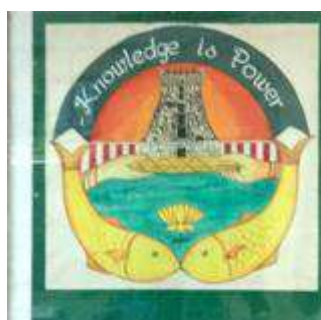


**SRI MEENAKSHI GOVERNMENT ARTS
COLLEGE FOR WOMEN (AUTONOMOUS)
MADURAI-02**



DEPARTMENT OF CHEMISTRY

**CBCS SYLLABUS FOR
B.Sc., CHEMISTRY**

FROM

2022 ONWARDS

SRI MEENAKSHI GOVERNMENT ARTS COLLEGE FOR WOMEN (A)
DEPARTMENT OF CHEMISTRY
(Academic year 2022 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 16 faculty members, of which 14 are Ph.D., holders. At present, 2 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, RUSA 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 294 (UG - 243 and PG - 51) major chemistry students and 230 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 five 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, Turbidity meter, BOD incubator, photocolourimeter etc.

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 8th 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 passion for science.

PROGRAMME OBJECTIVES FOR ALL UNDERGRADUATE PROGRAMMES

PO1: Inculcate a sustained interest to learn new concepts, techniques and acquire discipline-based knowledge.

PO2: Relate their knowledge to design problem solving strategies addressing the demands in the society.

PO3: Involve themselves in capacity building and hone their skills for technical, conceptual and creative excellence.

PO4: Perceive a plan to take up Post Graduate programmes leading to research within and outside their disciplines.

PO5: Contribute to the ecological space and be sensitive to the multi-dimensional aspects of our country and strive for harmonious existence through environment –friendly academic involvement.

B.Sc., CHEMISTRY PROGRAMME SPECIFIC OUTCOMES

After successful completion of B.SC., Chemistry the student is able to

PSO 1. Exhibit Sustained arousal of curiosity and interest to know the basic and amazing facts in chemistry.

PSO 2. Ability to demonstrate the firm foundation in the fundamentals about the basic concepts in Chemistry.

PSO 3. Able to discuss the concepts of chemistry confidently and perform laboratory testing/experiments independently.

PSO 4. Ability to recognize the role of chemistry in the applications to human society and assess the key issues in the environment and health.

PSO 5. Able to adapt to various progression routes in seeking higher studies or professional career.

LEVELS OF MAPPING AND QUESTION PATTERN

Mapping	1- 20%	21 - 40%	41 – 60 %	61 – 80%	81 – 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 – 2.0	2.1 – 3.0	3.1 – 4.0	4.1 – 5.0
Quality	Very Poor	Poor	Moderate	High	Very High
Mean Score of COs = $\frac{\text{Total of value}}{\text{Total No. of POs and PSOs}}$			Mean Overall Score of COs = $\frac{\text{Total of Mean Score}}{\text{Total No. of COs}}$		

BLOOM'S TAXONOMY	INTERNAL	EXTERNAL
K1 (Remembering / Recalling)	40%	40%
K2 (Understanding / Comprehension)	30%	30%
K3 (Application and analysis)	30%	30%

Year	K1	K2	K3
I	Part- A (4 questions) $4 \times 1 = 4$ Or Part- A (3 questions) $3 \times 2 = 6$	Part- A (3 questions) $3 \times 1 = 3$ Or Part- A (1 question) $1 \times 2 = 2$	Part- A (3 questions) $3 \times 1 = 3$ Or Part- A (1 question) $1 \times 2 = 2$
	Part-B (3 questions) $3 \times 5 = 15$ Part-C (3 questions) $3 \times 8 = 24$	Part-B (1 question) $1 \times 5 = 5$ Part-C (1 question) $1 \times 8 = 8$	Part-B (1 question) $1 \times 5 = 5$ Part-C (1 question) $1 \times 8 = 8$
II	Part- A (3 questions) $3 \times 1 = 3$ Or Part- A (1 question) $1 \times 2 = 2$	Part- A (4 questions) $4 \times 1 = 4$ Or Part- A (3 questions) $3 \times 2 = 6$	Part- A (3 questions) $3 \times 1 = 3$ Or Part- A (1 question) $1 \times 2 = 2$
	Part-B (2 questions) $2 \times 5 = 10$ Part-C (2 questions) $2 \times 8 = 16$	Part-B (2 questions) $2 \times 5 = 10$ Part-C (2 questions) $2 \times 8 = 16$	Part-B (1 question) $1 \times 5 = 5$ Part-C (1 question) $1 \times 8 = 8$
III	Part- A (3 questions) $3 \times 1 = 3$ Or Part- A (1 question) $1 \times 2 = 2$	Part- A (3 questions) $3 \times 1 = 3$ Or Part- A (1 question) $1 \times 2 = 2$	Part- A (4 questions) $4 \times 1 = 4$ Or Part- A (3 questions) $3 \times 2 = 6$
	Part-B (1 question) $1 \times 5 = 5$ Part-C (1 question) $1 \times 8 = 8$	Part-B (1 question) $1 \times 5 = 5$ Part-C (1 question) $1 \times 8 = 8$	Part-B (3 questions) $3 \times 5 = 15$ Part-C (3 questions) $3 \times 8 = 24$

