relations – criteria for reversible and irreversible processes in terms of Gibb's free energy.

Partial molar quantities: Chemical potential – relationship between partial molar quantities – Gibb's-Duhem equation – chemical potential in case of a system of ideal gases – application of the concept of chemical potential – Clausius-Claypeyron equation – derivation and its applications – thermodynamic properties of real gases – fugacity and activity concepts.

## Unit – III

(15Hrs)

Application of thermodynamics to various types of equilibria – equilibrium constant and free energy changes – van't Hoff reaction isotherm and van't Hoff isochore – thermodynamic interpretation of law of mass action and LeChatelier's principle.

Thermodynamics of ideal solution – free energy change of mixing, enthalpy change of mixing and entropy change of mixing.

Relation between osmotic pressure and vapour pressure lowering – thermodynamic derivation.

Relation between the depression of freezing point and concentration, elevation of boiling point and concentration – thermodynamic derivation.

### *Thermodynamics – III*

Nernst heat theorem and its applications -Third law of thermodynamics – a simple treatment of the law. Temperature dependence of heat capacity - its use in the determination of absolute entropy. Exceptions to III law – residual entropy of CO, N<sub>2</sub>O, H<sub>2</sub>O, NO and H<sub>2</sub>

## Unit – IV

(15Hrs)

### *Chemical Kinetics:*

Rate of a reaction – rate law and rate constant – order and molecularity of a reaction.

**Reactions of first order and psuedo first order reaction** – derivation of rate constant and half-life period – catalytic decomposition of hydrogen peroxide, conversion of N-chloro acetanilide to p- chloro acetanilide, decomposition of dinitrogen pentoxide – hydrolysis of ester by acids – inversion of cane sugar

**Reactions of II order:** derivation of rate constant and half- life period – saponification of ester.

**Reactions of III order:** derivation of rate constant and half- life period. Reaction between  $\text{FeCl}_3$  and  $\text{SnCl}_2$ .

### Methods of determining the order of reactions.

**Complex reactions, consecutive, parallel and reversible reactions** (preliminary discussion with examples – derivation not expected)

**Reactions of zero order** surface reactions – derivation of rate law - specific examples.

**Unit – V**

**(15Hrs)**

### *Chemical Kinetics:*

**Influence of temperature** on the rate of a reaction – Arrhenius rate equation and its significance – measurement of Arrhenius parameters, A and  $E_a$ .

**Theory of reaction rates** – Collision theory – unimolecular reactions – Lindemann – Christiansen mechanism– Theory of absolute reaction rates – enthalpy of activation – entropy of activation.

### *Physical Properties and chemical constitution:*

**Constitutive properties:** a) Dipole moment: definition – experimental determination – bond moments and group moments – various applications.

**Magnetic properties:** Magnetic susceptibility – para, dia and ferromagnetic – specific, molar magnetic susceptibility and constitution – determination by Gouy's method.

### TEXT BOOKS

1. Principles of Physical Chemistry- Puri, Sharma and Pathania- Vishal Publishing Co.; 46<sup>th</sup> edition.
2. Text book of physical chemistry by P.L.Soni., O.P.Dharmarha, U.V.Dash., S.Chand., 2016.
3. ArimurailyarpuVethiyal by Sudha soundirapandian, & T.R. Visalakshi, Published by Madurai Kamaraj University, Madurai, 1998.

### References

1. Essential of physical chemistry by Arun Bahl and B.S.Bahl and G.D.Tuli, S.Chand., 2014.
2. Basic chemical kinetics by G.L.Agarwal., tata Mc Graw Hill., 1990.
3. Electrochemistry by V.Viswanathan., Dr.S.Sundaram., , Viswanathan Printers and Publishers, 2007.
4. Physical chemistry by Peter Atkins., Oxford Univ Press., 2017.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1: Thermodynamics I			
	Terminologies in thermodynamics, Laws of thermodynamics First law, Kirchoff's equation Laws of thermochemistry, Zeroth law Scope and importance of thermodynamics, Bond enthalpies and Exact and inexact differential	12	Lecture Discussion, Problem solving.

	Joule Thomson coefficient and Isothermal reversible and irreversible expansion.	3	ICT
UNIT 11 Thermodynamics –II			
	Second Law of thermodynamics, Carnot Theorem and cycle, Gibbs Helmholtz equation Maxwell's relations Gibbs Duhem equation Clasius Claypeyron equation Partial molar quantities, Concepts of entropy and free energy	12	Lecture
	Entropy, Entropy and Probability (Examples) Free energy Functions (Examples)	3	ICT
UNIT III Thermodynamics-III			
	Vant Hoff Reaction Isotherm, Vant Hoff Isochore Enthalpy Change of mixing, Entropy change of mixing Relation between Osmotic Pressure and Lowering of Vapour pressure, Relation between Depression of Freezing point and concentration, Elevation of Boiling point and concentration, LeChatelier's principle, Nernst Heat Theorem and its applications, Third Law of Thermodynamics	11	Lecture
	Applications of Third Law of Thermodynamics Exceptions to III Law (Examples of imperfection) LeChatelier's principle	1 3	Discussion ICT
UNIT IV Chemical kinetics I			
	Rate law and rate constant, Rate constant and half-life period for 1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> and zero order reactions	9	
	Order and molecularity of a reaction, Types of chemical reactions (complex, parallel, consecutive..) Examples for 1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> and zero order reactions	3	Problem solving Seminar & Quiz
	Methods for determining order of the reaction	3	ICT
UNIT V Chemical kinetics II			
	Significance and measurement of Arrhenius parameters Theories of reaction rates Unimolecular, Lindemann, Absolute reaction rates Applications of bond and group moments Enthalpy of activation and entropy of activation	10	Lecture
	Influence of temperature on reaction rates Para, dia and ferromagnetic properties	2	Seminar & Discussion

	Collision theory, Experimental determination of dipole moment, Guoy's method of determination of magnetic susceptibility	3	ICT
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Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	5	4	3	4	4	4	4	5	3	4	4	4	3	3.93
CO2	4	5	4	3	4	4	4	4	5	3	4	4	4	3	3.93
CO3	4	4	5	4	4	4	4	4	5	3	4	4	4	3	4.00
CO4	4	5	4	3	4	4	4	4	5	3	3	4	4	3	3.86
CO5	4	4	5	4	4	4	4	4	5	3	4	4	4	3	4.00
Mean Overall Score														3.94	

Result: The Score for this Course is 3.94 (High Relationship)

**Programme :B.Sc Chemistry**

**Semester : V & VI**

**5 hours in V semester and 5 hours in VI semester**

**Sub. Code : PC3**

**Part III: (Core) Major paper 11**

**Hours : 5/W, 75 /S**

**Credits :5**

**TITLE OF THE PAPER: PRACTICALS -3, GRAVIMETRIC ANALYSIS, ORGANIC ANALYSIS AND PHYSICAL CHEMISTRY EXPERIMENTS**

Pedagogy	Hours	Lab session//Demonstration class/Viva voce
	5	5
<b>PREAMBLE: The objective of the course is to make the student to estimate the weight of the unknown solution gravimetrically, handle physical experiments and analyse the given organic compound.</b>		
<b>COURSE OUTCOME</b>		<b>Unit</b>
At the end of the Semester, the Students will be able to		<b>Hrs P/S</b>
<b>UNIT 1 CO1:</b> estimate the given inorganic solution gravimetrically.		1
<b>UNIT 2 CO2:</b> demonstrate the physical experiments and handle instruments		2
<b>UNIT 3 CO3:</b> analyse the given organic compound and find out the functional group present in it and prepare its derivatives		3

**Unit – I Gravimetric Analysis:**

Estimation of Ca as calcium monohydrate

Estimation of Ba as chromate

Estimation of Lead as chromate

**Unit – II Physical Chemistry:**

Thermometric experiments:

Determination of  $K_f$  of a solute by Rast method (cryoscopy)

Determination of molecular weight of a solvent by Rast method

Simple eutectic phase diagram

Determination of transition temperature of a salt hydrate

Determination of molecular weight by transition temperature method

Determination of C.S.T. of phenol – water system

Study of effect of impurities on C.S.T

Partition Coefficient: Determination of partition coefficient of iodine in  $\text{CCl}_4$  and water system.

Determination of equilibrium constant of  $\text{KI} + \text{I}_2 \rightleftharpoons \text{KI}_3$  system

Determination of strength of potassium iodide

Kinetic study

Determination of rate constant of a first order reaction – ester hydrolysis

Comparison of strengths of two acids by ester hydrolysis method

Electrochemistry: Conductivity titration between an acid and a base

Potentiometric titration between ferrous sulphate and potassium dichromate.

**Unit –III**

**Organic Analysis:** Analysis of the organic substance containing the following functional groups: Acids, phenols, aldehydes, ketones, esters, nitro compounds, amines, amides, anilides and halogenated hydrocarbons (side chain and nucleus) Monosaccharide –glucose.

Report should contain aromatic or aliphatic, saturated or unsaturated and a solid derivative or a colour reaction should be exhibited.

**Examination:** Unit I or Unit II (random choice) and Unit III (compulsory)

Internal - 40 marks (unit I or II = 20 + Unit III = 15 +5)

External - 60 marks

**Unit I (25 marks)**

Procedure -8 marks, Experiment –17marks, error up to 1% -17, 2% -12, 3% -7, 4% and above - 5

**Unit II (25 marks)**

Attendance – 10 marks, Experiment – 15marks

**Unit III (25 marks)**

Record – 5 marks

Viva voce – 5 marks.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1: Gravimetric Analysis			
	Gravimetric Estimation	30	Lab session
	Gravimetric Estimation	5	Demonstration
	Gravimetric Estimation	5	Viva-Voce

UNIT 11: Physical Chemistry			
	Physical Chemistry experiments	40	Lab session
	Physical Chemistry experiments	5	Demonstration
	Physical Chemistry experiments	5	Viva-Voce
UNIT 11: Organic Analysis			
	Organic Analysis	50	Lab session
	Organic Analysis	5	Demonstration
	Organic Analysis	5	Viva-Voce

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	5	5	4	5	4	4	4	4	4	5	4	3	4	3	4.14
CO2	5	5	4	5	4	4	4	4	4	4	4	3	4	3	4.07
CO3	5	5	4	5	4	4	4	4	4	4	4	3	4	3	4.07
Mean Overall Score														4.09	

Result: The Score for this Course is 4.09 (Very High Relationship)

**Programme :B.Sc Chemistry**  
**Semester :VI**  
**Sub. Code : C61**

**Part III: (Core) Major paper 12**  
**Hours : 5 /W, 75 /S**  
**Credits : 5**

**TITLE OF THE PAPER: INORGANIC CHEMISTRY**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class(Library session is conducted after the class hours).	ICT
	5	3	1	1

**PREAMBLE: The objective of the course is to make the student understand the chemistry of important compounds in VIA, VII A, d & f block elements, basic concepts, theories & applications of coordination compounds and structure of carbonyls and nitrosyls.**

<b>COURSE OUTCOME</b>	Unit	Hrs P/S
At the end of the Semester, the students will be able to		
<b>UNIT 1 CO1:</b> demonstrate the chemistry of H <sub>2</sub> O <sub>2</sub> , ozone, peracids, the extraction of Se & Te, Classification of oxides and solve the problems.	1	15
<b>UNIT 2 CO2:</b> discuss the chemistry of halogens and interhalogen compounds.	2	15

<b>UNIT 3 CO3:</b> explain the extraction of some d & f block elements, preparation, properties and uses of some industrially important inorganic compounds and the basic concepts of coordination chemistry.	3	15
<b>UNIT 4 CO4:</b> discuss the various theories involved in coordination chemistry.	4	15
<b>UNIT 5 CO5:</b> demonstrate the structure of carbonyls and nitrosyls and discuss the applications of coordination compounds.	5	15

**Unit – I****(15 Hrs)****Group 16 / VIA:** Group discussion.

Oxides – classification.

Hydrogen peroxide: preparation, properties, structure, estimation – problems on estimation

Ozone: Preparation, properties and structure.

Peracids and Persalts: Sulphur – permono and perdisulphuric acids - preparation and structure, potassium perdisulphate –preparation and structure.

Ores, extraction, properties and uses of Se and Te.

**Unit – II****(15 Hrs)****Group 17/VIIA-Halogens:** group discussion

- Fluorine:** Difficulties in isolation – oxides of fluorine – distinction from others.
- Chlorine:** Oxides and oxyacids – bleaching powder – estimation of available chlorine, manufacture, properties and uses.
- Bromine:** Oxides and oxyacids.
- Iodine:** Oxides and oxyacids, periodic acids – basic iodine
- Interhalogen compounds** – polyhalides – pseudohalogens.

**Unit – III****(15 Hrs)****d- block elements:** General characteristics.

Occurrence, extraction of the following metals: Vanadium, Molybdenum, Cobalt, Tungsten

**f-block elements:** General characteristics – Extraction and separation from monazite sand.

Differences between Lanthanides and actinides - Lanthanides and actinides contractions - Preparation, properties and uses of the following compounds: Thorium dioxide, ammonium molybdate, Vanadium pentoxide, sodium Cobaltinitrite, chloroplatinic acid.

**Basic Concepts of Coordination Chemistry:** Double salts and complexes, Classification of Ligands, , chelation– applications. Coordination number and stereochemistry of complexes, Nomenclature, Isomerism- structural and stereoisomerism, Werner's theory and its demerits, Sidgwick's EAN rule.**Unit – IV****(15 Hrs)****Coordination Chemistry:** Formation of inner and outer orbital octahedral complexes, tetrahedral, square planar complexes on the basis of valence bond theory [VBT].

Limitations of VBT. Crystal field theory – important features of crystal field theory [CFT] – crystal field splitting of d-orbital in octahedral, tetrahedral and square planar complexes – factors

affecting the magnitude of  $\Delta_o$ - spectrochemical series – high spin and low spin complexes, some applications of CFT. Magnetic properties of transition metal complexes (spin only moment) – application of coordination compounds. Distortion of octahedral complexes and Jahn-Teller theorem, crystal field stabilization energy.

**Unit V:****(15Hrs)**

**Applications of coordination compounds:** Estimation of nickel using DMG and aluminium using oxine – estimations of hardness of water using EDTA.

**Biologically important coordination compounds:** Functions of chlorophyll, haemoglobin and vitamin B12.

**Carbonyls:** Preparation and structure of  $\text{Ni}(\text{CO})_4$ ,  $\text{Fe}(\text{CO})_5$ ,  $\text{Cr}(\text{CO})_6$ ,  $\text{Co}_2(\text{CO})_8$ ,  $\text{Mn}_2(\text{CO})_{10}$

**Nitrosyls :** Preparation of sodium nitroprusside.

**TEXT BOOKS**

1. Principles of Inorganic Chemistry, Puri & Sharma, Vishal Publishing Co.; 46<sup>th</sup> edition
2. Advanced Inorganic Chemistry by Tuli, Basu and Madan S.Chand publishing; 19<sup>th</sup> edition
3. Kanima Vethiyal by L. Anjana, S.K. Santha, R. Santhanalakshmi, R. Saraswathi  
N. Vijayathara, Sudhasoundirapandian, D.SaralaThambavani, Published by Madurai Kamaraj University, Madurai, 1998.

**References:**

1. Selected Topics in Inorganic Chemistry by Wahid U. Malik, G.D. Tuli and R. D. Madan S.Chand Publishing; revised edition (2010)
2. Concise Inorganic Chemistry, by J.D.Lee, Wiley India, 5<sup>th</sup> edition, 2009
3. Advanced Inorganic Chemistry by F.Albert Cotton, Geoffrey Wilkinson et al., Wiley India, 6<sup>th</sup> edition 2012.
4. Principles, structure and reactivity by James E Huheey, Harper and Raw, 5<sup>th</sup> edition, 2012.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1: Group 16/VI A			
	Group discussion Classification of oxides	3	ICT
	Chemistry of $\text{H}_2\text{O}_2$ , ozone, peracids, persulphate.	9	Lecture
	Solving the problems based on Estimation of $\text{H}_2\text{O}_2$	1	Problem solving
	Extraction, properties and structure of Se & Te.	2	Problem solving
UNIT II Group 17/ VII A Halogens group discussion			
	Chemistry of oxides and oxy acids of halogens, integrate the different inter halogen compounds	9	Lecture
	Identify and differentiate fluorine from other halogens, compare halogen with pseudo halogen	3	ICT
	Estimation of available chlorine	1	Problem solving
	Structure of oxy acids of halogen and inter halogen	2	seminar

UNIT III			
	Extraction of some d and f block elements Ti, V, Mo, Co, W, Pt and U	5	Lecture
	Preparation and properties of some industrial important compounds	2	Seminar (peer teaching)
	Basic concepts of coordination chemistry	5	Lecture
	Isomerism in coordination compounds, Chelation	2	ICT
	Applications of Chelates	1	Discussion/Role Play
UNIT IV COORDINATION CHEMISTRY			
	Theories of coordination Chemistry	9	Lecture
	CFT models in octahedral, square planar & tetrahedral complexes.	3	ICT
	Calculation of CFSE	2	Problem solving
	Applications of coordination compounds	1	Seminar (Peer teaching)
UNIT V			
	Application of coordination compounds, metal carbonyls preparation, properties and structure	9	Lecture
	Biologically important coordination compounds	4	ICT
	Structure of nitrosyl compounds	1	discussion
	EAN rule calculation	1	Problem solving

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	5	4	3	4	4	4	4	5	3	4	4	4	3	3.93
CO2	5	5	4	3	4	3	4	4	5	4	4	4	3	3	3.93
CO3	5	5	4	3	4	4	4	4	5	4	3	4	3	3	3.93
CO4	5	5	4	3	4	4	4	4	5	3	2	4	4	3	3.86
CO5	5	5	3	4	4	4	3	5	5	3	3	4	3	4	3.93
Mean Overall Score														3.916	

Result: The Score for this Course is 3.916 (High Relationship)