SRI MEENAKSHI GOVERNMENT ARTS COLLEGE FOR WOMEN(A),

MADURAI-2

DEPARTMENT OF CHEMISTRY

SYLLABUS – NEW PATTERN – CBCS FOR B.Sc Chemistry

For those who are admitted from July 2022 onwards

SEMESTER–I

Part	Course Type	Code	Title of the Course	Hrs /Week	Credits	Exam Hrs	Marks		
							Int	Ext	Total
I	LC	U221A1/ U221H1	TAMIL/HINDI	6	3	3	25	75	100
II	ELC	U222A1	ENGLISH	6	3	3	25	75	100
III	CC I	U22CC1	Core Course I GENERAL CHEMISTRY I	6	6	3	25	75	100
III	CC II	U22CC2P	Core Course II PRACTICAL-I QUALITATIVE ANALYSIS & ORGANIC PREPARATION	3	-	-	-	-	-
III	AC	U22APCT1	Allied Physics paper 1	4	3	3	25	75	100
III	AC	U22APCP	Allied Physics Practical paper I	3	-	-	-	-	-
IV	AEC -I	U22AE1	Ability Enhancement Course - I VALUE EDUCATION	2	2	3	25	75	100
TOTAL				30	17				500

SEMESTER–II

Part	Course Type	Code	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
							Int	Ext	Total
I	LC	U221A2/ U221H2	TAMIL/HINDI	6	3	3	25	75	100
II	ELC	U222A2	ENGLISH	6	3	3	25	75	100
III	CC II	U22CC2P	Core Course II PRACTICAL-I QUALITATIVE ANALYSIS & ORGANIC PREPARATION	3	3	6	40	60	100
III	CC III	U22CC3	Core Course III GENERAL CHEMISTRY II	3	3	3	25	75	100
III	CC IV	U22CC4	Core Course IV GENERAL CHEMISTRY III	3	3	3	25	75	100
III	AC	U22ACPT2	ALLIED PHYSICS PAPER –II	4	4	3	25	75	100
III	AC	U22APCP	ALLIED PHYSICS PRACTICAL PAPER-I	3	3	3	40	60	100
IV	AEC - II	U22AE2	Ability Enhancement Course - II ENVIRONMENTAL STUDIES	2	2	3	25	75	100
TOTAL				30	24				800

SEMESTER-III

Part	Course Type	Code	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
							Int	Ext	Total
I	LC	U221A3/ U221H3	TAMIL/HINDI	6	3	3	25	75	100
II	ELC	U222A3	ENGLISH	6	3	3	25	75	100
III	CC V	U22CC5	Core Course V GENERAL CHEMISTRY IV	6	5	3	25	75	100
III	CC VI	U22CC6P	Core Course VI PRACTICAL –II VOLUMETRIC ANALYSIS AND ORGANIC ESTIMATION	3	-	-	-	-	-
III	AC	U22AMC1	ALLIED MATHEMATICS (only for maths ancillary students)	3	3	3	25	75	100
III	AC	U22AMC1/ U22AZC1	ALLIED MATHEMATICS/ALLIED ZOOLOGY	4	3	3	25	75	100
III	AC	U22AZCP	ALLIED ZOOLOGY PRACTICAL	3	-	-	-	-	-
IV	NMEC-I	U22NMC1	NME I CHEMISTRY IN LIFE	2	2	3	25	75	100
V			NCC/NSS/EXTENSION ACTIVITY		1		100	-	100
Total				30	20 /17*				700

*20 credits and 700 marks for Maths Ancillary students and 17 credits and 600 marks for Zoology Ancillary students in Semester III.

*21 credits and 700 marks for Maths Ancillary students and 24 credits and 800 marks for Zoology Ancillary students in Semester IV.

SEMESTER-IV

Part	Course Type	Code	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
							Int	Ext	Total
I	LC	U221A4/ U221H4	TAMIL/HINDI	6	3	3	25	75	100
II	ELC	U222A4	ENGLISH	6	3	3	25	75	100
III	CC VI	U22CC6P	Core Course VI PRACTICAL –II VOLUMETRIC ANALYSIS AND ORGANIC ESTIMATION	3	3	6	40	60	100
III	CC VII	U22CC7	Core Course VII PHYSICAL AND INORGANIC CHEMISTRY	4	4	4	25	75	100
III	AC	U22AZCP	ALLIED ZOOLOGY PRACTICAL	3	3	3	40	60	100
III	AC	U22AMC2/ U22AZC2	ALLIED MATHEMATICS/ALLIED ZOOLOGY	7/4	4	3	25	75	100
IV	NMEC –II	U22NMC2	NME II - DAY TO DAY CHEMISTRY	2	2	3	25	75	100
IV	SEC-I	U22SEC1	SKILL ENHANCEMENT COURSE I CHEMISTRY FOR COMPETITIVE EXAMINATION	2	2	3	25	75	100
Total				30	21/24*				800

SEMESTER-V

Part	Course Type	Code	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
							Int	Ext	Total
III	CC VIII	U22CC8	Core Course VIII ORGANIC CHEMISTRY I	5	5	3	25	75	100
III	CC IX	U22CC9	Core Course IX PHYSICAL CHEMISTRY I	5	5	3	25	75	100
III	CC X	U22CC10	Core Course X ANALYTICAL TECHNIQUES	5	5	3	25	75	100
III	CC XI	U22CC11P	Core Course XI PRACTICAL -III GRAVIMETRIC AND ORGANIC ANALYSIS	6	5	6	40	60	100
III	DSEC -I	U22DSC1A	Discipline Specific Elective Course-I FOOD CHEMISTRY	5	5	3	25	75	100
		U22DSC1B	POLYMER CHEMISTRY						
III	GEC I	U22GEC1	Generic Elective Course INVENTIONS AND INNOVATIONS IN CHEMISTRY	2	2	3	25	75	100
IV	SEC- II	U22SEC2	Skill Enhancement Course II SMALL SCALE INDUSTRIES	2	2	3	25	75	100
Total				30	29				700

SEMESTER-VI

Part	Course Type	Code	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
							Int	Ext	Total
III	CC XII	U22CC12	Core Course XII INORGANIC CHEMISTRY	4	4	3	25	75	100
III	CC XIII	U22CC13	Core Course XIII ORGANIC CHEMISTRY II	4	4	3	25	75	100
III	CC XIV	U22CC14	Core Course XIV PHYSICAL CHEMISTRY II	4	4	3	25	75	100
III	CC XV	U22CC15P	Core Course XV PRACTICALS -IV PHYSICAL CHEMISTRY EXPERIMENTS	6	5	6	40	60	100
III	DSEC-II	U22DSC2A	Discipline Specific Elective Course-II APPLIED CHEMISTRY	4	4	3	25	75	100
		U22DSC2B	BIOCHEMISTRY						
III	DSEC-III	U22DSC3A	Discipline Specific Elective Course-III PHARMACEUTICAL CHEMISTRY	4	4	3	25	75	100
		U22DSC3B	AGRICULTURAL CHEMISTRY						
IV	SEC-III	U22SEC3P	Skill Enhancement Course III APPLIED CHEMISTRY PRACTICAL	2	2	3	40	60	100
IV	AEC III	U22AE3	Ability Enhancement Course - III GENERAL KNOWLEDGE	2	2	3	25	75	100
Total				30	29				800

VALUE ADDED COURSES (For B.Sc., Chemistry)

Value Added course	Code	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
						Int	Ext	Total
For B.Sc Chemistry (IV semester)								
1		CHEMISTRY OF HEALTH AND HERBS	2	2	2	20	30	50
2		INDUSTRIAL CHEMISTRY	2	2	2	20	30	50
Common for all majors (III Semester)								
1		INTRODUCTION TO CHEMICAL PRODUCTS AROUND US	2	2	2	20	30	50

CORE PAPERS OFFERED BY THE DEPARTMENT OF CHEMISTRY

Semester	Core Paper no.	Code	Title	Lecture hrs. / Week	Credits
I	1	U22CC1	General Chemistry – I	6	6
I & II	2	U22CC2P	Practical -1 (Qualitative analysis & organic preparation)	3+3	3
II	3	U22CC3	General chemistry – II	3	3
II	4	U22CC4	General chemistry – III	3	3
III	5	U22CC5	General chemistry – IV	6	5
III & IV	6	U22CC6P	Practical 2 (Volumetric analysis and organic estimation)	3+3	3
IV	7	U22CC7	Physical and Inorganic chemistry	4	4
V	8	U22CC8	Organic Chemistry – 1	5	5
V	9	U22CC9	Physical Chemistry – 1	5	5
V	10	U22CC10	Analytical Techniques	5	5
V	11	U22CC11P	Practical -3 Gravimetric & organic analysis	6	5
VI	12	U22CC12	Inorganic Chemistry	4	4
VI	13	U22CC13	Organic Chemistry – 2	4	4
VI	14	U22CC14	Physical Chemistry – 2	4	4
VI	15	U22CC15P	Practical -4 Physical chemistry experiments	6	5
TOTAL	15			73	64

DISCIPLINE SPECIFIC ELECTIVE COURSE (DSEC)

Part	semester	Course Type	Code	Title of the Course	Hrs/ Week	Credits
III	V	DSEC-I		Elective 1: FOOD CHEMISTRY	5	5
				Elective 1: POLYMER CHEMISTRY		
III	VI	DSEC-II		Elective 2: APPLIED CHEMISTRY	4	4
				Elective 2: BIOCHEMISTRY		
III	VI	DSEC-III		Elective 3: PHARMACEUTICAL CHEMISTRY	4	4
				Elective 3: AGRICULTURAL CHEMISTRY		

SKILL ENHANCEMENT COURSE (SEC)

Part	Semester	Course Type	Code	Title of the Course	Hrs/ Week	Credits
III	IV	SEC-I	U22SEC1	CHEMISTRY FOR COMPETITIVE EXAMINATION	2	2
III	V	SEC-II	U22SEC2	SMALL SCALE INDUSTRIES	2	2
III	VI	SEC-III	U22SEC3P	APPLIED CHEMISTRY PRACTICAL	2	2