**Programme :B.Sc Chemistry**  
**Semester :VI**  
**Sub. Code : C62**

**Part III: (Core) Major paper 13**  
**Hours : 4 /W, 60 /S**  
**Credits : 4**

**TITLE OF THE PAPER:ORGANIC CHEMISTRY - 2**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class (Library session is conducted after the class hours).	ICT
	5	3	1	1

<b>PREAMBLE:</b> The objective of the course is to make the student understand, learn and gain knowledge about the chemistry of PolynuclearHydrocarbons, Molecular rearrangements with complete mechanisms, Chemistry of Heterocyclic compounds with one hetero atom, Chemistry of some Alkaloids and Terpenoids, Preparation and properties of Amino acids, structure of proteins, role of enzymes in chemical reactions and biological systems, study of Nucleic Acids, Chemistry of Tautomerism with emphasis on triad systems and Chemistry of Polymers.		
<b>COURSE OUTCOME</b> At the end of the Semester VI, the students will be able to.	Unit	Hrs /S
UNIT 1 CO1 : explain the definition and classification with example for polynuclear hydrocarbons and the chemistry of some of them and their derivatives.	1	12
UNIT 2 CO2 : express nine molecular rearrangements with complete mechanism, and their importance in various chemical fields. They will also have a thorough knowledge of the chemistry of Heterocyclic compounds with one hetero atom.	2	12
UNIT 3 CO3 : discuss the chemistry of alkaloids –Coniine, Piperineand Nicotine& the chemistry of Terpenoids – Citral, Menthol and preparation of $\alpha$ -Terpeniol, Dipentene, Limonene.	3	12
UNIT 4 CO4 : describe preparation and properties of some amino acids, properties, color reactions and structure of proteins, role of enzymes in biological systems examples of a few reactions of various classes of enzymes and chemistry of nucleic acids with brief study of general structure of RNA and DNA.	4	12
UNIT 5 CO5 : extend detailed explanation about the definition of Tautomerism, conditions of tautomerism – prototropy and anionotropy, types of tautomerism their mechanism and uses. Also describe chemistry of Polymers, along with preparation and uses of some individual polymers.	5	12

**Unit – I****(12 Hrs)*****Polynuclear hydrocarbons and their derivatives:*****Isolated systems:** Preparation and properties of diphenyl, diphenyl methane, triphenyl methane and stilbene.**Condensed systems:**Naphthalene: isolation from coal tar - properties, uses and structural discussion of naphthalene. Derivatives of naphthalene – preparation, properties and uses of naphthylamines, naphthols and naphthaquinones.**Anthracene:** Preparation, properties, uses and structural discussionof anthracene, derivatives of anthracene – anthraquinone, alizarin.**Phenanthrene:** Preparation, properties and structure of phenanthrene**Unit- II:****(12Hrs)**

**Molecular rearrangements:** Detailed mechanism of the following: i) Pinacol-Pinacolone, ii) Hofmann, iii) Curtius, iv) Benzil - Benzylic acid, v) Claisen, vi) Benzidine, vii) Beckmann, viii) Fries, ix) Wagner - Meerwin rearrangements

**Heterocyclic compounds with one hetero atom:** Preparation, properties and structure of pyrrole, furan and thiophene, pyridine, quinoline, isoquinoline and indole.

### Unit – III (12Hrs)

**Alkaloids:** Definition – occurrence – extraction – general properties – classification – general methods of determining the structure – structure and synthesis of the following: coniine, piperine and nicotine.

**Terpenoids:** Classification – occurrence – isolation – general properties – isoprene rule – general methods of determining the structure – structure and synthesis of citral, menthol  
Preparation and applications of  $\alpha$ - terpeniol, dipentene, limonene.

### Unit – IV (12Hrs)

**Amino acids:** Classification, preparation, properties of glycine, alanine and phenyl alanine – action of heat on  $\alpha$ ,  $\beta$  and  $\gamma$  – aminoacids.

**Proteins:** Definition, classification, general properties – color reactions, primary and secondary (an elementary idea)

**Enzymes:** Definition – role of enzymes in biological systems – examples of a few reactions of various classes of enzymes.

**Nucleic acids:** Nucleocides, nucleotides – RNA and DNA – general structure.

### Unit – V (12Hrs)

**Tautomerism:** Definition – conditions of tautomerism – prototropy and anionotropy, types of tautomerism:

- a) Keto – enol tautomerism
- b) Nitro – acinitro tautomerism
- c) Nitro – isonitroso tautomerism
- d) Lactam – lactim tautomerism
- e) Quinone monoxime – p-nitroso phenol.

**Polymerization:** Definition of polymer, monomer, repeating units, degree of polymerization. Types of polymers (classification on different basis) – polymerization reactions (addition, condensation) – mechanisms - differences between addition polymers and condensation polymers – preparation, and uses of some individual polymers - polyethylene (HDPE and LDPE), polypropylene, polystyrene, PVC, PMMA, nylon, polyesters (PET), epoxy resin.

### TEXTBOOKS

1. Text book of Organic chemistry by P.L.Soni- Sultan Chand & Sons; 29<sup>th</sup> edition (2012)
2. Advanced Organic Chemistry by B.S.Bahl and Arun Bahl ; S. Chand Publishing 2<sup>nd</sup> edition
3. Industrial Chemistry by B.K.Sharma Krishna prakashan (p) Ltd 2011
4. Stereochemistry by Kalsi, New Age International, 7<sup>th</sup> edition, 2010.
5. Arimurai Karima Vethiyal by R. Saraswathi, N. Subbulakshmi, R. Santhanalakshmi, N. Vijayathara, M. Thilagavathi, Published by Madurai Kamaraj University, Madurai, 1998

### References:

1. Organic Chemistry by Morrison and Boyd; Pearson Education India; 7<sup>th</sup> edition (2010)
2. Organic Chemistry vol 1 by Finar; Pearson Education India; 6<sup>th</sup> edition (2002)
3. Stereochemistry of organic compounds by Eliel., Wiley Publisshers, 2008.

4. Organic chemistry by Morrison and Boyd., PHI, 6<sup>th</sup> edition, 2008.
5. Organic chemistry Concept and Application by Dr. Jagdamba Singh, 6<sup>th</sup> edition, Pragati Prakashan publisher, 2008.

UNITS	TOPICS	LECTURE HOURS	MODE OF TEACHING
UNIT I : Polynuclear hydrocarbons and their derivatives			
	Definition, types, proper examples for Isolated and condensed systems, isomerism exhibited by stilbene, isolation of Naphthalene from coal tar.	2	ICT
	Preparation, properties, uses and structural elucidation Naphthalene, Anthracene and Phenanthrene.	8	Lecture
	Derivatives of naphthalene an anthracene.	2	Seminar/Assignment /tutorial
Unit II : Molecular rearrangements and Heterocyclic compounds with one hetero atom			
Molecular rearrangements	Detailed Reaction, mechanism and uses of the following rearrangements: i) Pinacol-Pinacolone, ii) Hofmann, iii) Curtius, iv) Benzil - Benzylic acid, v) Claisen, vi) Benzidine, vii) Beckmann, viii) Fries, ix) Wagner - Meerwin	7	Lecture, ICT, Assignment, discussion, problem solving and library class
Heterocyclic compounds with one hetero atom	Preparation, properties and structure of pyrrole, furan and thiophene, pyridine, quinoline, isoquinoline and indole.	5	Lecture, seminar, discussion and library class
Unit III: Alkaloids and Terpenoids			
	Definition, occurrence, extraction, types of Alkaloids and Terpenoids, isoprene rule and special isoprene rule-suitable examples.	2	ICT
	Structural elucidation of Coniine, Piperine, Nicotine and Citral, Menthol and preparation and applications of $\alpha$ -Terpeniol, Dipentene, Limonene.	8	Lecture
	Naming, drawing the structures and identifying the types of alkaloids and terpenoids.	2	Quiz/Seminar/Assignment
Unit IV:Aminoacids, proteins, enzymes and nucleic acids			
	Classification, synthesis, properties of glycine alanine and phenyl alanine and definition classification and properties of proteins	3	Lecture

	Color reactions of proteins	1	Demonstration and lab session
	Primary and secondary structures of proteins	1	Video
	Action of heat on $\alpha$ , $\beta$ , $\gamma$ -amino acids, Zwitter ion, isoelectric point, essential amino acids definition, sources and examples.	1	Seminar/assignment /tutorial
Enzymes	Definition, classification, role of enzymes in biological systems, examples of a few reactions of various classes of enzymes.	3	Lecture, seminar, quiz
Nucleic acids	Nucleosides, nucleotides, RNA and DNA - general structure.	3	Lecture and assignment
Unit V : Tautomerism and Polymers			
Tautomerism	Definition – conditions of tautomerism – prototropy and anionotropy, types of tautomerism:a) Keto – enol, b) Nitro – acinitro c) Nitro – isonitroso, d) Lactam – lactim e) Quinone monoxime – p-nitroso phenol.	6	Lecture, ICT, Discussion and assignment
Polymers	Definition of monomer, polymer, repeating units, degree of polymerization, types of polymers (classification on different basis), polymerization reactions (addition, condensation), mechanisms, differences between addition polymers and condensation polymers, preparation, and uses of some individual polymers, polyethylene (HDPE and LDPE), polypropylene, polystyrene, PVC, PMMA, nylon, polyesters (PET), epoxy resin.	6	Lecture, Videos, Demonstration class and seminar

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	
CO1	4	4	3	3	3	4	4	4	4	3	3	3	3	3	3.43
CO2	4	3	3	4	4	3	3	3	4	3	3	3	4	4	3.43
CO3	4	3	3	4	3	3	4	4	3	4	3	4	3	3	3.43
CO4	4	3	3	4	4	3	3	3	4	3	3	3	4	4	3.43
CO5	4	3	3	4	4	3	3	3	4	3	3	3	4	4	3.43
Mean Overall Score														3.43	

Result: The Score for this Course is 3.43 (High Relationship)

**Programme : B.Sc Chemistry Part III: (Core) Major paper 14**

**Semester : VI**

**Hours : 4 /W, 60/S**

**Sub. Code : C63**

**Credits : 4**

**TITLE OF THE PAPER: PHYSICAL CHEMISTRY -2**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role Play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class (Library session is conducted after the class hours).	ICT	
	4	2	1	1	
<b>PREAMBLE: The objective of the course is to make the student to understand the fundamentals of electrochemistry, Ionic equilibria and basic ideas in photochemistry and principles of group theory.</b>					
<b>COURSE OUTCOME:</b> At the end of the Semester, the students will be able to				Unit	Hrs /S
<b>UNIT 1 CO1</b> describe conductance, significance of Ostwald's dilution law, Kohlrausch law and applications of conductivity measurements.				1	12
<b>UNIT 2 CO2:</b> explain the concept of hydrolysis constant, principles of buffer action and applications of common ion effect and solubility product.				2	12
<b>UNIT 3 CO3:</b> explain the concept of electrode potential, electro chemical cells and applications emf measurements.				3	12
<b>UNIT 4 CO4:</b> demonstrate the basic terminologies and laws of photochemistry, Photochemical reactions and photo chemical processes				4	12
<b>UNIT 5 CO5:</b> demonstrate the basic ideas of symmetry operations, point group, matrix representations and construction of group multiplication tables.				5	12

**Unit – I**

**(12Hrs)**

***Electrochemistry-I***

**Conductance:**

Definition and determination – specific, equivalent and molecular conductance – variation of equivalent conductance with dilution and its limiting values.

Strong and weak electrolytes: theory of strong electrolytes – Debye-Huckel-Onsager equation (no derivation) Ostwald's dilution law and its applications

Kohlrausch's law of ionic mobilities and its applications. Absolute velocity of ions and its determination – Transport number of ions and their determination.

Applications of conductivity measurements – degree of dissociation – solubility of a sparingly soluble salt - degree of hydrolysis – basicity of acids – conductometric titrations.

**Unit – II**

**(12Hrs)**

**Ionic Equilibria:**

Common ion effect and solubility product – quantitative study and their applications.

**Hydrolysis:** definition – nature of solutions of salts undergoing hydrolysis – degree of hydrolysis ( $\alpha$ ) – hydrolysis constant ( $K_h$ ) – their experimental determination and derivation of these values for different salt solutions – based on  $K_w$ ,  $K_a$  and  $K_b$  calculation involving hydrolytic constants.

**Buffer solution** – definition – types – theory of buffer action and applications – Henderson – Hasselbalchequation.

### Unit- III

(12Hrs)

#### Electrochemistry – II

##### Electrode potentials and electrochemical cells.

single electrode potential – oxidation and reduction potentials. Thermodynamics and electromotive force (emf) – relation between chemical and electrical energies – calculation of  $\Delta G$ ,  $\Delta S$  and  $\Delta H$  of cell reaction. Calculation of emf. Nernst equation – standard electrode potential and its characteristics – calculation of equilibrium constant.

Types of electrodes: metal – metal ion, amalgam electrodes, gas, metal – insoluble salts, redox, glass electrodes.

##### *Electrochemical cells:*

**Chemical and voltaic cells:** Definition – cell reaction and representations of electrodes and cells – emf of cell – conventions regarding signs of emf – calculation of cell emf from single electrode potentials. Calculation of cell emf with the aid of Nernst equation. Experimental determination of emf of cells. Measurement of single electrode potentials – electrochemical series – liquid junction potential and salt bridge.

**Concentration cells:** Definition and calculation of emf – types of concentration cells – concentration cells with and without transference.

**Commercial cells:** Primary and secondary cells – lead storage cell, Ni-Cd cell, fuel cell.

##### *Applications of emf measurements.*

Determination of solubility and solubility product of sparingly soluble salts. Determination of pH – using Hydrogen electrode, glass electrode, quinhydrone electrode. Determination of valency of ion. Potentiometric titrations – acid-base, redox, precipitation and complexometric titrations. Determination of transport number.

### Unit – IV

(12Hrs)

#### *Photochemistry:*

**Photochemical reactions** – definition - comparative study of thermal and photochemical reactions – laws of photochemistry: Lambert and Beer's laws, Grotthus-Draper law, Stark-Einstein law – quantum efficiency and its determination – consequences of light

Absorption by atoms and molecules – photophysical processes – fluorescence, phosphorescence and other deactivating processes.

**Photochemical processes:** Jablonski diagram - Kinetics of photochemical reactions.

- i) Gaseous reactions: Hydrogen-chlorine reaction, decomposition of HI
- ii) Reactions in liquid phase (solutions) – isomeric transformation of maleic to fumaric acid – polymerization of anthracene.
- iii) Photochemical equilibrium – flash photolysis – photosensitisation – chemiluminescence.

### Unit – V

(12Hrs)

#### *Group theory:*

Symmetry elements and symmetry operations – definition of a group, sub-group – relation between orders of a finite group and its sub-group – Similarity transformation, Point symmetry group, Schonflies symbols – representation of groups by matrices [statement and utility only, without proof]. Deduction group multiplication table: C<sub>2v</sub>, C<sub>3v</sub> example H<sub>2</sub>O, NH<sub>3</sub>

### TEXT BOOKS

1. Principles of Physical Chemistry by Puri, Sharma and Pathania - Vishal Publishing Co.; 46<sup>th</sup> edition
2. Group theory by Gopinathan Vishal publishing Co 2<sup>nd</sup> (reprint) edition
3. Group theory and its application in chemistry by K.V.Raman., Tata Mc Graw Hill, 1990.
4. Thermodynamics by J.C.Kuriacose and Rajaram., Pearson Edn., 2013.
5. Arimurailiyarpu Vethiyal by Sudha soundirapandian, & T.R. Visalakshi, Published by Madurai Kamaraj University, Madurai, 1998.

### References:

1. Physical chemistry by Peter Atkins., Oxford Univ Press., 2017.
2. A text book of physical chemistry by K. L.Kapoor, Vol 6, 2<sup>nd</sup> edition.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT 1: Electrochemistry I</b>			
	Debye Huckelonsagar equation, Ostwalds' dilution law, Kohlrausch's law, Variation of conductance with dilution, Types of conductance, Strong and weak electrolyte	7	Lecture
	Calculating the conductance of weak electrolytes using Kohlrausch's law	2	Problem solving
	Transport number determination Applications of conductivity measurements	1 2	ICT
<b>UNIT 11 Ionic Equilibria</b>			
	Common ion effect, Solubility product, Hydrolysis	7	Lecture
	Applications of common ion effect, Applications of solubility product, Buffer action	3	Seminar, Demo
	Experimental determination of hydrolysis constant, Applications of buffer action	2	ICT
<b>UNIT III Electrochemistry-II</b>			
	Single electrode potential, Oxidation and reduction potentials, Thermodynamics and electromotive force, Nernst equation, Types of electrodes, Chemical and voltaic cells	7	Lecture

	electrochemical series, Concentration cells with and without transference	3	Lecture and seminar
	Calculation of emf with the aid of Nernst equation, Measurement of single electrode potential	2	Problem solving
	Commercial cells, Applications of emf measurements	3	ICT
<b>UNIT IV Photochemistry</b>			
	Comparative study of thermal and Laws of Photochemistry, Determination of Quantum efficiency, Kinetics of photochemical reactions, Flash photolysis, Photosensitisation, Chemiluminescence	9	Lecture
	Photophysical processes-Fluorescence and Phosphorescence	3	ICT
<b>UNIT V Group theory</b>			
	Types of groups, Point groups Construction of multiplication tables, Similarity transformation, Representation of group by matrices	7	Lecture
	Identifying Point groups	2	Peer Teaching
	Symmetry elements and operations	3	ICT

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	5	4	3	4	4	4	4	5	4	4	4	4	4	3	4.00
CO2	4	4	4	4	3	4	5	4	5	4	3	4	4	3	3.80
CO3	4	4	3	3	3	4	5	4	5	4	3	4	4	3	3.78
CO4	4	4	3	3	3	4	5	4	5	4	3	4	4	3	3.78
CO5	4	5	4	3	3	3	4	4	5	4	3	4	4	3	3.78
Mean Overall Score														3.83	

Result: The Score for this Course is 3.83 (High Relationship)

Programme :B.Sc Chemistry  
Semester :V  
Sub. Code : EC51

Part III: Elective paper 1  
Hours : 5 /W, 75 /S  
Credits : 5

**TITLE OF THE PAPER: ELECTIVE 1 – ANALYTICAL TECHNIQUES**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class (Library session is conducted after the class hours).	ICT	
	5	3	1	1	
<b>PREAMBLE: The objective of the course is to make the student understand the basic concepts of different types of chromatography, their applications, the basic principles of Infrared, Raman UV, PMR, ESR, Mass and <sup>13</sup>C spectroscopy.</b>					
<b>COURSE OUTCOME:</b> At the end of the Semester, the students will be able to				Unit	Hrs S
<b>UNIT 1 CO1:</b> explain the basic concepts of chromatography, its classification, the techniques of column and thin layer chromatography & their applications.				1	15
<b>UNIT 2 CO2:</b> explain the basic concepts, techniques of Paper and ion exchange chromatography and the basic concepts of Gas Chromatography & HPLC.				2	15
<b>UNIT 3 CO3:</b> demonstrate the basic concepts of spectroscopy, IR and Raman spectroscopy and their applications in structural diagnosis.				3	15
<b>UNIT 4 CO4:</b> demonstrate the basic principles in UV and PMR spectroscopy.				4	15
<b>UNIT 5 CO5:</b> demonstrate the basic concepts of <sup>13</sup> C NMR, ESR and Mass spectroscopy.				5	15

**Unit- I: CHROMATOGRAPHY**

**(15Hrs)**

Definition of chromatography, mobile phase and stationary phase. Classification of chromatography. Principles of adsorption and partition chromatography.