GENERIC ELECTIVE

Part	Sem	Course Type	Code	Title of the Course	Hrs/ Week	Credits
III	V	GEC-I	U22GEC1	INVENTIONS AND INNOVATIONS IN SCIENCE	2	2

NON-MAJOR ELECTIVE COURSES OFFERED BY DEPARTMENT OF CHEMISTRY

Part	Semester	Course Type	Code	Title of the Course	Hrs/ Week	Credits
IV	III	NMEC1	U22NMC1	CHEMISTRY IN LIFE	2	2
IV	IV	NMEC II	U22NMC2	DAY TO DAY CHEMISTRY	2	2

ALLIED COURSES OFFERED BY DEPARTMENT OF CHEMISTRY

Part	Semester	Course Type	Code	Title of the Course	Hrs/ Week	Credits
III	III	AC	ACT1	Allied Course I: ALLIED CHEMISTRY I	4	3
III	IV	AC	ACT2	Allied Course II: ALLIED CHEMISTRY II	4	3
III	III & IV	AC	ACP	Allied Course II: ALLIED CHEMISTRY PRACTICAL	3+3	3

COURSE STRUCTURE ABSTRACT FOR B.Sc. Chemistry PROGRAMME

Part	Course	Total No. of Papers	Hours	Credit	Marks	
I	Language Course (LC)	4	24	12	400	
II	English Language Course (ELC)	4	24	12	400	
III	Core Course (CC)	15	73	64	1500	
III	Allied Course (AC)	6	28	20	600	
III	Discipline Specific Elective Course (DSEC)	3	13	13	300	
III	Generic Elective Course (GEC)	1	2	2	100	
IV	Non-Major Elective Course (NMEC)	2	4	4	200	
IV	Skill Enhancement Course (SEC)	3	6	6	300	
IV	Ability Enhancement Course(AEC)	Value Education	1	2	2	100
IV		Environmental Studies	1	2	2	100
IV		General Knowledge	1	2	2	100
V	NCC/NSS/Extension Activity	1	-	1	100	
Total		42	180	140	4200	
Value Added Courses		2		4	200	
Total		44		144	4400	

Value Added course	Code	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
						Int	Ext	Total
For B.Sc Chemistry								
1		CHEMISTRY OF HEALTH AND HERBS	2	2	2	20	30	50
2		INDUSTRIAL CHEMISTRY	2	2	2	20	30	50
Common for all majors								
1		INTRODUCTION TO CHEMICAL PRODUCTS AROUND US	2	2	2	20	30	50

Internal 20 marks (Test 10 and 10 Demo/Assignment)

Question paper pattern for External Exam

Either or type 5X6=30 marks

Programme: B.Sc CHEMISTRY
Semester: I
Code: U22C1

Part III: Core paper 1
Hours: 6 / W, 90 / S
Credit-6

TITLE OF THE PAPER: GENERAL CHEMISTRY - I

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Discussion/ProblemsolvingQuiz/Assignment/ Periodic Table chart.	ICT	
	6	4	1	1	
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.					
COURSE OUTCOME: At the end of the Semester, the students will be able to				Unit	hrs. /S
CO1: write IUPAC names organic compounds (upto C10), bicyclo compounds and simple aromatic compounds.				1	18
CO2: (i) describe the hybridization. (ii) explain the electronic effects. (iii) apply the influence of electronic effects, relative strengths of acid and base and stability of radicals, carbocations & carbanions.				2	18
CO3 (i) explain the factors affecting ionic compounds, Born Haber cycle, Pauling & Mullikan's scales of electronegativity and Fajan's rule. (ii) differentiate inter and intramolecular hydrogen bonding. (iii) apply VSEPR theory to simple inorganic compounds. (iv) apply MO theory (v) compare VB and MO Theories.				3	18
CO4: to explain the quantum numbers, Pauli's exclusion principle, Hund's rule, Aufbau Principle and periodic properties.				4	18
CO5: to describe the basics of atomic structure and quantum theory.				5	18

UNIT-I: CLASSIFICATION AND NOMENCLATURE OF ORGANIC COMPOUNDS
(18 Hours)

Classification of organic compounds - based on the nature of carbon skeleton and functional groups - classification of organic compounds (primary/secondary/tertiary) - IUPAC system of nomenclature of common organic compounds (upto C-10) - alkanes, alkenes, alkynes, cycloalkanes, bicycloalkanes with and without bridges and aromatic compounds - Naming of organic compounds with one functional group - halogen compounds, alcohols, phenol, aldehydes, ketones, carboxylic acids and its derivatives, cyano compounds, amines, nitro compounds (Both aliphatic and aromatic) - Naming of compounds with two functional groups - naming of compounds with more than one carbon chain - Naming of heterocyclic compounds containing one and two hetero atoms present in five/six membered rings.