**Column Chromatography:** solid stationary phase – adsorbent – requirement of a good adsorbent – examples – liquid stationary phase – solid support- solvent mobile phase – requirement of a good solvent - Preparing a column for chromatography - Separation of a mixture of several components using adsorption column chromatography – development – identification of

components - elution techniques – factors affecting column efficiency – applications of column chromatography.

**Thin Layer Chromatography** – adsorption and partition – preparation of plate – application of separating mixture – developing chambers – development of plate – identification of components – Rf value – factors affecting Rf value – Applications of TLC.

### Unit – II

(15Hrs)

**Paper Chromatography** – type of paper used – various methods of development (ascending, descending and radial) – Rf value – factors affecting Rf value – identification of components – applications of paper chromatography – Separation of amino acids by Paper chromatography- TLC is superior to other methods of chromatography.

**Ion exchange chromatography** – cation exchangers – anion exchangers – mode of their action – method of separation – separation of chloride and bromide ions – separation of zinc and magnesium ions – separation of cobalt and nickel ions. – other applications of ion exchange chromatography

Gas chromatography and HPLC – elementary idea only.

### Unit – III

(15 Hrs)

#### SPECTROSCOPY

Regions of electromagnetic spectrum – parameters of electromagnetic radiation – molecular spectroscopy – Born- Oppenheimer approximation – relative energies required for rotational, vibrational, electronic transitions.

**Infra red spectroscopy** - Introduction – principle – types of stretching and bending vibrations. Vibrational frequency- factors influencing vibrational frequencies - instrumentation - simple problems involving identification of organic compounds from characteristic absorption bands. : functional group detection – fingerprint region – study of hydrogen bond.

**Raman Spectroscopy** - Rayleigh and Raman scattering- stoke's and anti-stoke's lines. Complementation of Raman and IR spectroscopy. Application- mutual exclusion principle – structural diagnosis

### Unit – IV

(15 Hrs)

**UV spectroscopy:** Instrumentation - Frank-Condon principle- predissociation. Types of electronic transitions, chromophore, auxochrome,  $\lambda_{\max}$  and intensity of absorption bands, factors influencing  $\lambda_{\max}$  and  $\epsilon$ . identification of conjugation – calculation of  $\lambda_{\max}$  for dienes,  $\alpha$ ,  $\beta$ -unsaturated carbonyl compounds and aromatic compounds

**PMR spectroscopy:** Principle of nuclear magnetic resonance – Instrumentation- number of signals – equivalent and non-equivalent protons - shielding mechanism – chemical shift – peak area and proton counting- spin-spin coupling – coupling constant (J) – splitting of signals – NMR spectrum of ethanol – low and high resolution.

### Unit – V:

(15 Hrs)

**C<sup>13</sup> NMR spectroscopy** – simple treatment.

**ESR spectroscopy:** Theory – selection rule for transition – hyperfine splitting – ESR spectra of simple radicals, hydrogen and methyl radicals.

**Mass spectroscopy:** Instrumentation – Basic principles of mass spectroscopy, molecular ion peak, base peak, isotopic peak and meta stable peak – nitrogen rule and ring rule. Mass spectrum of simple organic compounds (acetaldehyde, ethyl alcohol, methyl amine and toluene). McLafferty rearrangement.

**Textbooks**

1. Text Book of Organic Chemistry by P.L.Soni ; Sultan Chand & Sons 29<sup>th</sup> edition ; 2012
2. Analytical Chemistry by Gopalan et al ; Sultan Chand & Sons (2013)
3. Analytical spectroscopy by G.R.Chatwal, Himalaya Publishing House, 1<sup>st</sup> edition, 1996.
4. Spectroscopy by B.K.Sharma, Goel Publishing House, 10<sup>th</sup> edition, 1993.

**References:**

1. Instrumental methods of Chemical Analysis by B.K.Sharma KrishnaPrakashan Media Pvt Ltd 1/e edition (2011)
2. Fundamentals of Molecular spectroscopy by Colin.N.Banwell and Elaine.M. Mc cash, 4<sup>th</sup> edition, Mc Graw Hill Edn (Ind) Pvt Ltd, 2016.
3. Elementary of spectroscopy by Gupta, Kumar and Sharma., Pragati Prakasan, 10<sup>th</sup> edition, 1995.
4. Analytical chemistry by Skoog and West, Holler, HBJ publisher, 6<sup>th</sup> edition, 1992

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT 1: CHROMATOGRAPHY</b>			
	Preparation of column, TLC plates and separation of components.	4	ICT
	Basic principles of chromatography, classification, basic terminologies used, separation techniques of column and thin layer chromatography, R <sub>f</sub> value and its calculation.	9	Lecture
	Applications of Chromatography.	2	Seminar
<b>UNIT 11</b>			
	Various methods of development of paper chromatography and separation of components. Gas chromatography explanation.	3	ICT
	Applications of paper Chromatography and ion exchange chromatography.	2	Seminar and Assignment
	Basic principles of Paper chromatography, R <sub>f</sub> value and the factors affecting it, ion exchange chromatography, ion exchangers, Gas chromatography and HPLC.	10	Lecture
<b>UNIT III SPECTROSCOPY</b>			
	Regions of electromagnetic spectrum, IR instrumentation, spectral stretching frequencies.	4	ICT
	Functional group detection and solving simple problems in IR	2	Group discussion & Problem solving
	Basic principles of molecular spectroscopy, IR and Raman spectroscopy	9	Lecture
<b>UNIT IV</b>			
	Types of electronic transitions, Principle of PMR spectroscopy, Instrumentation of PMR and UV spectroscopy.	3	ICT

	Calculation of $\lambda_{\max}$ , Finding out the number of signals in NMR spectra.	3	Problem solving session
	Frank Condon principles of UV, pre-dissociation, factors affecting $\lambda_{\max}$ , Identification of conjugation, Principles of NMR, shielding mechanism, Chemical shift, spin-spin coupling, proton counting, splitting of signals, NMR of ethanol.	9	Lecture
UNIT V			
	Instrumentation of Mass, Basic concept of mass spectroscopy, ESR spectra of simple molecules.	3	ICT
	ESR spectroscopy, theory, selection rule, hyperfine splitting, Other contents of mass spectroscopy, $^{13}\text{C}$ NMR spectroscopy	10	Lecture
	Mass spectrum of simple organic compounds, ESR of hydrogen and methyl radical.	2	Tutorial

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	5	4	3	3	4	4	4	5	3	3	4	4	3	3.79
CO2	4	5	4	3	3	4	4	4	5	3	3	4	4	3	3.79
CO3	4	5	4	3	4	4	4	4	5	3	3	4	4	4	3.92
CO4	4	5	4	3	4	4	4	4	5	3	3	4	4	4	3.92
CO5	4	5	4	3	4	4	4	4	5	3	3	4	4	3	3.86
Mean Overall Score														3.86	

Result: The Score for this Course is 3.86 (High Relationship)

Programme : B.Sc Chemistry  
 Semester : V  
 Sub. Code : EC54

Part III: Elective Paper I  
 Hours : 5 / W, 75 / S  
 Credits : 5

**TITLE OF THE PAPER: BIOCHEMISTRY**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class(Library session is conducted after the class hours).	ICT	
	5	3	1	1	
<b>PREAMBLE: The objective of the course is to make the concepts of carbohydrates, amino acids and proteins, lipids, nucleic acids and enzymes.</b>					
<b>COURSE OUTCOME:</b> At the end of the Semester, the students will be able to				Unit	Hrs / S
<b>UNIT 1 CO1: CARBOHYDRATES</b> explain the basic concepts of carbohydrates and Glycolysis, TCA cycle, energy yield, HMP pathway.				1	15
<b>UNIT 2 CO2: AMINO ACIDS AND PROTEINS</b> demonstrate the basic concepts of amino acids, catabolism of amino acids and urea cycle.				2	15
<b>UNIT 3 CO3: LIPIDS</b> describe the basic concepts, importance of fatty acids and their functions.				3	15
<b>UNIT 4 CO4: NUCLEIC ACIDS</b>				4	15

explain Nucleosides and nucleotides, Watson and Crick model, Replication, Transcription, Mutations and mutants, DNA repair, DNA sequencing and PCR, Recombinant DNA technology.		
<b>UNIT 5 CO5:ENZYMES</b> demonstrate the properties and action of enzymes	5	15

**UNIT I : CARBOHYDRATES****(15 Hrs)**

Classification – reducing and non-reducing sugars, Occurrence, structure and biological importance of mono, di and polysaccharide (esp. starch, glycogen and cellulose). An introduction to mucopolysaccharide (proteoglycon). Reaction of Carbohydrates due to the presence of hydroxyl, aldehyde and ketone groups. Glycolysis, TCA cycle, energy yield, HMP pathway.

**UNIT II: AMINO ACIDS AND PROTEINS****(15 Hrs)**

Classification and structure of amino acids based on structure - Essential amino acids - structure of standard amino acid as zwitter ion in aqueous solution - Chemical synthesis of poly peptide chain and solid phase polypeptide synthesis. Biologically important peptides-structure and functions (esp. insulin, glutathione, vasopressin) – Clasification – Properties, 3D structure – determination of amino acid sequence, denaturation, renaturation of protein molecules. Separation and purification of proteins – dialysis – Gel filtration – electrophoresis – Catabolism of amino acids: Transamination, oxidative deamination, decarboxylation – Urea cycle.

**UNIT III LIPIDS****(15 Hrs)**

Introduction, definition of fatty acids, Classification, saturated fatty acids, unsaturated fatty acids, EFA, structures, properties of fatty acids – Hydrolysis - acid number and saponification number, auto-oxidation(Rancidity) –Addition reactions – iodine number, Polenske number Reichert – Meissl number, acetyl number Structure and function of prostaglandins, tri-acyl glycerol. Structure and functions of phospholipids (esp. lecithin cephalin, phosphotidyl inositol and phosphotidyl serine) spingomyelin, plasmologens. Structure and function of glycolipids, cholesterol.

**UNIT IV NUCLEIC ACIDS****(15 Hrs)**

Nucleosides and nucleotides – purine and pyrimidine bases. Nucleic acids – DNA and RNA, **Watson** and Crick model, Replication, Transcription, Mutations and mutants, DNA repair, DNA sequencing and PCR, Recombinant DNA technology.

**UNIT V ENZYMES****(15 Hrs)**

Classification and properties- specificity, factors influencing enzyme action, Mechanism of enzyme action, Lock and key model and induced fit models. Coenzymes- Cofactors – Prosthetic groups and importance of them (TPP, NAD, NADP, FAD, ATP) Mechanism of inhibition (Competitive, non & uncompetitive and allosteric), Immobilization of enzymes, isoenzymes.

**TEXTBOOKS**

1. Biochemistry, Dr. Ambika Shanmugam, Published by Auth.
2. Essentials of Biochemistry, U.Sathyanarayana and U. Chakrapani, Books and Allied(P) Ltd., 2<sup>nd</sup> ed.,

## REFERENCES

1. Fundamentals of Biochemistry, J.L.Jain 4<sup>th</sup> revised Edition, S. Chand & Company Ltd.,
2. Advances in Bio Chemistry, S.N.SriharshaSonali Publications, New Delhi.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT 1 CARBOHYDRATES</b>			
	Classification, reducing and non-reducing sugars, Occurrence, structure. An introduction to mucopolysaccharide (proteoglycon). Reaction of Carbohydrates due to the presence of hydroxyl, aldehyde and ketone groups. Glycolysis, TCA cycle, energy yield, HMP pathway.	9	Lecture
	Biological importance of mono, di and polysaccharide (esp. starch, glycogen and cellulose).	3	Discussion
	Glycolysis, TCA cycle, energy yield, HMP pathway.	3	ICT
<b>UNIT 11 AMINO ACIDS AND PROTEINS</b>			
	Classification and structure of amino acids based on structure, Essential amino acids, structure of standard amino acid as zwitter ion, Chemical synthesis of poly peptide chain and solid phase polypeptide synthesis. Biologically important peptides, structure and functions (esp. insulin, glutathione, vasopressin) Classification, Properties, determination of amino acid sequence, denaturation, renaturation of protein molecules. Separation and purification of proteins, Catabolism of amino acids, Urea cycle.	10	Lecture
	Essential amino acids, Biologically important peptides	2	Seminar
	3D structure of proteins	3	ICT
<b>UNIT III LIPIDS</b>			
	Introduction, definition of fatty acids. Classification, saturated fatty acids, unsaturated fatty acids, EFA, structures, properties of fatty acids, Structure and function of prostaglandins, tri-acyl glycerol. Structure and functions of phospholipids, spingo myelin, plasmologens. Structure and function of glycolipids, cholesterol.	10	Lecture
	Importance of EFA	1	Discussion
	saturated fatty acids, unsaturated fatty acids (examples), structure and function of glycolipids, cholesterol.	4	ICT
<b>UNIT IV NUCLEIC ACIDS</b>			
	Nucleosides and nucleotides – purine and pyrimidine bases. Nucleic acids, DNA and RNA, <b>Watson</b> and Crick model, Replication, Transcription, Mutations and mutants, DNA repair, DNA sequencing and PCR, Recombinant DNA technology.	7	Lecture

	Mutations and mutants	1	Seminar
	Watson and Crick model, Replication, Transcription, Mutations and mutants, DNA repair, DNA sequencing and PCR, Recombinant DNA technology.	7	ICT
<b>UNIT V ENZYMES</b>			
	Classification and properties- specificity, factors influencing enzyme action, Mechanism of enzyme action, Lock and key model and induced fit models. Coenzymes, Cofactors, Prosthetic groups and importance of them, Mechanism of inhibition (Immobilization of enzymes, isoenzymes).	9	Lecture
	Mechanism of enzyme action, Lock and key model and induced fit models. Coenzymes, Mechanism of inhibition (Competitive, non & uncompetitive and allosteric),	6	ICT

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	5	4	3	4	4	4	4	5	3	3	4	4	4	3.93
CO2	4	5	4	3	4	4	4	4	5	3	3	4	4	3	3.86
CO3	4	4	5	3	4	4	4	4	5	3	4	4	4	3	3.93
CO4	4	5	4	3	4	4	4	4	5	3	3	4	4	3	3.86
CO5	4	4	5	4	4	4	4	4	5	3	4	4	4	3	4.00
Mean Overall Score															3.92

Result: The Score for this Course is 3.92 (High Relationship)

Programme :B.Sc Chemistry  
 Semester : V  
 Sub. Code : EC52

Part III: Elective Paper II  
 Hours : 5 /W, 75 /S  
 Credits : 5

**TITLE OF THE PAPER: ELECTIVE-2 FOOD CHEMISTRY**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class (Library session is conducted after the class hours).	ICT	
	5	3	1	1	
<b>PREAMBLE : The objectives of the course is to understand the nutritive value of food stuffs and nutraceuticals, detection of food adulteration, food additives and its restriction, food poisoning and dairy chemistry</b>					
<b>COURSE OUTCOME:</b> At the end of the Semester, the students will be able to				Unit	Hrs/ S
<b>UNIT 1 CO1:</b> demonstrate the nutritive value of food stuffs and nutraceuticals				1	15

<b>UNIT 2 CO2:</b> explain the detection of food adulteration	2	15
<b>UNIT 3 CO3:</b> discuss on food additives and its restriction	3	15
<b>UNIT 4 CO4:</b> demonstrate in detail about different Food Poisons.	4	15
<b>UNIT 5 CO5:</b> display an in-depth knowledge of Dairy chemistry	5	15

**Unit – I FOOD AND NUTRITION (15 Hrs)**

Food and nutrition – role of nutrients – nutritive value of food stuffs – cereals and millets, rice, wheat, pulses, nuts and oil seeds, vegetables, fruits, animal foods – meat, egg, fish. Nutraceuticals - flavour and aroma of food – cooking processes – chemistry of cooking – Principles of microwave cooking

**Unit – II FOOD ADULTERATION (15 Hrs)**

Food adulteration –contamination – list of food items and their contaminants – detection of adulteration – by simple techniques – prevention of food adulteration.

**Unit – III FOOD ADDITIVES (15Hrs)**

Food additives – reasons for adding additives – examples – artificial sweeteners – saccharin, cyclamate and aspartane. Food flavours – taste sensation – chemical composition of flavourings – common characteristics of flavourings- classification – synthetic flavourings – formulation of flavourings – artificial colours – restrictions in the usage of additives – emulsifying agents – leavening agents – baking powder – yeast – taste makers – MSG and vinegar.

**Unit – IV FOOD POISONS (15 Hrs)**

Food Poisons - Sources of chemical poisons in food – Toxins naturally present in food - sources and toxic effects of: toxic minerals and metals, organic toxicants in food, toxins present in fish. Toxins from other sources – metallic toxins, pesticides and pesticide residues – contaminants of fats and oils – microbial toxins.

**Unit – V : DAIRY CHEMISTRY (15 Hrs)**

Milk – definition – general composition of milk – constituents of milk – lipids, proteins, carbohydrates, vitamins and minerals. Physical properties of milk – colour, odour, acidity, specific gravity, viscosity and conductivity. Factors affecting the composition of milk – Pasteurization, homogenization, toning, standardization, reconstitution of milk – adulteration of milk – milk products – cream, butter, ghee, butter milk, yoghurt, curd , icecream.

**TEXT BOOKS**

1. Food Science by Sri Lakshmi; New Age International Publishers; 7<sup>th</sup> edition.
2. Fundamental Concepts of Applied Chemistry by Jayasree Ghosh, S.Chand& Company Ltd.,
3. Ancillary Chemistry for Home Science students by Thankamma Jacob.

**References:**

1. Text Book of Dairy Chemistry, D.D. Roy, P. Dinakar for ICAR, M.P. Mathur – 2008.
2. Text Book of Preventive and Social Medicine by Park and Park; Bhanot; 23<sup>rd</sup> edition (2015).

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT 1: FOOD AND NUTRITION</b>			
	Nutritive value of food stuffs	8	Discussion
	Nutraceuticals	4	Demowith charts
	Principles, advantages and disadvantages of microwave cooking	3	ICT
<b>UNIT II : FOOD ADULTERATION</b>			
	Food adulteration	3	Lecture
	Detection of adulterants by simple methods	10	Lab session, ICT
	Prevention of adulteration	2	Discussion
<b>UNIT III : FOOD ADDITIVES</b>			
	Food additives	2	Discussion
	Artificial sweeteners	2	Lecture and demo
	Flavoring	6	ICT&Lecture
	Restriction in usage of food additives	2	Demonstration
	Emulsifying agents, leavening agents and taste makers.	3	Lecture
<b>UNIT IV : FOOD POISONS</b>			
	Sources of chemical poisons in food	2	Lecture
	Toxins naturally present in food	2	Lecture, ICT& Lab Class
	Sources and toxic effects of: toxic minerals and metals	2	Lecture and Tutorial
	Organic toxicants in food	2	Lecture, ICT & Lab Class
	Toxins present in Fish	1	Lecture & Video
	Toxins from other sources- Metallic toxins	2	LectureandDemo stration Class
	Pesticides and Pesticide residues	1	Lecture and Demostration Class
	Contaminants of fats and oils	2	Lecture and Assignment
	Microbial toxins	1	Lecture, Seminar
<b>UNIT V : DAIRY CHEMISTRY</b>			
	Milk – definition, general composition of milk, constituents of milk, lipids, proteins, carbohydrates, vitamins and minerals.	3	Lecture, ICT & Lab Class
	Physical properties of milk – colour, odour, acidity, specific gravity, viscosity and conductivity	3	Lecture, assignment&Dem ostration Class
	Factors affecting the composition of milk	3	Lecture & Seminar

	Pasteurization, homogenization, toning standardization, reconstitution of milk	3	Lecture & Discussion
	Adulteration of milk – milk products – cream, butter, ghee, butter milk, yoghurt, curd, icecream.	3	Lecture

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	4	4	4	3	3	5	3	4	2	4	4	4	3	3.64
CO2	5	4	4	4	4	4	3	5	4	4	4	4	4	4	4.21
CO3	4	4	4	4	4	5	5	4	4	5	4	4	3	3	4.07
CO4	4	4	3	4	3	4	4	4	4	4	4	3	3	3	3.64
CO5	4	4	3	4	3	4	4	4	4	4	4	3	4	4	3.78
Mean Overall Score															3.87

Result: The Score for this Course is 3.87 (High Relationship)

**Programme :B.Sc Chemistry**

**Semester : V**

**Sub. Code :EC55**

**TITLE OF THE PAPER: POLYMER CHEMISTRY**

**Part III: Elective Paper 2**

**Hours : 5/W, 75 /S**

**Credits : 5**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class (Library session is conducted after the class hours).	ICT
	5	3	1	1

**PREAMBLE: The objective of the course is to make the student understand the definition classification with suitable examples, bonding structure of polymers and various determining methods of molecular mass of polymers, kinetics and mechanism of various polymerization**

<b>reactions, different kinds of polymer reactions and degradation, raw material and preparation of industrial polymers and different polymer processing techniques</b>		
<b>COURSE OUTCOME: At the end of the Semester, the students will be able to</b>	<b>Unit</b>	<b>Hrs /S</b>
<b>UNIT 1 CO1:</b> describe the chemistry behind structure and bonding of polymers and various methods of determining the molecular mass of polymers	1	15
<b>UNIT 2 CO2:</b> characterize the type of mechanisms and kinetics involved in synthesis of polymers	2	15
<b>UNIT 3 CO3:</b> exhibit knowledge of various polymer reactions and methods of degradation	3	15
<b>UNIT 4 CO4:</b> discuss the raw materials and methods of preparing industrially important polymers and elastomers	4	15
<b>UNIT 5 CO5:</b> analyze the additives involved in processing polymers and various processing techniques of polymers	5	15

**Unit – I INTRODUCTION TO POLYMERS (15 Hrs)**

Monomers, oligomers, polymers and their characteristics – classification of polymers: natural, synthetic, linear, cross linked, homopolymers and copolymers – bonding in polymers: primary and secondary bond forces – effect of polymer structure on properties – determination of molecular mass of polymers: number average molecular mass, weight average molecular mass – determination by viscosity, light scattering method, osmometry and ultra-centrifuging.

**Unit – II KINETICS AND MECHANISM OF POLYMERIZATION (15 Hrs)**

Chain growth polymerization: cationic, anionic, free radical polymerization – stereo regular polymers: Ziegler Natta catalyst – polycondensation: non catalysed, acid catalyzed – molecular weight distribution – step growth polymers – degrees of polymerization.

**Unit – III POLYMER REACTIONS AND DEGRADATION (15 Hrs)**

Introduction – hydrolysis, acidolysis, aminolysis, hydrogenation – addition and substitution reactions – cyclisation reactions – crosslinking reactions, vulcanization and cure reactions  
Polymer degradation – types of degradation – degradation by high energy radiation, ultrasonic waves – oxidative degradation – antioxidants.

**Unit – IV INDUSTRIAL POLYMERS (15 Hrs)**

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 - Buna - N, Buna-S and neoprene.  
Conducting Polymers: poly sulphur nitriles, poly phenylene, poly pyrrole and poly acetylene.  
Poly methylmethacrylate, polyimides, polyamides, polyurethanes, polyureas, polyethylene and polypropylene glycols

**Unit – V POLYMER PROCESSING (15 Hrs)**

Compounding: Polymer Additives: Fillers, Plasticizer antioxidants and thermal stabilizers fire retardants and colourants.

Processing Techniques: Calendaring, Die casting, Compression moulding, Injection moulding, Blow moulding, Extrusion moulding and Reinforcing, Foaming, Spinning of fibers and Mercerization.

### TEXT BOOKS

1. V.R. Gowariker, Polymer Science, Wiley Eastern, 1995.

### Reference books

2. F. N. Billmeyer, Textbook of Polymer Science, Wiley Interscience, 1971.

3. A. Kumar and S. K. Gupta, Fundamentals and Polymer Science and Engineering, Tata McGraw-Hill, 1978

4. B.K.Sharma - Industrial chemistry, Krishnaprakashan Media(P) Ltd (2014) 18<sup>th</sup>edn

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT I: INTRODUCTION TO POLYMERS</b>			
	Monomers, oligomers, polymers and their characteristics – classification of polymers: natural, synthetic, linear, cross linked, homopolymers and copolymers	4	Library followed by discussion
	bonding in polymers: primary and secondary bond forces – effect of polymer structure on properties, determination of molecular mass of polymers: number average molecular mass, weight average molecular mass	6	Lecture
	determination of molecular mass of polymers: number average molecular mass, weight average molecular mass	2	Problem solving session
	determination by viscosity, light scattering method, osmometry and ultra-centrifuging	3	ICT
<b>UNIT II: KINETICS AND MECHANISM OF POLYMERIZATION</b>			
	Chain growth polymerization: cationic, anionic, free radical polymerization, stereo regular polymers: Ziegler Natta catalyst, molecular weight distribution, step growth polymers, degrees of polymerization polycondensation: non catalysed, acid catalyzed	11	Lecture
	stereo regular polymers: Ziegler Natta catalyst, molecular weight distribution	3	ICT
	polycondensation: non catalysed, acid catalyzed	1	Seminar /peer teaching
<b>UNIT III: POLYMER REACTIONS AND DEGRADATION</b>			
	Introduction – hydrolysis, acidolysis, aminolysis, hydrogenation, addition and substitution reaction, Polymer degradation – types of degradation, oxidative degradation, antioxidants	8	Lecture
	cyclisation reactions – crosslinking reactions, vulcanization and cure reactions	4	ICT
	degradation by high energy radiation, ultrasonic waves	3	Seminar
<b>UNIT IV: INDUSTRIAL POLYMERS</b>			

	Raw material, preparation, fibreforming polymers, elastomeric material. Thermoplastics: Polyethylene, Polypropylene, polystyrene, Polyacrylonitrile, Poly Vinyl Chloride, Poly tetrafluoro ethylene, nylon and polyester.	7	Lecture
	Thermosetting Plastics: Phenol formaldehyde and epoxide resin. Elastomers: Natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene.	4	ICT
	Conducting Polymers: poly sulphur nitriles, poly phenylene, poly pyrrole and poly acetylene.	2	Lecture followed by discussion
	Poly methylmethacrylate, polyimides, polyamides, polyurethanes, polyureas, polyethylene and polypropylene glycols	2	Role play/ tutorial
<b>UNIT V: POLYMER PROCESSING</b>			
	Polymer Additives: Fillers, Plasticizers antioxidants and thermal stabilizers fire retardants and colourants.	5	Lecture
	Processing Techniques: Calendaring, Die casting, Foaming, Spinning of fibers and Mercerization	5	Lecture followed by Seminar / peer teaching
	Compression moulding, Injection moulding, Blow moulding, Extrusion moulding and reinforcing	5	ICT

Course Outcomes (COs)	Programme Outcomes (Pos)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	5	4	4	3	4	3	3	5	4	3	4	4	4	3.64
CO2	4	4	5	4	4	3	3	3	4	4	3	4	3	4	3.71
CO3	4	4	3	4	5	4	4	4	4	4	3	4	4	3	3.85
CO4	4	4	4	4	5	4	3	4	4	5	3	4	4	4	4.0
CO5	5	4	3	4	5	5	4	4	5	5	4	4	5	4	4.3
Mean Overall Score														3.90	

Result: The Score for this Course is 3.90 (High Relationship)

**Programme : B.ScChemistryPart III: Elective 3**

**Semester : VI**

**Hours : 5 /W, 75/S**

**Sub. Code : EC63**

**Credits: 5**

**TITLE OF THE PAPER: PHARMACEUTICAL CHEMISTRY**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class (Library session is conducted after the class hours).	ICT	
	5	3	1	1	
<b>PREAMBLE: The objectives of the course is to understand the effects, mechanism and metabolism of drugs, medically important compounds of Mg, Al, P, As, Hg, Fe, occurrence, isolation, absorption, storage, physiological functions and deficiency functions of vitamins, metabolism of P, Mg, Na, K, Fe, I<sub>2</sub> and Cl and metallic poisons and their treatment.</b>					
<b>COURSE OUTCOME:</b> At the end of the Semester, the Students will be able to				Unit	Hrs/S
<b>UNIT 1 CO1:</b> discuss the effects, mechanism and metabolism of drugs				1	15
<b>UNIT 2 CO2:</b> explain the medically important compounds of Mg, Al, P, As, Hg, Fe				2	15
<b>UNIT 3 CO3:</b> recognize the occurrence, isolation, absorption, storage, physiological functions and deficiency of vitamins				3	15
<b>UNIT 4 CO4:</b> describe the metabolism of P, Mg, Na, K, Fe, I <sub>2</sub> and Cl <sup>-</sup>				4	15
<b>UNIT 5 CO5:</b> explain the metallic poisons of As, Pb, Hg, Cu, nitrites , and their symptoms, actions, chemical test ant treatment.				5	15

**Unit – I (15hrs)**

Drugs: Definition – Effects of drugs (additive, synergistic, antagonistic) – mechanism of drug action – absorption of drugs – metabolism of drugs – factors influencing metabolism of drugs – Drug stability – medication (encapsulation, tablet medication, types of capsules)

**Unit – II (15hrs)**

Medically important compounds of Mg, Al, P, As, Hg and Fe:

Importance of Mg – Epsom, milk of magnesia - Aluminium hydroxide gel - Compounds of phosphorous – compounds of arsenic – compounds of mercury – mechanism of bactericidal action of compounds of mercury

**Unit – III (15hrs)**

Vitamins – Definition – Classification – provitamins – Occurrence, isolation absorption, storage, excretion and physiological functions of vitamin A, vitamin D, Vitamin E, Thiamine, pantothenic acid, nicotinic acid, pyridoxine, cobalamine and ascorbic acid. Vitamin deficiency.

**Unit – IV: (15hrs)**

Mineral metabolism: Calcium – source, daily requirement, blood calcium, hypocalcemia,

Phosphorus – functions of phosphate, requirement, source, serum level.

Magnesium – requirement, source, normal serum level, functions

Sodium – normal level of sodium, excretion of sodium, restriction of sodium in diet, hypernatremia.

Potassium – requirement, source, function.

Chloride –importance of chloride ion, serum level, hypochloremia

Iron – Total iron content – requirement – source – iron deficiency

Iodine – daily requirement – goitrogens – biological role.

**Unit – V: (15hrs)**

Metallic poisons and their treatments: Arsenic – poisonous compound- action, signs and symptoms, treatment, chemical test. Mercury – poisonous compounds – symptoms – treatment – chemical test. Lead – poisonous compounds – action – treatment – plumbism – signs and

symptoms – treatment – chemical test. Copper – poisonous compounds – signs and symptoms – treatment – chemical test. Nitrites – source – action – symptoms, treatment – methanemoglobinaemia – causes – treatment.

### TEXT BOOKS

1. Pharmaceutical chemistry by Dr.S.Lakshmi ,
2. Industrial Chemistry by B.K.Sharma; Krishna Prakashan Media(p) Ltd 2011

### References:

1. Text Book of biochemistry for medical students by D.M.Vasudeva and S.Sreekumari; Jaypee Brothers Medical Publishers ; 8<sup>th</sup> edition
2. The essentials of Forensic Medicine and toxicology by Dr.K.S.Narayan Reddy; Jaypee Brothers Medical Publishers ; 3<sup>rd</sup> edition

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1 to describe the physiological effects of drugs and its interaction			
	Effects of drugs,	3	Lecture
	mechanism of drugs	3	ICT and Demonstration
	Absorption of drugs	3	Lecture
	Metabolism of drugs	3	Lecture
	Factors influencing metabolism of drugs	3	Lecture and Group Discussion
UNIT II Input on Medically important compounds			
	Role of Compounds of Mg	3	Practical demo and Lecture
	Role of Compounds of Al	3	ICT and Lecture
	Role of Compounds of P	3	Lecture and Assignment
	Role of Compounds of As	3	Lecture and Peer Teaching
	Compounds of Hg	3	ICT and Lecture
UNIT III Enrich the knowledge on Vitamins and Physiological actions			
	Vitamins, classification, provitamins	1	Discussion
	Vitamin B & C	3	Lecture
	Vitamins A ,D, E, K	5	Lecture
	Deficiency diseases of vitamins	3	ICT and Quiz
	Physiological functions	3	Peer teaching and Lecture
UNIT IV grasping the fundamentals of mineral metabolism			
	Metabolism of Ca and P	3	ICT and Lecture
	Metabolism of Iron	3	ICT and Lecture
	Metabolism of Na and K	3	ICT and Lecture
	Metabolism of Mg	3	Lecture and Group Discussion
	Metabolism of Chloride and Iodine	3	Lecture
UNIT V Awareness and indepth knowledge in Metallic poison			

	Arsenic poisoning- actions, signs and symptoms, chemical tests and treatment	3	ICT and Lecture
	Lead poisoning- actions, signs and symptoms, chemical tests and treatment	3	ICT and Lecture
	Mercury poisoning- actions, signs and symptoms, chemical tests and treatment	3	ICT and Lecture
	Copper poisoning- actions, signs and symptoms, chemical tests and treatment	3	Peer teaching and Lecture
	Nitrites poisoning- actions, signs and symptoms, chemical tests and treatment	3	Assignment and Lecture

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	4	5	3	3	4	4	4	4	3	4	4	4	4	3.85
CO2	4	4	3	3	4	4	4	4	3	4	4	4	4	4	3.78
CO3	4	5	3	3	4	3	5	3	4	4	4	4	3	3	3.71
CO4	4	4	3	4	5	4	3	3	4	4	4	4	3	4	3.78
CO5	4	4	3	4	4	4	4	3	3	4	4	3	4	3	3.64
Mean Overall Score														3.75	

Result: The Score for this Course is 3.75 (High Relationship)

Code :EC66

Credits: 5

**TITLE OF THE PAPER: AGRICULTURAL CHEMISTRY**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class (Library session is conducted after the class hours).	ICT	
	5	3	1	1	
<b>PREAMBLE: The objective of the course is to make the student understand the properties and components of soil, principles and types of organic manures, inculcate the chemistry of fertilizers, pesticides and various soil sampling and methods of analysis.</b>					
<b>COURSE OUTCOME</b>				Unit	Hrs /S
At the end of the Semester, the Students will be able to					
<b>UNIT 1 CO1:</b> demonstrate the skills in assessing soil suitability for various agricultural and non-agricultural uses by means of understanding various physical, chemical and biological properties and their impact on plant growth.				1	15
<b>UNIT 2 CO2:</b> explore the types of manures and analyze the importance of using various ecological farming techniques to preserve soil's natural composition				2	15
<b>UNIT 3 CO3:</b> assess the need and effects of using artificial fertilizers, describe the preparation and properties of some industrially important artificial fertilizers				3	15
<b>UNIT 4 CO4:</b> describe various chemical materials developed to assist in the production of food such as insecticides fungicides and herbicides				4	15
<b>UNIT 5 CO5:</b> apply analytical procedures and methods in the analysis of soil and plants and recommend soil remediation based on the analysis.				5	15

**Unit –ISOIL CHEMISTRY****(15 Hrs)**

Components of soil – physical and chemical properties of soil – factors controlling soil pH and influence of soil reaction on availability of nutrients – soil colloids – soil organic matter – soil air – soil water – retention, soil moisture constant – macro and micro plant nutrients.