UNIT-II: BONDING IN ORGANIC MOLECULES **(18 Hours)**

Hybridization and geometry –sp³, sp² and sp - bond angle, bond length, bond strength of C-H and C-C bonds (comparison of C-C, C=C, Carbon-carbon triple bond)- Electronic effects - inductive effect, resonance effect - drawing of resonance structures - conditions for resonance -

stability of resonance structures, hyper conjugation, electromeric effect, steric effect - steric overcrowding - steric inhibition of resonance - steric relief (with examples). Dissociation of bonds - homolysis and heterolysis - radicals, carbocations, carbanions - electrophiles and nucleophiles - Influence of electronic effects - relative strengths of acids and bases (Relative strength of acidic character of phenols and alcohols, strength of inductive effect on the acidity of carboxylic acids, comparison of relative basic strength of ethylamine and aniline)- stability of radicals, carbocations and carbanions.

UNIT-III: CHEMICAL BONDING

(18 Hours)

Ionic bond – Properties of ionic compounds, factors favoring the ionic compounds - ionization potential – electron affinity – electronegativity – Lattice energy – Born-Haber Cycle – Pauling and Mullikan’s scales of electronegativity – Polarizing power and Polarizability – Partial ionic character from electronegativity. Transition from ionic to covalent character and vice versa – Covalent character of ionic compounds – Fajan's rules – Covalent bond – structure and bonding of homo and heteronuclear molecules (H_2 , Cl_2 , HCl , HF) – Hydrogen bonding – Its nature, types, effect on properties – Intermolecular forces – London forces and van der Waals forces – ion dipole-dipole interactions. VSEPR Theory – Principles and hybridization- Shapes of simple inorganic molecules ($BeCl_2$, BF_3 , $SiCl_4$, PCl_5 , SF_6 , IF_7 , H_2O , NH_3 , XeF_6) -MO Theory – Bonding and anti-bonding orbitals – Applications of MO theory H_2 , He , N_2 , O_2 , HF and CO molecules – Comparison of VB and MO Theories.

UNIT – IV: PERIODIC PROPERTIES

(18 Hours)

Atomic orbitals - Quantum numbers- Principal, Azimuthal, Magnetic and Spin quantum numbers and their significance - principles governing the occupancy of electrons in various quantum levels- Pauli’s exclusion principle – Hund’s rule- Aufbau Principle, (n+1) rule- Stability of half-filled and completely filled orbitals- inert pair effect.

Periodic properties – classification of elements as s, p, d and f-block elements – variation of atomic volume – atomic and ionic radii – ionization potential – electron affinity and electro negativity along period and groups – variation of metallic characters - Factors affecting the periodic properties. Periodic properties – classification of elements as s, p, d and f-block elements – variation of atomic volume – atomic and ionic radii – ionization potential – electron affinity and electro negativity along period and groups – variation of metallic characters - Factors affecting the periodic properties.

UNIT – V: ATOMIC STRUCTURE

(18 Hours)

Planck’s quantum theory - Photoelectric effect, Compton effect, Bohr’s model of hydrogen atom, Wave particle duality, de Broglie equation, Heisenberg uncertainty principle - Eigen function and Eigen value - Postulates of Quantum mechanics - Schrodinger’s time independent wave equation (no derivation), wave functions and its physical properties -Normalization and Orthogonal function.

TEXTBOOKS

1. Textbook of Organic Chemistry by P.L.Soni– Sultan Chand & Sons; 29th edition (2012).
2. Sathyaprakash's Modern Inorganic Chemistry by R.D. Madan; S. Chand Publishing 3rd ed. Reprint (2016).
3. Principles of Physical Chemistry- Puri, Sharma and Pathania–Vishal Publishing Co.; 46th 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.Sarala Thambavani, Published by Madurai Kamaraj University, Madurai, 1998.
6. Arimurai Iyarpur Vethiyal by Sudha soundirapandin, & T.R. Visalakshi, Published by Madurai Kamaraj University, Madurai, 1998.
7. B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, 23rd edn, New Delhi, Shoban Lal Nagin Chand & Co., 1993.

References

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

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1: CLASSIFICATION AND NOMENCLATURE OF ORGANIC COMPOUNDS			
	Classification of organic compounds - based on the nature of carbon skeleton and functional groups - classification of organic compounds (primary/secondary/tertiary) - IUPAC system of nomenclature of common organic compounds (upto C-10) - alkanes, alkenes, alkynes, cycloalkanes, bicycloalkanes with and without bridges and aromatic compounds	5	Atomic models
	Naming of organic compounds with one functional group - halogen compounds, alcohols, phenol, aldehydes, ketones, carboxylic acids and its derivatives, cyano compounds, amines, nitro compounds (Both aliphatic and aromatic)	6	Lecture
	Naming of compounds with two functional groups - naming of compounds with more than one carbon chain - Naming of heterocyclic compounds containing one and two hetero atoms present in five/six membered rings.	7	Lecture, Quiz & Assignment
UNIT II BONDING IN ORGANIC MOLECULES			
	Hybridization and geometry –sp ³ , sp ² and sp - bond angle, bond length, bond strength of C-H and C-C bonds (comparison of C-C, C=C, Carbon-carbon triple bond)- Electronic effects - inductive effect, resonance effect - drawing of resonance structures - conditions for	9	Atomic models /ICT