**Unit – II ORGANIC MANURES AND ORGANIC FARMING****(15 Hrs)**

General principles of manuring – special and general manures– action of manures on chemical and physical properties of soil – advantages of using manures in farming – Natural manures – Farm yard and liquid manures – composition and application – properties and composition of vegetable and animal manures with examples –ecological farming – biofertilizers, vermicompost – organic farming – advantages of organic farming

**Unit –III FERTILIZERS****(15 Hrs)**

Need for fertilizers – essential requirements –classification of fertilizers – preparation and importance of artificial fertilizers – urea, ammonium nitrate, calcium cyanamide, phosphate rock, superphosphate, triple superphosphate – potassium fertilizers – NPK fertilizers – mixed fertilizers – compound fertilizers – effects of fertilizers.

**Unit –IV PESTICIDES****(15 Hrs)**

Insecticides – natural insecticides – organic insecticides – DDT, Alderin&dielldrin, endrin and p – DCB – fumigants –rodenticides

Fungicides – inorganic (Bordeaux mixture) organic (dithiocarbamate) – industrial fungicides  
Herbicides and weedicides – 2,4-D and 2,4,5 –T (structure and function), treflan

### Unit – VSOIL TESTING

(15 Hrs)

Soil sample collection and preparation – dry and moist soil – soil pH determination – lime requirement determination – procedure for determining nitrogen – PPNT and PSNT test – phosphorus – potassium – micronutrients – measuring cation exchange capacity of soil – soil chloride analysis

### TEXT BOOKS

1. Elements of agriculture chemistry – Thomas Anderson, Andesite press (2015)
2. Industrial chemistry – B.K.Sharma, Krishna prakashan Media(P) Ltd(2014) 18<sup>th</sup>edn

### Reference books

1. Agricultural chemistry – B.A.Yagodin, Mir publishers (Moscow) 1976.
2. Soil sampling and methods of analysis – M.R.Cartar, Gregorich (2<sup>nd</sup>edn, 2008) CRC press.
3. Soil physical analysis – R.A.Singh, kalyani publishers, 1980.
4. Environmental chemistry – B.K.Sharma, Krishna prakashan Media(P) Ltd, (2014) 14<sup>th</sup>edn.
5. Principles of inorganic chemistry, Puri, Sharma, Kalia, ShobanLalNaginchand& co., 24<sup>th</sup>edn, 1990.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT I: SOIL CHEMISTRY</b>			
	Components of soil, physical and chemical properties of soil	5	Lecture
	factors controlling soil pH and influence of soil reaction on availability of nutrients	4	Discussion / peer teaching
	soil colloids, soil organic matter, soil air, soil water, retention, soil moisture constant	3	ICT
	macro and micro plant nutrients	3	Seminar / assignment
<b>UNIT II: ORGANIC MANURES AND ORGANIC FARMING</b>			
	General principles of manuring, special and general manures, action of manures on chemical and physical properties of soil, advantages of using manures in farming	4	Discussion/ seminar/ peer teaching
	Natural manures, Farmyard and liquid manures, composition and application	4	Lecture
	properties and composition of vegetable and animal manures with examples	3	Library session followed by discussion/ quiz
	ecological farming – biofertilizers, vermicompost, organic farming	4	ICT
<b>UNIT III: FERTILIZERS</b>			
	Need for fertilizers – essential requirements – classification of fertilizers	4	Lecture

	preparation and importance of artificial fertilizers – urea, ammonium nitrate, calcium cyanamide	4	Seminar /assignment
	phosphate rock, superphosphate, triple superphosphate	3	ICT
	potassium fertilizers – NPK fertilizers – mixed fertilizers – compound fertilizers – effects of fertilizers	4	Discussion/ quiz
<b>UNIT IV: PESTICIDES</b>			
	Insecticides, natural insecticides, fumigants, rodenticides	4	Lecture
	organic insecticides – DDT, Alderin&dieldrin, endrin and p – DCB	4	ICT
	Fungicides – inorganic (Bordeaux mixture) organic (dithiocarbamate) – industrial fungicides	4	Peer teaching/ assignment
	Herbicides and weedicides – 2,4-D and 2,4,5 –T (structure and function), treflan	3	Library session/ quiz
<b>UNIT V: SOIL TESTING</b>			
	Soil sample collection and preparation for dry and moist soil	4	Peer teaching/ seminar
	soil pH determination, lime requirement determination	4	Lecture
	procedure for determining nitrogen – PPNT and PSNT test, phosphorus, potassium, micronutrients	4	ICT
	measuring cation exchange capacity of soil – soil chloride analysis	3	Discussion

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	
CO1	4	4	3	5	5	4	3	4	4	4	3	4	4	4	3.92
CO2	4	4	4	5	5	4	4	3	4	3	3	5	5	4	4.07
CO3	4	4	3	4	4	3	4	3	3	3	3	4	3	3	3.42
CO4	4	3	3	5	5	3	4	4	3	3	3	4	4	4	3.71
CO5	5	4	4	5	5	4	4	5	5	5	4	4	5	5	4.0
Mean Overall Score														3.82	

Result: The Score for this Course is 3.82 (High Relationship)

**Programme :B.Sc Chemistry**  
**Semester : III**  
**Sub. Code : SC31**

**Part IV: Skill based Elective 1**  
**Hours : 2 /W, 30 /S**  
**Credits :2**

**TITLE OF THE PAPER: SMALL SCALE INDUSTRIES**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class (Library session is conducted after the class hours).	ICT	
	2	1	(1hr if needed)	1	
<b>PREAMBLE:</b> The objective of the course is to inspire the students of both Chemistry and Non-Chemistry departments to engage themselves in self-employment schemes. To provide adequate information about the foundation they need to develop a business. To provide methods and materials for the preparation of a few commodities which are used in our everyday life					
<b>COURSE OUTCOME</b>				Unit	Hrs/S
At the end of the Semester, the Students will be able to					
<b>UNIT 1 CO1:</b> discuss the Scope of small scale industries, industries that can be stated or developed location of industries, and describe the steps to be taken before constructing or establishing a factory , licenses registration.				1	6
<b>UNIT 2 CO2:</b> discuss the Indian organizations assisting small scale industries.				2	6
<b>UNIT 3 CO3:</b> explain the preparation of Tooth powder, tooth paste, Talcum powder, shampoo, handkerchief perfumes, dry perfume sachets, soap powder, dishwashing powder, various soaps & toilet cleaning liquids.				3	6
<b>UNIT 4 CO4:</b> demonstrate the wax products, candles, boot polish, furniture polish paste. describe Inks, blue, red, blue black, white board marker, printing inks and ink for stamp pad.				4	6
<b>UNIT 5 CO5:</b> explain safety matches, agarbathies-naphthalene balls, chalk crayons, insecticides such as lice killer, mosquito repellent, cockroach terminator & moth repellent and discuss simple medicines: Pain balm, digestive tablets, disinfectant solutions.				5	6

**Unit I: (6 hrs)**

Scope of small-scale industries- definition of small scale industry, cottage industry, village industry- industries that can be stated or developed – location of industries – steps to be taken before constructing or establishing a factory – licenses – registration.

**Reference books:**

- 1) Reference book and Directory for small industries – Malik and Aggarwal, Small Industry Research Institute, New Delhi (1975-1976)
- 2) (Tamil) Siruthozhilhalsila --- Oruarimugam, Vasan, New Century Book House Pvt.Ltd., Chennai, 1985.

**Unit II: (6 hrs)**

Indian organizations assisting small scale industries, agencies promoting industries, such as IDBI, SISI, SIPCOT etc.

**References:**

- 1) Entrepreneurial Development, Dr. L. Rangarajan, Sree Ranga Publications, Rajapalayam.
- 2) [www.techno-preneur.net](http://www.techno-preneur.net)

**Unit III: (6 hrs)**

Preparation of Tooth powder, toothpaste, Talcum powder, shampoo, Handkerchief perfumes, dry perfume sachets, soap powder, dishwashing powder, various soaps, toilet cleaning liquids.

**References:**

- 1) Small scale industries, B.S.Sekar, Jaime Publications, Bombay, 1975.
- 2) (Tamil) NeengalumSiruthozhilnadathalam, S. A.Soosairaja, New Century Book House Pvt. Ltd., Chennai, 1983.
- 3) Hand Book of Soap Industries, Malik and Dhingra, Small Industry Research Institute, Delhi (1974-1975)

**Unit IV: (6 hrs)**

Wax products – candles, boot polish, furniture polish paste.

Inks – blue, red, blue black, white board marker, printing inks, ink for stamp pad.

**References:**  
Small Scale industries by B.S.Sekar, Jaime Publications, Bombay, 1975.

**Unit V: (6 hrs)**

Safety matches- agarbathies-naphthalene balls- chalk crayons

Insecticides such as lice killer, mosquito repellent, cockroach terminator, moth repellent.

Simple medicines: Pain balm, digestive tablets, disinfectant solutions.

**References:**

- 1) Small Scale industries by B.S.Sekar, Jaime Publications, Bombay, 1975.
- 2) (Tamil) NeengalumSiruthozhilnadathalam, S. A.Soosairaja, New Century Book House Pvt. Ltd., Chennai, 1983.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1:			
	Know about Scope of small scale industries. Define small scale industry, cottage industry, village industry, Explain industries that can be started or developed location of industries, Describe steps to be taken before constructing or establishing a factory, license registration.	2 3 1	Assignment  Lecture ICT
UNIT 11			

	Know about the Indian organizations assisting small scale industries, describe agencies promoting industries, such as IDBI, SISI, SIPCOT etc.	3 3	ICT Group discussion & Lecture
UNIT III			
	Explain Preparation of Tooth powder, toothpaste, Demonstrate Talcum powder, shampoo, Handkerchief perfumes, dry perfume sachets, Describe soap powder, dishwashing powder, various soaps and toilet cleaning liquids.	2 2 2	ICT Lecture Assignment
UNIT IV			
	Demonstrate wax products, candles, boot polish, furniture polish paste. Describe Inks, blue, red, blue black, white board marker, printing inks, ink for stamp pad.	3 3	ICT Assignment
UNIT- V			
	Safety matches, agarbathies-naphthalene balls- chalk crayons, Insecticides such as lice killer, mosquito repellent, cockroach terminator, moth repellent. Simple medicines: Pain balm, digestive tablets, disinfectant solutions.	2 2 2	ICT Lecture and Discussion

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of Cos
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	
CO1	5	4	4	3	5	5	4	4	4	4	3	3	3	5	4.0
CO2	4	4	3	4	5	5	4	4	3	4	4	4	3	5	4.0
CO3	5	4	4	3	5	5	4	4	4	4	3	3	4	4	4.0
CO4	4	4	3	4	5	5	4	4	3	4	4	4	3	4	3.93
CO5	4	4	4	3	5	5	4	4	4	4	3	3	4	4	3.93
Mean Overall Score														3.97	

Result: The Score for this Course is 3.97 (High Relationship)

Programme : B.Sc Chemistry  
 Semester : III & IV  
 Sub. Code : SC42

Part IV: Skill Based Elective 2  
 Hours : 1 /W, 15 /S  
 Credits : 2

**TITLE OF THE PAPER: ANALYTICAL CHEMISTRY**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class (Library session is conducted after the class hours).	ICT	
	1	1	(1hr if needed)	1	
<b>PREAMBLE: The objective of the course is to make the student understand analytical chemistry and its importance.</b>					
<b>COURSE OUTCOME: At the end of the Semester, the Students will be able to</b>				Unit	Hrs/S
<b>UNIT 1 CO1:</b> demonstrate the methods to handle the corrosive and carcinogenic chemicals, various methods to store chemicals				1	3
<b>UNIT 2 CO2:</b> discuss some first aid procedures for accidents due to chemicals such as acid, alkali, poisonous chemicals and heat burns				2	3
<b>UNIT 3 CO3:</b> explain the separation of solid mixture and miscible liquids				3	3
<b>UNIT 4 CO4:</b> identify the types of error and causes of their occurrence in our analysis				4	3
<b>UNIT 5 CO5:</b> describe the theory, principle and instrumentation of thermo analytical methods				5	3

**Unit I: (6 hrs)**

**Laboratory hygiene and safety:** Storage and handling of corrosive, flammable, explosive, toxic, carcinogenic and poisonous chemicals.

**Simple first aid procedure for accidents:** acid in eye, alkali in eye, acid burns, alkali burns, bromine burns, poisoning, inhalation of gases, cut by glasses and heat burns.

**Unit II: (6 hrs)**

**Separation and purification techniques:** Solvent extraction, desiccant, vacuum drying, distillation, reduced pressure distillation, fractional distillation, steam distillation, azeotropic distillation, crystallization and sublimation – principles and techniques.

**Unit III: (6 hrs)**

**Error Analysis:** Definitions – terms –absolute and relative error – precision and accuracy . Classification of errors – confidence limit – students’ “t” test- rejection of experimental data – Q test – sources and elimination of errors – significant figures and computation.

**Analysis of experimental results:** Graphical methods – curve fitting – method of least squares

**Unit – IV: (6hrs)**

**Principle of gravimetric analysis** – Formation of precipitate – coprecipitation - post precipitation – adsorption – precipitation from homogeneous solution.

**Unit – V: (6hrs)**

**Thermoanalytical methods** – principles involved in thermogravimetric analysis and differential thermal analysis – characteristics of thermogravimetric and differential thermal analysis curves. Factors affecting TGA and DTA curves – applications of TGA. and DTA.

**Textbooks:**

1. Elements of analytical chemistry by Gopalan et al; Sultan Chand & Sons.
2. Instrumental methods of Chemical Analysis by B.K.Sharma; Krishna Prakashan Media ; 2011.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT 1: Laboratory hygiene and safety: Simple first aid procedure for accidents:</b>			
	Storage and handling of corrosive, flammable, explosive, toxic,	4	Lecture
	First aid procedure for accidents acid in eye, alkali in eye, acid burns, alkali burns	3	Discussion
	carcinogenic and poisonous chemicals.	3	ICT
	bromine burns, poisoning, inhalation of gases, cut by glasses and heat burns	2	Assignment
<b>UNIT II Separation and purification techniques</b>			
	principles and techniques: Solvent extraction, desiccant, vacuum drying, distillation, reduced pressure distillation	5	Lecture
	fractional distillation and steam distillation	3	Seminar
	azeotropic distillation,	2	ICT
	crystallization and sublimation	2	Assignment
<b>UNIT III :Error Analysis, Analysis of experimental results</b>			
	<b>Error Analysis</b> Definitions – terms –absolute and relative error – precision and accuracy-	4	Lecture
	Classification of errors – confidence limit – students’ “t” test- rejection of experimental data, significant figures and computation.	5	Group discussion Discussion, Problem solving session
	Q test sources elimination of errors Graphical methods – curve fitting – method of least squares	3	ICT
<b>UNIT IV :Principle of gravimetric analysis</b>			

	Formation of precipitate, co-precipitation, post precipitation, Adsorption- Precipitation from homogeneous solution	12	Lecture, Assignment/Seminar
<b>UNIT V Principle of gravimetric analysis</b>			
	Principles involved in thermo gravimetric analysis and differential thermal analysis	5	Lecture
	characteristics of thermo gravimetric and differential thermal analysis curves	3	ICT
	Factors affecting TGA and DTA curves	2	Discussion
	Applications of TGA and DTA.	2	Peer teaching

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	5	4	3	4	4	4	4	5	3	4	4	4	3	3.93
CO2	4	5	4	3	4	4	4	4	5	3	4	4	4	3	3.93
CO3	4	5	4	3	4	4	4	4	5	3	4	4	4	3	3.93
CO4	5	5	4	3	4	4	4	4	5	3	2	4	4	3	3.86
CO5	4	5	4	3	4	4	4	4	5	3	4	4	4	3	3.93
Mean Overall Score														3.92	

Result: The Score for this Course is 3.92 (High Relationship)

Programme : B.Sc Chemistry  
 Semester : IV  
 Sub. Code : SC43

Part IV: Skill Based Elective 3  
 Hours : 2 /W, 30 /S  
 Credits : 2

**TITLE OF THE PAPER: CHEMISTRY FOR COMPETITIVE EXAMINATIONS**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar//Discussion//Problem solving session/Quiz/videos/Library session.	ICT	
	2	1	1 ( if needed )	1	
<b>PREAMBLE: The objective of the course is to train the students face any competitive examinations for jobs or entrance examinations for higher studies with confidence and to develop the skill to answer multiple choice questions.</b>					
<b>COURSE OUTCOME:</b> At the end of the Semester, the Students will be able to				Unit	Hrs P/S
<b>UNIT I CO I;</b> discuss General characteristics of alkanes,alkenes,alkynes, stereochemistry, Explain carbohydrates,hybridization,polar effects.				1	6
<b>UNIT 2 CO 2;</b> describe the periodic properties, metallurgical processes, types of chemical bonding and Nuclear chemistry.				2	6
<b>UNIT 3 CO3:</b> explain Colligative properties, Phase rule, Catalysis, chemical kinetics and electrochemistry.				3	6
<b>UNIT 4 CO4:</b> apply the concepts of volumetric analysis, thermo gravimetric analysis.				4	6