	resonance - stability of resonance structures, hyper conjugation, electromeric effect, steric effect - steric overcrowding - steric inhibition of resonance - steric relief (with examples).		
	Dissociation of bonds - homolysis and heterolysis - radicals, carbocations, carbanions - electrophiles and nucleophiles - Influence of electronic effects - relative strengths of acids and bases (Relative strength of acidic character of phenols and alcohols, strength of inductive effect on the acidity of carboxylic acids, comparison of relative basic strength of ethylamine and aniline)- stability of radicals, carbocations and carbanions.	9	Lecture
UNIT III CHEMICAL BONDING			
	Ionic bond – Properties of ionic compounds, factors favoring the ionic compounds - ionization potential – electron affinity – electronegativity – Lattice energy – Born-Haber Cycle – Pauling and Mullikan’s scales of electronegativity – Polarizing power and Polarizability – Partial ionic character from electronegativity. Transition from ionic to covalent character and vice versa – Covalent character of ionic compounds – Fajan's rules	9	Atomic models/ ICT
	Covalent bond – structure and bonding of homo and heteronuclear molecules – Hydrogen bonding – Its nature, types, effect on properties – Intermolecular forces – London forces and van der Waals forces– ion dipole-dipole interactions.	5	Lecture
	VSEPR Theory – Principles and hybridization- Shapes of simple inorganic molecules (BeCl ₂ , BF ₃ , SiCl ₄ , PCl ₅ , SF ₆ , IF ₇ , H ₂ O, NH ₃ , XeF ₆) -MO Theory –Bonding and anti-bonding orbitals – Applications of MO theory H ₂ , He, N ₂ , O ₂ , HF and CO molecules – Comparison of VB and MO Theories.	4	Lecture & Assignment
UNIT IV PERIODIC PROPERTIES			
	Atomic orbitals - Quantum numbers- Principal, Azimuthal, Magnetic and Spin quantum numbers and their significance - principles governing the occupancy of electrons in various quantum levels- Pauli’s exclusion principle – Hund’s rule- Aufbau Principle, (n+1) rule- Stability of half-filled and completely filled orbitals- inert pair effect.	6	Periodic table chart
	Periodic properties – classification of elements as s, p, d and f-block elements – variation of atomic volume – atomic and ionic radii – ionization potential – electron affinity and electro negativity along period and groups – variation of metallic characters - Factors affecting the periodic properties.	8	Lecture Quiz.
	Periodic properties – classification of elements as s, p, d and f-block elements – variation of atomic volume –	4	Discussion

	atomic and ionic radii – ionization potential – electron affinity and electro negativity along period and groups – variation of metallic characters - Factors affecting the periodic properties.		
UNIT V ATOMIC STRUCTURE			
	Planck's quantum theory - Photoelectric effect, Compton effect, Bohr's model of hydrogen atom, Wave particle duality, de Broglie equation, Heisenberg uncertainty principle - Eigen function and Eigen value	9	ICT
	Quantum mechanics	9	Lecture

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	3	4	4	2.5	4	4	3.5	3	4	3.6
CO2	4	3.5	3.5	3	3	4	3.5	3.5	3	4	3.5
CO3	4	3.5	3	4	2	4	4	3.5	3	4	3.5
CO4	4	3.5	4	4	2	4	4	3	3.5	4	3.6
CO5	4	3.5	3.5	4	2	4	4	3	3	4	3.5
Mean Overall Score											3.54

Result: The Score for this Course is 3.54 (High Relationship)

UNIT	Part A(10X1)	Part B (5 X 5 = 25) Either or Pattern	PART C(5 X 8 = 40) Either or Pattern
I	K1, K1	K1 (5)	K1 (8)
II	K1, K1	K1 (1.5), K2 (3.5)	K1 (1.5), K2 (6.5)
III	K2, K3	K1 (1.5), K3 (3.5)	K1 (1.5), K3 (3.5)
IV	K2, K2	K1 (1.5), K2 (3.5)	K1 (2), K2 (6)
V	K3, K3	K1 (1.5), K3 (3.5)	K1 (2), K2 (6)

Programme:B.Sc Chemistry
Semester : I & II
Sub. Code : U22CC2P

Part III: Core paper 2
Hours : 3 /W, 45/S
Credits : 3

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

Pedagogy	Hours	Lab session//Demonstration class/Viva voce
	3	3
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.		
COURSE OUTCOME: At the end of the Semester, the students will be able to		Unit hrs.
CO1: analyse the mixture containing two cations and two anions.		1 70
CO2: prepare a few important organic compounds		2 20

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

Bromination of acetanilide

Oxidation: Benzoic acid from benzaldehyde (Demonstration)

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
UNIT 1: QUALITATIVE ANALYSIS			
	Analysis of mixture	60	Lab session
	Analysis of mixture	5	Demonstration
	Analysis of mixture	5	Viva-Voce
UNIT 11: ORGANIC PREPARATION			
	Organic preparation	14	Lab session
	Organic preparation	3	Demonstration
	Organic preparation	3	Viva-Voce

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	5	5	4	5	5	4	4	4	4	4	4.4
CO2	5	5	4	5	4	4	4	4	4	4	4.3
Mean Overall Score											4.35

Result: The Score for this Course is 4.35 (Very High Relationship)