<b>UNIT 5 CO5:</b> discuss the properties of Paints, varnishes, cement, fuels, soaps and detergents, insecticides.	5	6
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**Unit I: (6 hrs)**

Multiple choice questions in organic chemistry

**Unit II: (6hrs)**

Multiple choice questions in Inorganic chemistry

**Unit III(6hrs)**

Multiple choice questions in Physical Chemistry

**Unit IV: (6hrs)**

Multiple choice questions in Analytical Chemistry

**Unit V: (6hrs)**

Multiple choice questions in Applied Chemistry

Internal : 25 marks

External : 15 questions in each unit ( 1mark each) – no choice.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT 1: Organic chemistry</b>			
	General characteristics of alkanes, alkenes, alkynes.	4	Lecture
	Stereochemistry.	1	ICT
	Carbohydrates, hybridization, polar effects.	1	Quiz
<b>UNIT II: Inorganic chemistry</b>			
	periodic properties, metallurgical processes	3	Lecture
	types of chemical bonding	2	Quiz
	Nuclear chemistry	1	ICT
<b>UNIT III : Physical Chemistry</b>			
	Colligative properties	1	Lecture
	Phase rule	1	ICT
	Catalysis	1	Lecture
	chemical kinetics	1	Lecture
	electrochemistry	2	ICT and Quiz.
<b>UNIT IV : Analytical Chemistry</b>			
	concepts of volumetric analysis.	3	Demo
	thermogravimetric analysis	3	ICT, Lecture, & Assignment.
<b>UNIT V : Applied Chemistry</b>			
	properties of Paints, varnishes, cement, fuels, soaps and detergents, insecticides.	3	Lecture &

			Group Discussion
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Course Outcomes (COs)	Programme Outcomes (Pos)							Programme Specific Outcomes (PSOs)							Mean scores of Cos
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	3	3	3	4	5	5	4	5	4	3	4	5	5	3	4
CO2	4	5	4	4	4	4	3	5	4	3	4	4	5	3	3.9
CO3	3	3	3	4	5	5	4	5	4	3	4	5	5	3	4
CO4	4	4	3	4	5	5	3	4	3	3	3	5	4	4	3.85
CO5	4	5	4	4	4	4	3	5	4	3	4	4	5	3	3.9
Mean Overall Score															3.93

Result: The Score for this Course is 3.93 (High Relationship)

**Programme :B.Sc Chemistry**

**Semester : V & VI**

**Sub. Code : SC65**

**Part IV: Skill Based Elective 5**

**Hours : 1 /W, 15/S**

**Credits : 2**

**TITLE OF THE PAPER: COMPUTER APPLICATIONS IN CHEMISTRY**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class (Library session is conducted after the class hours).	ICT	
	1	1	1hr(if needed)	-	
<b>PREAMBLE: The objective of the course is to make the student understand basics of structures, variables, constants, operators, expressions, keywords and control structures of C programming, construct and solve the simple chemistry problems using C programming and applications of MS office and Internet</b>					
<b>COURSE OUTCOME: At the end of the Semester, the Students will be able to</b>				Unit	Hrs /S
<b>UNIT 1 CO1: demonstrate the fundamentals of structure data types, variables, constants, key words, operators, identifiers and instructions in C programming.</b>				1	3
<b>UNIT 2 CO2: explain control structures like if, if-else, goto, if-then, if-then-else, for.... Next loop, while and do ..... while loop in C programming.</b>				2	3

<b>UNIT 3 CO3:</b> construct the simple C programs of Conversion of Celsius temperature to Kelvin temperature, Conversion of Celsius to Fahrenheit, Beer-Lambert's law Molecular weights from atomic weights, Bohr radius, Average, RMS, and most probable velocities of gas molecules.	3	3
<b>UNIT 4 CO4:</b> solve the chemistry problems like Rydberg equations, Energy of electromagnetic radiations, Clapeyron – Clausius equation, Rate constant for a first order reaction and Henderson equations using C programming language.	4	3
<b>UNIT 5 CO5:</b> gather extensive knowledge of MS Office like MS word, MS power point presentation, MS excel and Applications of Internet.	5	3

**Unit: I C PROGRAMMING****(6Hrs)**

Elementary features of C programming – Character set of C Language, Key words, Constants, Identifiers, Variables, Data types, Operators and Instructions.

**Unit II: (CONTROL STRUCTURES IN C PROGRAMMING (6Hrs)**

Decision Control in C Program–if, if-else, go to, For ....while loop, do ..... While loop

**Unit III: SIMPLE CHEMISTRY PROGRAMS I****(6Hrs)**

Examples of +simple Chemistry programs in C Language: 1) Conversion of Celsius temperature to Kelvin temperature. Conversion of Celsius to Fahrenheit and vice- versa 2) Application of Beer-Lambert's law 3) Molecular weights from atomic weights, 4) Bohr radius, 5) Average, RMS, and most probable velocities of gas molecules

**Unit IV: SIMPLE CHEMISTRY PROGRAMS I****(6Hrs)**

Chemistry programs in C Language –  $\Delta E$  for atomic spectral transitions using Rydberg equations, 7) Energy of electromagnetic radiations, 8) Enthalpy change using Clapeyron – Clausius equation, 9) Rate constant for a first order reaction, 10) pH of a buffer solution using Henderson equations.

**Unit V: MS OFFICE AND BROWSING INTERNET****(6Hrs)**

MS Office (Microsoft word, excel, powerpoint, access) and browsing internet.

**Textbooks:**

1. Computers in Chemistry by K.V.Raman; Tata McGraw Hill Education Pvt Ltd; 2004
2. C Programming by E.Balagurusamy McGraw Companies; 3<sup>rd</sup> edition

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT I: C PROGRAMMING</b>			
	Elementary features of C programming	2	Lecture
	Structure data types in C programming	1	Lecture
	Variables and Constants in C programming	1	Lecture
	Key Words and Operators in C programming	1	Seminar/peer teaching
	Identifiers and Instructions in C programming	1	ICT
<b>UNIT II: CONTROL STRUCTURES IN C PROGRAMMING</b>			
	Decision Control in C Program–if, if-else, go to	2	Lecture

	Control structures in C– if-then and if-then-else,	2	Discussion/ peer teaching
	Control structures in C – for.... Next loop	1	Lecture
	Control structures in C – while, do ..... while loop	1	ICT
<b>UNIT III: SIMPLE CHEMISTRY PROGRAMS I</b>			
	Conversion of Celsius temperature to Kelvin temperature and vice- versa, Conversion of Celsius to Fahrenheit and vice- versa	2	Lecture
	Application of Beer-Lamber’s law and Molecular weights from atomic weights, Bohr radius	2	Lecture , Discussion/Assignment
	Average, RMS, and most probable velocities of gas molecules	2	Seminar/Peer teaching
<b>UNIT IV : SIMPLE CHEMISTRY PROGRAMS II</b>			
	$\Delta E$ for atomic spectral transitions using Rydberg equations	2	Lecture
	Energy of electromagnetic radiations and Enthalpy change using Clapeyron – Clausius equation,	2	Lecture
	Rate constant for a first order reaction	1	Library / assignment
	pH of a buffer solution using Henderson equations	1	ICT
<b>UNIT V: MS OFFICE AND BROWSING INTERNET</b>			
	MS word	2	Lecture
	MS power point presentation	2	ICT, Seminar
	MS excel, Applications of Internet	2	Group Discussion

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	4	3	3	4	4	4	4	3	4	3	4	4	3	3.64
CO2	3	3	4	4	4	4	4	4	3	4	3	4	4	3	3.64
CO3	4	3	3	4	3	3	4	3	3	4	4	4	4	3	3.50
CO4	3	4	4	4	4	4	4	4	3	4	4	4	4	3	3.79
CO5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4.00
Mean Overall Score														3.71	

Result: The Score for this Course is 3.71 (High Relationship)

**Programme :B.Sc Chemistry**  
**Semester :VI**  
**Sub. Code : SC66**

**Part IV: Skill Based Elective 6**  
**Hours : 2 /W, 30 /S**  
**Credits : 2**

**TITLE OF THE PAPER: WATER TREATMENT**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class (Library session is conducted after the class hours).	ICT
	2	1	-	1

**PREAMBLE: The objective of the course is to inculcate student the importance of purity of water and the methods used in purifying the water in large and small scale for human consumption.**

COURSE OUTCOME: At the end of the Semester VI, the Students will be able to	Unit	Hrs /S
UNIT 1 CO1: explain uses of water,hydrologicalcycle,acidrain, artificial rain,rainwater harvesting,sources of water, water borne diseases and substances affecting potability of water	1	6
UNIT 2 CO2: discusscolour,taste,odour,turbidity,sediment and microorganisms in water,concept of hardness-types-EDTA method of estimation,softening methods-lime addition,sodium carbonate addition and ion exchange method.	2	6
UNIT 3 CO3: describe the methods of clarification of water,electro chemical coagulation of water,chemical and physical methods of sterilization of water.	3	6
UNIT 4 CO4: analyse BOD and COD of water by chemical methods and discuss various methods of demineralization and desalination of water.	4	6
UNIT 5 CO5:explain various methods of removing colour,odour,taste,iron, manganese,fluorine,slime,algae and excess oxygen	5	6

**Unit – I:****(6 Hrs)**

Uses of water- safe and wholesome water – sources of water supply: Rain: hydrological cycle, acid rain, artificial rain, rain water harvesting. – surface water: impounding reservoir, river and tanks – their characteristics and impurities. Ground water: wells and springs. Water borne diseases. Substances affecting the potability of water.

**Unit – II****(6 Hrs)**

Effects of impurities in natural waters: colour, taste and odour, turbidity and sediment and micro organism. Dissolved mineral matter- hardness – types – Estimation (EDTA method) – methods of softening – boiling, addition of lime – addition of sodium carbonate – ion exchange method.

**Unit – III****(6 Hrs)**

Clarification of water: sedimentation and filtration. Coagulation of water – electrochemical coagulation – flocculants – sterilization and disinfection of water: Chemical methods and physical methods.

**Unit IV:****(6 Hrs)**

Demineralization of water – ion exchange process - Desalination of sea water: electro dialysis method, reverse osmosis methods.

Water analysis: physical examination – Chemical examination - bacteriological examination – BOD, COD.

**Unit – V:****(6 Hrs)**

Miscellaneous methods of water treatment: Colour, odour and taste removal- iron and manganese removal – fluoridation – defluoridation – prevention of plumbosolvency – removal of slime and algae from water - deoxygenation of water.

**Textbooks:**

1. Industrial Chemistry by B.K.Sharma Krishna Prakashan Media Pvt Ltd 2011
2. Text Book of Preventive and Social Medicine by Park and Park; Bhanot 23<sup>rd</sup> edition 2013
3. Engineering Chemistry by S.S.Dara S Chand & company



CO1	4	4	3	3	4	4	4	4	3	4	3	4	4	3	3.64
CO2	3	3	4	4	4	4	4	4	3	4	3	4	4	3	3.64
CO3	4	3	3	4	3	3	4	3	3	4	4	4	4	3	3.50
CO4	3	4	4	4	4	4	4	4	3	4	4	4	4	3	3.79
CO5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4.00
Mean Overall Score															3.71

Result: The Score for this Course is 3.71 (High Relationship)

**Programme :B.Sc (Physics/Zoology/HomeScience /Botany) Part III:Allied**  
**Semester :III Hours : 4 /W, 60/S**  
**Code : AC1 Credits :3**

**TITLE OF THE PAPER: ANCILLARY CHEMISTRY – I**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class(Library session is conducted after the class hours).	ICT	
	4	2	1	1	
<b>PREAMBLE: The objective of the course is to make the student understand the principles behind basic laboratory techniques involved in organic analysis, titrations and clinical chemistry, also gains an idea on metallurgy, adsorption, catalyst and photochemistry.</b>					
<b>COURSE OUTCOME: At the end of the Semester, the Students will be able to</b>				Unit	Hrs /S
<b>UNIT 1 CO1:</b> gain knowledge on purification of organic compounds and summarize chemical reactions involved in organic analysis				1	12
<b>UNIT 2 CO2:</b> identify the types of oxides, various processes involved in extraction of metals from their ores preparation, properties and uses of industrially important inorganic compounds				2	12
<b>UNIT 3 CO3:</b> define the concept and applications of adsorption, explain the types and functions of catalyst and develop a knowledge on broad variety of photo chemical systems				3	12
<b>UNIT 4 CO4:</b> discuss the proper procedure and regulation for safe handling and use of chemicals, explain the theoretical principles and perform calculations of analytical methods within titration				4	12
<b>UNIT 5 CO5:</b> exhibit knowledge of body chemistry levels under healthy or abnormal conditions and chemistry behind various tests performed in clinical chemistry.				5	12

**Unit – I Organic Chemistry****(12 Hrs)**

**Purification of organic compounds:** crystallization, fractional crystallization, sublimation, distillation, fractional distillation, distillation under reduced pressure, steam distillation, chromatography, zone refining and chemical methods.

**Principles of reactions involved in organic analysis:** Reactions of acids, phenols, aldehydes, amines, amides, aliphatic diamide and monosaccharide.

**Unit – II Inorganic Chemistry****(12 Hrs)**

**Oxides:** Classification with examples.

**Metallurgy:** Ore, gangue, flux and slag – definition. Principle and general methods of extraction of metals. **Extraction** of cobalt and nickel.

**Preparation, properties and uses of the following compounds:** a) verdigris, b) blue vitriol, c) Bordeaux mixture, d) Epsom salt, e) gypsum, f) Plaster of Paris, g) Green Vitriol, h) Potassium ferrocyanide, i) Potassium ferricyanide, j) sodium nitroprusside, k) White vitriol, l) Sodium borohydride, m) Lithium aluminium hydride.

**Unit – III Physical Chemistry****(12 Hrs)**

**Adsorption:** Definition of various terms. Adsorption of gases on solids – characteristics of adsorption of gases on solids – physical adsorption and chemisorption- factors influencing adsorption – application of adsorption- adsorption indicators.

**Catalysis:** Definition – characteristics – theories of catalysis – promoters and poisons –enzyme catalysis – acid-base catalysis – auto catalysis (definitions with suitable examples)

**Photochemistry:** Definition of Photochemical reactions- Grotthus Draper Law and Einstein's law – quantum efficiency (high and low) – comparison between thermal and photochemical reactions – chemiluminescence, fluorescence, phosphorescence- photosensitization – flash photolysis (elementary treatment)

#### Unit – IV Analytical Chemistry

(12 Hrs)

**Laboratory hygiene and safety:** Storage and handling of chemicals – toxic chemicals - waste and fume disposal – Precautions for avoiding accidents – First aid techniques

**Principles of volumetric analysis:** Expressions of concentrations – equivalent weights- principle of volumetric analysis – primary and secondary standards – classification according to reactions – various types of indicators.

#### Unit- V Applied Chemistry

(12 Hrs)

##### Clinical Chemistry:

Qualitative and quantitative analysis of cholesterol in serum – standard value of cholesterol – heart attack

Qualitative and quantitative analysis of sugar in serum and urine – standard value of sugar - glucose tolerance test – Benedict's test – hypoglycemia and diabetes (symptoms)

Estimation of hemoglobin – standard value of Hb – anemia.

Diagnostic test for albumin in serum and urine – reasons for albuminuria.

Formation and Analysis of Kidney Stones

##### References

Course material supplied by the department.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT I: Organic Chemistry</b>			
	crystallization, fractional crystallization, sublimation, chromatography, zone refining and chemical methods	5	Lecture
	distillation, fractional distillation, distillation under reduced pressure, steam distillation	3	ICT
	Reactions involved in qualitative organic analysis of acids, phenols, aldehydes, amines, amides, aliphatic diamide and monosaccharide.	4	Lecture, lab session & Demonstration
<b>UNIT II: Inorganic chemistry</b>			
	Classification of oxides with examples	2	Lecture
	Principle and general methods of extraction of metals. Extraction of nickel	3	ICT
	Extraction of cobalt.	1	Peer teaching / tutorial
	<b>Preparation , properties and uses of</b> verdigris, blue vitriol, Bordeaux mixture, Epsom salt, gypsum, Plaster of Paris, Green Vitriol, White vitriol,	3	Lecture, Tutorial, Assignment & Quiz
	Preparation, properties and uses of Potassium ferrocyanide, Potassium ferricyanide, sodium nitroprusside Sodium borohydride, Lithium aluminium hydride.	3	Lecture & Tutorial
<b>UNIT III: Physical chemistry</b>			

	Definition of various terms in Adsorption, characteristics of adsorption of gases on solids, physical adsorption and chemisorptions catalysts, promoters and poisons theories of catalysts Definition of Photochemical reactions- Grotthus Draper Law and Einstein's law – quantum efficiency (high and low) – comparison between thermal and photochemical reactions	8	Lecture
	Factors influencing adsorption, application of adsorption, adsorption indicators.	2	Lecture, Assignment & quiz
	Chemi-luminescence, fluorescence, phosphorescence- photosensitization – flash photolysis	2	ICT
<b>UNIT IV: Analytical chemistry</b>			
	Storage and handling of chemicals, toxic chemicals, waste and fume disposal,	3	Lecture
	Precautions for avoiding accidents, First aid techniques	2	videos
	Principles of volumetric analysis: Expressions of concentrations, equivalent weights- principle of volumetric analysis	4	Lecture with problem solving and discussion
	Primary and secondary standards, classification according to reactions, various types of indicators.	3	Lecture & peer teaching
<b>UNIT V: Applied chemistry</b>			
	Qualitative and quantitative analysis of cholesterol in serum, standard value of cholesterol, heart attack	3	Lecture
	Qualitative and quantitative analysis of sugar in serum and urine, standard value of sugar, glucose tolerance test, Benedict's test, hypoglycemia and diabetes (symptoms)	3	ICT
	Estimation of hemoglobin – standard value of Hb – anemia	2	peer teaching/ seminar/ assignment
	Diagnostic test for albumin in serum and urine, reasons for albuminuria, Formation and analysis of kidney stones	4	Discussion / library session

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4	5	4	4	3	3	3	3	4	5	4	4	3	3	3.71
CO2	4	4	3	5	3	4	4	4	4	4	4	3	3	3	3.71
CO3	4	5	3	4	4	4	4	3	4	4	4	4	4	3	3.85
CO4	4	5	4	5	4	4	3	4	4	5	5	4	4	4	4.14
CO5	4	5	4	5	5	4	4	4	4	5	5	4	3	4	4.21
<b>Mean Overall Score</b>															3.92

Result: The Score for this Course is 3.92 (High Relationship)

**Programme :B.Sc (Physics/Zoology/Home Science /Botany) Part III: Allied**  
**Semester : IV Hours : 4 /W, 60 /S**  
**Code : AC2 Credits :4**

**TITLE OF THE PAPER: ANCILLARY CHEMISTRY – II**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class (Library session is conducted after the class hours).	ICT	
	4	2	1	1	
<b>PREAMBLE: The objective of the course is to make the student understand the fundamental concept of nature and bonding in organic compounds, chemistry behind hydrogen peroxide &amp; ozone, create awareness on ways of using nuclear energy, principle behind chromatography and provide knowledge on industrial preparation of day-to-day products in our life.</b>					
<b>COURSE OUTCOME:</b> At the end of the Semester, the Students will be able to				Unit	Hrs /S
<b>UNIT 1 CO1:</b> recognize the concept of hybridization and gain knowledge about reaction types and stability of reaction intermediates.				1	12
<b>UNIT 2 CO2:</b> describe the chemistry of preparation, properties, structure and application of hydrogen peroxide and ozone.				2	12
<b>UNIT 3 CO3:</b> discuss artificial radioactivity, nuclear fission and fusion.				3	12
<b>UNIT 4 CO4:</b> explain the principles of chromatography.				4	12
<b>UNIT 5 CO5:</b> appraise the importance of chemical industry such as cement, glass, ceramics, petrochemicals, paper and recognize the method of converting raw materials into desired products.				5	12

**Unit- I Organic Chemistry**

**(12 Hrs)**

***Fundamental Concepts:***

Tetrahedral arrangement of valencies of carbon atom, Concept of hybridization in organic molecules.