Programme: B. Sc Chemistry
Semester : II
Code: U22CC3

Part III: Core paper 3
Hours : 3 / W, 45 / S
Credits:3

TITLE OF THE PAPER: GENERAL CHEMISTRY- II

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Discussion/Problem solving session/Quiz/ /videos/Demonstration class /ICT
	3	2	1
PREAMBLE: The objective of the course is to make understand the chemistry of Alkanes, Alkenes, Alkynes, cycloalkanes, Diels-Alder reaction and s-block elements and the principles metallurgical processes, qualitative analysis, gas and liquid state.			
COURSE OUTCOME: At the end of the Semester, the students will be able to			Unit
CO1: to describe the chemistry Alkanes, Alkenes and Alkynes.			Hrs. / S
CO2: to explain the chemistry of cycloalkanes, Diels-Alder reaction.			1
CO3: to demonstrate the metallurgical processes and explain the principles of qualitative analysis			2
CO4: describe the chemistry of s-block elements			3
CO5: to explain gas and liquid state			4
			5

UNIT – I: ALIPHATIC COMPOUNDS

(9 Hours)

Alkanes: Preparation – Hydrogenation of alkenes or alkynes, reduction of alkyl halides, decarboxylation of carboxylic acids, hydrolysis of Grignard reagent, Wurtz synthesis– reactions with radical mechanism for substitution reaction.

Alkenes: Preparation from alcohol, haloalkane, and alkynes - reactions of alkenes -electrophilic addition reactions – Markownikoff's rule and peroxide effect - allylic substitution, oxidation by KMnO₄ and polymerization - Application in the synthesis of following molecules - Dibenzyl (from toluene), cis and trans 2-butene.

Alkynes: Preparation- dehydrohalogenation of vicinal halides, dehalogenation of tetrahalides, reaction of calcium carbide with water. Nature of triple bond in alkynes – acidity of terminal alkynes – electrophilic addition reactions.

Environmental Awareness: Hydrocarbons and photochemical smog.

UNIT – II: ALICYCLIC COMPOUNDS

(9 Hours)

Cycloalkanes: Preparation (small, medium & large ring compounds) - reactions - cycloaddition, dehalogenation, pyrolysis of calcium salt of dicarboxylic acid - Wurtz reaction - stability of cycloalkanes - Baeyer's strain theory. Cycloalkenes: Preparation and reactions of cycloalkenes.

Conjugate dienes 1,3-butadiene- 1,2 and 1,4 addition, and Diels-Alder reaction – Examples of Diene and Dienophile.

Application in the synthesis of following molecules – cyclohexene, Phthalic Anhydride, cis and trans 1,4-dimethylcyclohexene.

UNIT – III: METALLURGY & PRINCIPLES OF QUALITATIVE ANALYSIS (9 hrs)

Metallurgy: Occurrence of metals — General methods involved in extraction of metals- concentration of ores – froth floatation, magnetic separation, calcination, roasting, smelting, flux, aluminothermic process. Extraction processes – Chemical reduction – electrolytic reduction – metal displacement – refining methods – distillation – fractional crystallization – electrolysis. Zone refining – Van Arkel de Boer Method- electrolytic refining

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

Application of Solubility principle in the separation of elements

UNIT –IV: S- BLOCK ELEMENTS

(9 Hours)

Position of hydrogen in the periodic table, General characteristics of s – block elements – Compounds of s-block metals – oxides, hydroxides, peroxides, superoxide- oxo salts – carbonates – bicarbonates – nitrates – halides and polyhalides (Examples alone). Anomalous behavior of Li and Be – Extraction of Mg – physical and chemical properties . Complexes of s-block metals – complexes with crown ethers – Organometallic compounds of Li and Be.

Biological Importance of s-block Elements in human – Sodium, Potassium, Calcium and Magnesium (Brief Idea)

UNIT – V: KINETIC THEORY OF GASES

(9 Hours)

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. Textbook of Organic Chemistry by P.L.Soni- SultanChand & Sons; 29th edition (2012).
2. Sathyaprakash's Modern Inorganic Chemistry by R.D.Madan; S. Chand Publishing 3rd ed. reprint (2016).
3. Principles of Physical Chemistry- Puri, Sharma and Pathania- Vishal Publishing Co.; 46th 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. KanimaVethiyal by L. Anjana, S.K. Santha, R. Santhanalakshmi, R. Saraswathi, N. Vijayathara, Sudhasoundirapandian, D.SaralaThambavani, Published by Madurai Kamaraj University, Madurai, 1998.

6. ArimuraiIyarpuVethiyal 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, 22nd edition.

2. Organic Chemistry by Morrison & Boyd, Pearson Publishers, 7th edition.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT – I: ALIPHATIC COMPOUNDS			
	Hydrocarbons and photochemical smog	1	ICT
	Chemistry of Alkanes, Alkenes and Alkynes	7	Lecture
	Acidity of Alkynes	1	Seminar
UNIT – II: ALICYCLIC COMPOUNDS			
	Chemistry of Alicyclic Compounds and Diels Alder reaction.	7	Lecture
	Application in the synthesis of following molecules – cyclohexene, Phthalic Anhydride, cis and trans 1,4-dimethylcyclohexene.	2	Problem solving
UNIT – III: METALLURGY & PRINCIPLES OF QUALITATIVE ANALYSIS			
	froth floatation, magnetic separation, calcination, roasting, smelting	2	ICT
	Principles of metallurgy	7	Lecture
UNIT – IV: S - BLOCK ELEMENTS			
	Biological Importance of s-block Elements in human	2	ICT
	General characteristics of s – block elements and their chemistry.	7	Lecture
UNIT – V: KINETIC THEORY OF GASES			
	Maxwell-Boltzmann law of distribution of molecular velocities, Graphical representation –Effect of Temperature on velocity distribution- Experimental verification of Maxwell velocity distribution – 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.	9	Lecture, Quiz