Cleavage of bonds: Homolytic and heterolytic cleavage of carbon bond

Reaction intermediates: Free radicals, carbenes, carbonium ion and carbanion – their generation and stability

Nucleophilic and electrophilic reagents.

Types of reactions: Substitution, addition, elimination, rearrangement and polymerisation with suitable examples[no mechanism needed]. Isomerism – geometric and stereoisomerism.

**Unit – II Inorganic Chemistry**

**(12 Hrs)**

**Hydrogen peroxide:** Preparation, manufacture, purification, properties and uses. Structure – estimation by permanganometric and iodometric methods. Methods of expressing the strengths of hydrogen peroxide and their interconversion.

**Ozone:** Preparation, manufacture, properties, composition, structure and uses. Estimation by iodometric method. Distinction between hydrogen peroxide and ozone.

**Unit – III Physical Chemistry****(12 Hrs)****Artificial radioactivity:** Definition – projectiles – examples – radioactive transformations**Nuclear fission:** Definition – chain reaction – energy released during fission – principle of atom bomb and nuclear reactors.**Nuclear fusion** – Definition – energy released during fusion – stellar energy – hydrogen bomb – comparison of nuclear fission and fusion**Isotopes and isobars:** Definitions and consequences of isotopy**Applications of radioactivity** – radioactive isotopes as tracer elements in medicine, agriculture and industry, in the elucidation of structure and in the investigation of reaction mechanism – carbon dating.**Unit – IV Analytical Chemistry****(12 Hrs)****Chromatography** – Definition of chromatography, mobile phase and stationary phase, Classification of chromatography, Principles of adsorption and partition chromatography.

Paper and Column Chromatography, Thin Layer chromatography, Rf value, general applications of chromatography.

Gas chromatography – Principles, instrumentation (brief description) – applications

**Unit – V Applied Chemistry****(12 Hrs)****Silicate industry:** Cement, glass and ceramics, raw materials and manufacture of cement, glass and ceramics.**Petrochemicals:** An elementary study, Definition – origin – composition – chemicals from natural gas, petroleum, light naphtha and kerosene – synthetic gasoline.**Paper industry:** Raw materials and manufacture- types of papers.**References**

Course material supplied by the department.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT I: Organic Chemistry</b>			
	Tetrahedral arrangement of valencies of carbon atom, Concept of hybridization in organic molecules.  molecules	3	ICT, Model demonstration with discussion
	Cleavage of bonds: Homolytic and heterolytic cleavage of carbon bond. Reaction intermediates: Free radicals, carbenes, carbonium ion and carbanion, their generation and stability, Nucleophilic and electrophilic reagents.	3	Lecture
	Types of reactions: Substitution, addition, elimination, rearrangement and polymerisation with suitable examples	3	Lecture, peer teaching & assignment
	Isomerism – stereoisomerism, definition, classification with suitable examples	3	ICT
<b>UNIT II: Inorganic chemistry</b>			

	Preparation, manufacture, purification, properties and uses of hydrogen peroxide and ozone.	5	Lecture
	estimation of H <sub>2</sub> O <sub>2</sub> by permanganometric and iodometric methods. Methods of expressing the strengths of hydrogen peroxide. Estimation of ozone by iodometric method	5	Lecture with problem solving session
	Structure of ozone and hydrogen peroxide, Distinction between hydrogen peroxide and ozone.	2	ICT & Quiz
<b>UNIT III: Physical chemistry</b>			
	<b>Artificial radioactivity:</b> Definition – projectiles, examples, radioactive transformations, Definition, energy released during nuclear fission and fusion, comparison of nuclear fission and fusion. Determination of age through carbon dating.	6	Lecture
	Principle of atom bomb, nuclear reactors, hydrogen bomb, stellar energy	3	ICT
	<b>Isotopes and isobars:</b> Definitions and consequences of isotopy	1	Peer teaching
	<b>Applications of radioactivity</b> – radioactive isotopes as tracer elements in medicine, agriculture and industry, in the elucidation of structure and in the investigation of reaction mechanism	2	Seminar, discussion & assignment
<b>UNIT IV: Analytical chemistry</b>			
	Definition of chromatography, mobile phase and stationary phase, Classification of chromatography, principles of partition and adsorption chromatography. Paper chromatography, Column chromatography and thin layer chromatography R <sub>f</sub> value	7	Lecture
	Applications of chromatography	3	Peer discussion, seminar & assignment
	Column chromatography and thin layer chromatography, Gas chromatography – principles and applications	2	ICT
<b>UNIT V: Applied chemistry</b>			
	Raw materials and manufacture of cement and ceramics	4	Lecture
	Raw materials and manufacture of glass and paper, types of paper	4	Discussion / peer teaching / seminar / quiz
	<b>Petrochemicals:</b> Definition, origin, composition, chemicals from natural gas, petroleum, light naphtha and kerosene – synthetic gasoline.	4	ICT

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	4	4	4	3	3	3	3	3	3	3	3	3	4	4	3.35
CO2	3	4	3	3	3	3	3	3	3	4	3	3	4	3	3.21
CO3	4	4	3	4	4	3	3	3	4	3	3	4	4	4	3.57
CO4	4	3	3	4	4	3	2	3	4	4	4	4	4	3	3.5
CO5	4	4	3	3	4	4	3	4	4	3	3	5	4	5	3.28
<b>Mean Overall Score</b>															3.38

Result: The Score for this Course is 3.38 (High Relationship)

Programme :B.Sc Chemistry  
Semester : III & IV  
Sub. Code : CPA

Part III: Allied  
Hours : 3/W, 45 /S  
Credits : 3

**TITLE OF THE PAPER: ANCILLARY CHEMISTRY - PRACTICALS**

Pedagogy	Hours	Lab session//Demonstration class
	3	3
<b>PREAMBLE: The objective of the course is to make the student to estimate the solution of unknown strength and analyse the given organic compound.</b>		
<b>COURSE OUTCOME</b>		Unit
At the end of the Semester, the Students will be able to		Hrs / S
<b>UNIT 1 CO1:</b> analyse and find out the given organic compound and report the functional group present in it.		1
<b>UNIT 2 CO2:</b> find out the strength of given solution and the weight.		2
		45

**Unit I:QUALITATIVE ANALYSIS**

Qualitative analysis of an organic compound containing one or two functional groups and confirmation by the preparation of a solid derivative / colour reactions – acids, phenols, aldehydes, primary amines, amides, aliphatic diamide and monosaccharide.

Scheme of valuation: **Internal:** Organic Analysis = **20 marks**

**Unit – II VOLUMETRIC ANALYSIS**

**A double titration involving making up of the solution to be estimated.**

**I. Acidimetry and alkalimetry:**

- Titration between a strong acid against NaOH
- Titration between a strong acid against Na<sub>2</sub>CO<sub>3</sub>
- Titration between sodium hydroxide against oxalic acid.

**II . Permanganometry:**

- Titrations between KMnO<sub>4</sub> against oxalic acid
- Titrations between KMnO<sub>4</sub> against ferrous sulphate
- Titrations between KMnO<sub>4</sub> against Mohr's salt (Ferrous ammonium sulphate)

**III . Iodometry:**

- Titrations between sodium thiosulphate and potassium permanganate
- Titrations between sodium thiosulphate and potassium dichromate
- Titrations between sodium thiosulphate and copper sulphate

**Internal:** Volumetric Analysis 20

**Total internal** = 40 marks **External:** 60 marks

**Record** -5 Marks

**Organic analysis** – 25 (Preliminary reactions with correct procedure – 10 marks, aromatic/aliphatic – 5 marks, saturated/ unsaturated – 5 marks, functional group – 5 marks,)

**Volumetric analysis** – 30 (Procedure – 10 marks, upto 2% - 20 marks, 3% -15 marks, 4% and above 10 marks)

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT 1: Qualitative analysis</b>			
	Analysis of organic compound	40	Lab session
	Analysis of organic compound	5	Demonstration
<b>UNIT II: Volumetric analysis</b>			
	Volumetric analysis	40	Lab session
	Volumetric analysis	5	Demonstration

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	5	5	4	4	4	4	4	3	4	4	4	3	4	3	3.92
CO2	5	5	4	4	4	4	4	3	4	4	4	3	4	3	3.92
Mean Overall Score															3.92

Result: The Score for this Course is 3.92 (High Relationship)

**Programme : BSc/BCom/BA/BBA/BCA**

**Part IV: Non Major Elective**

**Semester : V**

**Hours -2 / W, 30 /S**

**Code: NMC1Credit: 2**

**TITLE OF THE PAPER– CHEMISTRY IN LIFE**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class (Library session is conducted after the class hours).	ICT	
	2	1	1 hr(if needed)	1	
<b>PREAMBLE: The objective of the course is to make the student understand the chemistry of fuels, know the commodity values of oils, fats and waxes, importance of food additives, preservatives and adulterants and gain knowledge on basic principles behind corrosion and its prevention methods like electroplating</b>					
<b>COURSE OUTCOME</b>				Unit	Hrs /S
At the end of the Semester, the Students will be able to					
<b>UNIT 1 CO1:</b> acquire knowledge on characteristics of fuels.				1	6
<b>UNIT 2 CO2:</b> identify the differences between oils, fats and waxes and their classifications.				2	6
<b>UNIT 3 CO3:</b> discuss on various food additives, preservatives and adulterants and demonstrate various tests to find adulteration.				3	6
<b>UNIT 4 CO4:</b> describe the effects and consequences of corrosion.				4	6
<b>UNIT 5 CO5:</b> explain the various applications of electroplating for prevention of corrosion.				5	6

**Unit – I FUELS**

**(6Hrs)**

**Fuels:** Definition, requirements of a good fuel, classification, ignition temperature, calorific value, units of heat, liquid fuels (petrol, kerosene), gaseous fuels(LPG, Gobar gas)

**Unit – II OILS, FATS AND WAXES**

**(6 Hrs)**

**Oils, fats and waxes:** Definition, distinction between oils and fats, properties, classification, vegetable oils, hydrogenation of oil, manufacture of candle.

**Unit –III**

**(6 Hrs)**

**Food chemistry:** Flavour and aroma of food, food additives, flavourings, food preservatives, food adulterants, some simple tests to find adulteration.

**Unit IV CORROSION****(6 Hrs)**

**Corrosion:** Definition – Consequences of corrosion, corrosion reaction, atmospheric corrosion, factors influencing corrosion, types of corrosion, Protection from corrosion.

**Unit – V ELECTROPLATING****(6 Hrs)**

**Electroplating:** Applications of electroplating, Preparation of base material, Electroplating equipment and Operating Conditions, electroplating Baths.

**References**

Course material supplied by the department.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT I: FUELS</b>			
	Definition, requirements of a good fuel, classification of fuels ignition temperature, calorific value, units of heat.	4	Lecture
	Liquid fuels and gaseous fuels	2	ICT & Seminar
<b>UNIT II: OILS, FATS AND WAXES:</b>			
	Definition, distinction between oils and fats, properties, classification,	3	Lecture
	vegetable oils, hydrogenation of oil,	2	Group discussion
	Manufacture of candle.	1	ICT
<b>UNIT III: FOOD CHEMISTRY:</b>			
	Flavour and aroma of food, food additives, flavourings, food preservatives, food adulterants.	3	Lecture
	food preservatives, food adulterants	1	assignment
	some simple tests to find adulteration.	2	ICT
<b>UNIT IV: CORROSION:</b>			
	Definition – Consequences of corrosion, corrosion reaction, atmospheric corrosion	3	Lecture
	factors influencing corrosion, types of corrosion	2	ICT
	Protection from corrosion.	1	Peer teaching
<b>UNIT V: ELECTROPLATING:</b>			
	Applications of electroplating, Preparation of base material.	3	Lecture
	Electroplating equipment and operating conditions electroplating baths.	3	ICT

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	5	4	4	3	3	3	3	4	5	4	4	3	3	3.71
CO2	4	4	3	5	3	4	4	4	4	4	4	3	3	3	3.71
CO3	4	5	3	4	4	4	4	3	4	4	4	4	4	3	3.85
CO4	4	5	4	5	4	4	3	4	4	5	5	4	4	4	4.14
CO5	4	5	4	5	5	4	4	4	4	5	5	4	3	4	4.21
Mean Overall Score															3.92

Result: The Score for this Course is 3.92 (High Relationship)

**Programme : BSc/BCom/BA/BBA/BCA**

**Semester : VI**

**Code: NMC2Credit: 2**

**Offered for all arts and science students**

**Part IV: Non Major Elective**

**Hours -2 / W, 30 /S**

**TITLE OF THE PAPER– Day to day chemistry**

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class(Library session is conducted after the class hours).	ICT
	2	1	-	1

**PREAMBLE: The objective of the course is to make the student understand the principles behind extraction techniques of essential oils, gain knowledge about the food toxins, also gain an idea on fire extinguishing methods, manufacture of match sticks, explosives and water treatment methods.**

<b>COURSE OUTCOME</b>	Unit	Hrs /S
At the end of the Semester, the students will be able to		
<b>UNIT 1 CO1:</b> broaden their knowledge on essential oils and their production in India	1	6
<b>UNIT 2 CO2:</b> analyze the chemical poisons in food along with their sources and create awareness on microbial toxins.	2	6
<b>UNIT 3 CO3:</b> describe the various fire extinguishing methods and the chemistry behind the extinguishers	3	6
<b>UNIT 4 CO4:</b> discuss the chemistry behind match sticks, their manufacture and also give a logical idea on explosives	4	6

<b>UNIT 5 CO5:</b> describe the importance of water management and impart ideas on various water treatment methods	5	6
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**UNIT – I ESSENTIAL OILS AND PERFUMES (6 Hrs)**

**Essential oils and Perfumes:** Essential oils – occurrence and methods of production of any five essential oils of India. Requirement of a good perfume, classification

**Unit – II CHEMICAL POISONS IN FOOD (6 Hrs)**

**Chemical poisons in food :** Sources of chemical poisons in food – Toxins naturally present in food - sources and toxic effects of: toxic minerals and metals, organic toxicants in food, toxins present in fish. Toxins from other sources – metallic toxins, pesticides and pesticide residues – contaminants of fats and oils – microbial toxins.

**Unit –III FIRE EXTINGUISHING (6 Hrs)**

**Fire extinguishing:**

Methods of extinguishing fire – simple extinguishing agents: water, sand and earth – chemical fire extinguishers: Dry powder extinguisher, carbon dioxide extinguishers, extinguishers using halogen derivatives of hydrocarbons – foam type extinguishers.

**Unit –IV (6Hrs)**

**MATCH INDUSTRY, PYROTECHNY AND EXPLOSIVES:** manufacture of match boxes and match sticks, chemistry of burning a match stick, colour crackers, definition of explosives, classification, preparation and uses of the following explosives-gun powder, gun cotton, nitroglycerin, dynamite, TNT and picric acid.

**Unit – V DRINKING WATER (6 Hrs)**

**Drinking water:** Availability and portability, sources-artificial rain, rain water harvesting, potable water quality, water treatment (methods of softening) – boiling, addition of lime, addition of sodium carbonate, ion exchange method, desalination of sea water- reverse osmosis and electro dialysis.

**References**

Course material supplied by the department.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT I: Essential oils and Perfumes</b>			
	Essential oils& Perfumes.	4	Lecture
	Requirement of a good perfume, classification	2	ICT
<b>UNIT II: Chemical poisons in food</b>			
	Sources of chemical poisons in food – Toxins naturally present in food	2	Lecture
	sources and toxic effects of: toxic minerals and metals, organic toxicants in food, toxins present in fish.	3	ICT

	Toxins from other sources – metallic toxins, pesticides and pesticide residues – contaminants of fats and oils – microbial toxins.	1	Peer teaching / tutorial
<b>UNIT III: Fire Extinguishing</b>			
	Methods of extinguishing fire – simple extinguishing agents, chemical fire extinguishers, Dry powder extinguisher, carbon dioxide extinguishers, extinguishers using halogen derivatives of hydrocarbons – foam type extinguishers.	4	Lecture
	Methods of extinguishing fire	2	ICT
<b>UNIT IV: Match industry, pyrotechny and explosives</b>			
	manufacture of match boxes and match sticks, chemistry of burning a match stick, colour crackers	3	Lecture
	Definition of explosives, classification, preparation and uses of the following explosives-gun powder, gun cotton, nitroglycerin, dynamite, TNT and picric acid.	3	Discussion
<b>UNIT V: Drinking water</b>			
	Availability and portability, sources-artificial rain, rain water harvesting, potable water quality.	3	Lecture
	water treatment (methods of softening), ion exchange method, desalination of sea water- reverse osmosis and electro dialysis.	3	ICT

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	5	4	4	3	3	3	3	4	5	4	4	3	3	3.71
CO2	4	4	3	5	3	4	4	4	4	4	4	3	3	3	3.71
CO3	4	5	3	4	4	4	4	3	4	4	4	4	4	3	3.85
CO4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4.0
CO5	4	5	4	5	5	4	4	4	4	5	5	4	3	4	4.21
Mean Overall Score														3.90	

Result: The Score for this Course is 3.90 (High Relationship)

**VALUE ADDED COURSE**

**Code:**  
**Programme : B.Sc Chemistry**

**Hours : 30 Hours (6 weeks)**

**TITLE OF THE PAPER: CHEMISTRY OF HEALTH AND HERBS**

<b>PREAMBLE: The objective of the course is to help the students to get exposed to natural product drug discovery and to make the students understand the chemistry of important phytoconstituents of different categories.</b>		
<b>COURSE OUTCOME</b>	Unit	Hrs / S
At the end of the Course, the students will be able to		
<b>UNIT 1 CO1:</b> describe the important phytochemicals in our day today life and the role of phytochemical in modern medicine.	1	6
<b>UNIT 2 CO2:</b> explain the Soxhlet extraction and isolation by GC and HPLC.	2	6
<b>UNIT 3 CO3:</b> describe the chemical tests for various secondary metabolites.	3	6
<b>UNIT 4 CO4:</b> describe the medicinal properties of alkaloids such as Caffeine, Quinine and Resperine.	4	6
<b>UNIT 5 CO5:</b> discuss the chemical structure and medicinal properties of flavonoids Luteolin, Quercetin and kaempferol	5	6

**UNIT – I : DRUG DISCOVERY AND DEVELOPMENT**

**( 6 Hrs)**

History of Herbs as source of medicine - Phytochemicals - primary and secondary metabolites - Important phytochemicals in our day today life - Structure activity relationship - Role of phytochemical in modern medicine - Standardisation of herbal drugs.

#### **UNIT – II EXTRACTION AND ISOLATION OF ACTIVE PRINCIPLE ( 6 Hrs)**

Collection of plant material – Drying and Grinding – Extraction of active principles– Soxhlet extraction and recent advancements – Selection of solvents for extraction – Detection of active principle using TLC - Isolation of it by column and GC, HPLC.

#### **UNIT – III: DETECTION OF SECONDARY METABOLITES ( 6 Hrs)**

Chemical test for various secondary metabolites such as Alkaloids, Poly phenolics-Flavonoids, Anthocyanins- Terpinods- Steroids – General Structure elucidation by spectroscopic Techniques like UV, IR, NMR (1H, 13C).

#### **UNIT – IV : MEDICINAL PROPERTIES OF ALKALOIDS ( 6 Hrs)**

General structure of alkaloids - Sources, chemical structure and medicinal properties of following alkaloids- Caffeine-Quinine-Resperine

#### **UNIT V: FLAVONOIDS AS MEDICINE ( 6 Hrs)**

Sources, chemical structure and medicinal properties of following Flavonoids -Luteolin - Quercetin and kaempferol

#### **TEXT BOOK**

1. Medicinal Chemistry, G.R. Chatwal, Himalya Publishing House.

#### **REFERENCE BOOKS**

1. Phytochemical methods of chemical analysis by Harbone
2. Chemistry of natural products by Atur Rahman
3. Medicinal Chemistry Drug Discovery by Donald J, Abrahm,
4. Plant drug analysis by Wagner
5. Clarke's isolation & identification of drugs by AC Mottal

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT I: DRUG DISCOVERY AND DEVELOPMENT</b>			
	Phytochemicals - primary and secondary metabolites - Structure activity relationship - Role of phytochemical in modern medicine - Standardisation of herbal drugs.	4	Lecture
	History of Herbs as source of medicine	1	
	Important phytochemicals in our day today life	1	Discussion
<b>UNIT II EXTRACTION AND ISOLATION OF ACTIVE PRINCIPLE</b>			
	Extraction of active principles- Soxhlet extraction and recent advancements - Selection of solvents for extraction - Detection of active principle using TLC - Isolation of it by column and GC, HPLC.	4	
	Isolation of it by column and GC, HPLC	1	ICT
	Collection of plant material	1	Assignment work
<b>UNIT III DETECTION OF SECONDARY METABOLITES</b>			
	Chemical test for various secondary metabolites such as Alkaloids, Poly phenolics-Flavonoids, Anthocyanins- Terpinods- Steroids - General Structure elucidation by spectroscopic Techniques like UV, IR, NMR (1H, 13C).	4	Lecture
	Chemical test	1	Assignment
	Structure elucidation by spectroscopic Techniques like UV, IR, NMR (1H, 13C).	1	ICT
<b>UNIT IV MEDICINAL PROPERTIES OF ALKALOIDS</b>			
	General structure of alkaloids - Sources, chemical structure and medicinal properties of following alkaloids- Caffeine-Quinine-Resperine	4	Lecture
	medicinal properties of following alkaloids- Caffeine-Quinine-Resperine	2	Discussion
<b>UNIT V FLAVONOIDS AS MEDICINE</b>			
	Sources, chemical structure and medicinal properties of following Flavonoids -Luteolin - Quercetin and kaempferol	5	Lecture

	medicinal properties of following Flavonoids -Luteolin - Quercetin and kaempferol	1	discussion
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Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	5	4	3	4	4	4	4	5	3	4	4	4	3	3.93
CO2	5	5	4	3	4	3	4	4	5	4	4	4	3	3	3.93
CO3	5	5	4	3	4	4	4	4	5	4	3	4	3	3	3.93
CO4	5	5	4	3	4	4	4	4	5	3	2	4	4	3	3.86
CO5	5	5	3	4	4	4	3	5	5	3	3	4	3	4	3.93
Mean Overall Score														3.92	

Result: The Score for this Course is 3.92 (High Relationship)

### VALUE ADDED COURSE

**Code:**

**Hours : 30 Hours (6 weeks)**

**Programme : B.Sc Chemistry**

### TITLE OF THE PAPER: INDUSTRIAL CHEMISTRY

<b>PREAMBLE:</b> The objective of the course is to make the student to have a good knowledge about industrial chemistry and to get placement in reputed industries and to engage themselves in self-employment schemes		
<b>COURSE OUTCOME</b>	Unit	Hrs / S
At the end of the Semester, the Students will be able to		
<b>UNIT 1 CO1:</b> demonstrate the basic concepts in industrial chemistry such as structure of the global chemical industry, raw materials, chemical processes and flow diagrams	1	6
<b>UNIT 2 CO2:</b> describe the unit operations like size reduction, size enlargement and separation of materials	2	6

<b>UNIT 3 CO3:</b> discuss the unit processes like polymerization, alkylation and other unit processes	3	6
<b>UNIT 4 CO4:</b> explain the processes in various chemical industries like organic chemicals, fermentation and pharmaceutical industries and manufacturing units of organic, pharmaceutical and fermentation chemicals.	4	6
<b>UNIT 5 CO5:</b> implement the usage of analytical tools, chromatography and perform various chromatographic techniques.	5	6

**Unit I:****(6 Hrs)****Basic concepts in Industrial Chemistry**

- Introduction- Classification of Industries- Classification of Manufacturing industries – Manufacturing sub- sectors
- The structure of the global chemical industry – Commodity chemicals - Speciality chemicals and fine chemicals
- Raw material for the Chemical Industry
- Chemical Processes- Unit processes, unit operations
- Flow diagrams- Block diagrams, process flow diagram / flow sheet

**Unit II:****(6 Hrs)****Unit Operations**

- Size Reduction – Purpose Jaw crusher, Ball mill
- Size enlargement – Purposes, Pellet mills, Tumbling agglomerators(two types)
- Separation of Materials – Magnetic separation, froth floatation
- Other Unit operations – (Purpose and application only) Electrostatic separation, Sedimentation, Crystallization, Leaching, Spray drying, solvent extraction, Absorption.

**Unit III:****(6 Hrs)****Unit Processes**

- Polymerization – Addition Polymerization, condensation Polymerization, free radical Polymerization
- Alkylation, Hydrolysis
- Other Unit processes- (Definition and application only) Sulphonation, Esterification, Hydrogenation, Halogenation and Nitration

**Unit IV:****(6 Hrs)****Organic Chemicals, Fermentation and Pharmaceutical Industries**

- Organic Chemical Industries- Manufacture of Phthalic acid, Adipic acid and styrene-butadiene rubber
- Fermentation Industries – Manufacture of ethanol
- Pharmaceutical Industries – Manufacture of Penicillincand Acetyl salicylic acid

**Unit V:****(6 Hrs)**

### Industrial applications of Chromatography

Definition- Types- Classification-  $R_f$  value – Column chromatography – Simulated moving bed Chromatography- HPLC – Applications of Chromatography in various industries.

#### REFERENCES

1. Industrial Chemistry, Dr. B. K. Sharma, 17<sup>th</sup> edition, 2013, Goel Publishing house, Meerut
2. Industrial Chemistry, LouftyMadkour, Helen Njenga
3. Instrumental methods of Chemical analysis, Chatwal & Sam K Anand, 2019, Himalayan Publishing House, New Delhi

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1:			
	Introduction- Classification of Industries- Classification of Manufacturing industries – Manufacturing sub- sectors, The structure of the global chemical industry – Commodity chemicals - Speciality chemicals and fine chemicals, Raw material for the Chemical Industry	4	Lecture
	Chemical Processes- Unit processes, unit operations Flow diagrams-	1	ICT
	Block diagrams, process flow diagram / flow sheet	1	Assignment/ Seminar
UNIT 11			
	Size Reduction – Purpose Jaw crusher, Ball mill Size enlargement – Purposes, Pellet mills, Tumbling agglomerators(two types)	4	Lecture

	Separation of Materials – Magnetic separation, froth floatation	1	ICT
	Other Unit operations – (Purpose and application only) Electrostatic separation, Sedimentation, Crystallization, Leaching, Spray drying, solvent extraction, Absorption.	1	Assignment / Seminar
UNIT III			
	Polymerization – Addition Polymerization, free radical Polymerization	4	Lecture
	Alkylation, Hydrolysis	1	ICT
	Other Unit processes- (Definition and application only) Sulphonation, Esterification, Hydrogenation, Halogenation and Nitration	1	Assignment / Seminar
UNIT IV			
	Organic Chemical Industries- Manufacture of Phthalic acid, Adipic acid and styrene-butadiene rubber	4	Lecture
	Fermentation Industries – Manufacture of ethanol	1	ICT
	Pharmaceutical Industries – Manufacture of Penicillic and Acetyl salicylic acid	1	Assignment / Seminar
UNIT- V			
	Definition- Types- Classification- $R_f$ value	3	Lecture

	Column chromatography – Simulated moving bed Chromatography- HPLC.	2	ICT
	Applications of Chromatography in various industries	1	Assignment/ Seminar

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	4	4	4	4	3	4	4	3	3.8
CO2	4	4	4	3	4	4	4	3	4	4	3.8
CO3	4	4	4	4	4	3	4	4	4	4	3.9
CO4	4	3	4	4	4	4	4	4	4	3	3.8
CO5	4	4	4	4	4	4	4	3	4	4	3.9
Mean Overall Score											3.84

Result: The Score for this Course is 3.84 (High Relationship)

### VALUE ADDED COURSE

**Code:**

**Hours: 30**

**Programme: Common for B.Sc /B.A/B.B.A/B.Com/B.C.A**

#### TITLE OF THE PAPER: INTRODUCTION TO CHEMICAL PRODUCTS AROUND US

<b>PREAMBLE: The objective of the course is to make the student understand the basic concepts of every day usage products, food adulteration and medicinal importance of herbal plants .</b>		
<b>COURSE OUTCOME</b>	Unit	Hrs / S
At the end of the Course, the students will be able to		
<b>UNIT 1 CO1:</b> describe the key ingredients of cosmetic items and the preparation of some cosmetic items.	1	6
<b>UNIT 2 CO2:</b> explain the properties of milk and describe milk products	2	6
<b>UNIT 3 CO3:</b> describe the medicinal value of herbal plants	3	6
<b>UNIT 4 CO4:</b> identify the natural toxins and adulterants in the food items .	4	6
<b>UNIT 5 CO5:</b> demonstrate the polymer products in home and their uses.	5	6

#### **UNIT I : EVERYDAY CONSUMER ITEMS**

**6 hours**

Cosmetics – Key ingredients -Brief idea about Emulsifier, Preservatives, Moisturisers, Colours, Fragrances.

Benefits of Herbal extracts in cosmetics.

Formulation of Hand-made soaps, Shampoo, Hand sanitiser, Hair oils, Hair dye, After shave and Tooth paste.

## **UNIT II : MILK AND MILK PRODUCTS**

**6 hours**

Composition of Milk- Flavour and aroma of Milk - Effect of heat on milk ; Pasteurisation ; Homogenisation - Some Milk products : Cheese, Paneer, Cream, Butter, Ice Cream, Milk powder, Curd and butter milk.

## **UNIT III : MEDICIANL PLANTS AND HERBS IN THE KITCHEN 6 hours**

Medicinal properties of some Indian medicinal plants- Hibiscus Rosa-sinensis -Ocimum Sanctum(Tulsi) – Azadirachta indica (Neem) – Phyllanthus Niruri( Kilaynelli)-Solanum Trilobatum ( Thuduvalai)- Grass Cynodondactylon(Arugampullu) – Greens – Portulaca oleracea(Pulli-kirai),

Herbs in the kitchen – Turmeric, Garlic, Cumin and Asafotida.

## **UNIT IV : FOOD COLOURINGS, ADULTERATION, TESTING AND SAFETY**

**6 hours**

Natural flavourings – Crude spices and herbs – Synthetic flavourings – formulation.

Natural toxins in food from other sources – Food additives – Contaminants of fats and oils – Bacterial toxins in food – Health hazards – Testing Adulterants.

## **UNIT V : FIBRES AND POLYMER PRODUCTS IN HOME**

**6 hours**

Types of Fibre Reinforced Plastics - Things made of FRP.

Manmade Bio based fibre products and their uses.

Polyethylene foam – Polystyrene foam and Polyurethane foam – Components & Uses.

Graphite containing everyday products – pencils, lithium batteries

(Only brief idea for all the products)

## **TEXT BOOKS**

1. Fundamental Concepts of Applied Chemistry, Jayashree Ghosh, S. Chand & Company Ltd., First Ed., 2006.
2. A textbook of Applied Chemistry for Home Science and Allied Science, Thankamma Jacob, Macmillan India Ltd., Reprint 1987.
3. Engineering Chemistry, Jain & Jain, Dhanpat Rai Publishing Company, 16 th Edition.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
<b>UNIT 1: EVERYDAY CONSUMER ITEMS</b>			
	Cosmetics – Key ingredients - Formulation of some products	3	Lecture
	Demonstration of the preparation of some products	2	Demonstration/ICT
	Benefits of herbal extracts in cosmetics	1	Discussion
<b>UNIT II MILK AND MILK PRODUCTS</b>			
	Composition of Milk; Flavour and aroma of Milk; Physical properties of Milk: Effect of heat on milk; Pasteurisation ; Homogenisation. Milk products; Cheese, Paneer, Cream, Butter, Ice Cream, Milk powder, Curd and butter milk.	4	Lecture
	Effect of heat on milk; Pasteurisation; Homogenisation.	1	ICT
	Milk products; Cheese, Paneer, Cream, Butter, Ice Cream, Milk powder, Curd and butter milk.	1	Discussion
<b>UNIT III MEDICIANL PLANTS AND HERBS IN THE KITCHEN</b>			
	Medicinal properties of some Indian medicinal plants Herbs in the kitchen	3	Lecture
	Medicinal properties of mentioned herbal plants	1	Seminar (peer teaching)
	Collection of medicinal plants and exhibiting.	1	Collection of materials and demonstration
	Pictures of medicinal plants	1	ICT/Videos
<b>UNIT IV FOOD COLOURINGS, ADULTERATION, TESTING AND SAFETY</b>			
	Natural flavourings – Crude spices and herbs – Synthetic flavourings – formulation.  Natural toxins in food from other sources – Food additives – Contaminants of fats and oils – Bacterial toxins in food – Health hazards – Testing Adulterants.	4	Lecture

	Testing Adulterants	1	Demonstration
	Bacterial toxins in food	1	Discussion
<b>UNIT VFIBRES AND POLYMER PRODUCTS IN HOME</b>			
	Types of Fibre Reinforced Plastics - Things made of FRP.  Manmade Bio based fibre products and their uses.  Polyethylene foam – Polystyrene foam and Polyurethane foam – Components & Uses.  Graphite containing everyday products – pencils, lithium batteries	4	Lecture
	Polymer products used in home		ICT

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)							Mean scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	
CO1	4	5	4	3	4	4	3	4	5	3	4	4	4	3	3.857
CO2	5	5	4	3	4	3	3	4	5	4	4	4	3	3	3.857
CO3	5	5	4	3	4	4	3	4	5	3	3	4	3	3	3.785
CO4	5	5	4	3	4	4	3	4	5	3	2	4	3	3	3.714
CO5	5	5	3	4	4	4	3	5	5	3	3	4	3	4	3.928
Mean Overall Score														3.828	

Result: The Score for this Course is 3.828 (High Relationship)