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	3	4	4	2	4	4	3.5	3.5	4	3.6
CO2	4	3	3.5	4	2.5	4	4	3	3	4	3.5
CO3	4	3.5	3	4	2.5	4	3	3	4	4	3.5
CO4	4	3	3	4	3	4	4	3	3	4	3.5
CO5	4	3.5	3.5	4	2	4	4	3	3	4	3.5
Mean Overall Score											3.46

Result: The Score for this Course is 3.46 (High Relationship)

UNIT	Part A(10X1)	Part B (5 X 5 = 25) Either or Pattern	PART C(5 X 8 = 40) Either or Pattern
I	K1, K1	K1 (5)	K1 (8)
II	K1, K1	K1 (1.5) , K2 (3.5)	K1 (1.5) , K2 (6.5)
III	K2, K3	K1 (1.5) , K3 (3.5)	K1 (1.5) , K3 (3.5)
IV	K2, K2	K1 (1.5) , K2 (3.5)	K1 (2) , K2 (6)
V	K3, K3	K1 (1.5) , K3 (3.5)	K1 (2) , K2 (6)

Programme : B.Sc Chemistry
Semester : II
Sub. Code : U22CC4

Part III: Core paper 4
Hours :3 /W, 45 Hrs. /S
Credits:3

TITLE OF THE PAPER: GENERAL CHEMISTRY- III

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Discussion/Problemsolving session/Quiz/ videos/Demonstration class.	ICT	
	4	2	1	1	
PREAMBLE: The objective of the course is to make the student understand aromaticity and aromatic compounds, p-block elements Boron family, Carbon family, Colloids, Nanomaterials and Liquid crystals.					
COURSE OUTCOME: At the end of the Semester, the Students will be able to				Unit	hrs./S
CO1: demonstrate aromaticity, Aromatic electrophilic substitution				1	12
CO2: explain the characteristics of elements of Group III A and some important compounds of Boron and Aluminium.				2	12
CO3: demonstrate the characteristics of elements of IV A and the Chemistry of silicones.				3	12
CO4: explain the nature of applications of colloids				4	12
CO5: explain nanomaterials, liquid crystals and their applications.				5	12

UNIT – I: AROMATICITY AND AROMATIC COMPOUNDS

(9 Hours)

Aromaticity - definition - Huckel's rule - consequence of aromaticity - stability, carbon- carbon bond lengths in benzene ring, resonance energy - Aromatic electrophilic substitution - general pattern of the mechanism involving σ and π complexes, mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction - Activating and deactivating substituents - orientation in mono substituted benzenes - reactions of aromatic side chain - halogenation and oxidation - Methods of formation and chemical reactions of Naphthalene.

Application– Application of aromatic compounds in day-to-day life. (Medicine, Aromatic derived products in Automotives, electronics, Polystyrene foam, Perfume, and Preservative)

UNIT – II: p-BLOCK ELEMENTS – BORON FAMILY

(9 Hours)

General characteristics of elements of Group III A – Physical and chemical properties of Boron – compounds of boron – Borax, Boric acid, Diborane, Boron nitride – Extraction of Al – Physical and Chemical properties.

Applications of Boron nitride, Aluminium chloride, Alumina, alums and alloys of Aluminium.

UNIT – III: p-BLOCK ELEMENTS –CARBON FAMILY

(9 Hours)

General characteristics of elements of Group IV A – Allotropic forms of carbon – Chemistry of charcoal – Types of Charcoal – chemistry of oxides of carbon- Physical and chemical properties of Si- Oxides of silicon – structures of silicates. Chemistry of silicones –extraction of lead – physical and chemical properties – Uses – lead pigments.

Environmental Awareness: Air Pollution due to CO – Leaded Petrol- Biochemical effect of Lead in its interference with heme synthesis.

Applications of Silicones, Uses of Charcoal.

UNIT-IV: COLLOIDS**(9 Hours)**

Colloids - Distinguishing characteristics of colloids, suspensions and solutions- Types of colloidal dispersions-Optical properties-Tyndall effect- Kinetic properties – Brownian motion- Electrical properties–Helmholtz and diffuse double layers – electro kinetic or zeta potential – electrophoresis and its applications Coagulation – methods of coagulation – Hardy Schultz law – Hofmeister series -Protective colloids – protective action – gold number – Emulsions – classification, preparation, Gels – preparation – properties (thixotropy, syneresis and imbibition). **Applications** of Colloids (Food, Medicine, Smoke precipitation, water purification, Sewage disposal, Rubber industry, Artificial rain, Leather tanning, Photography, Cleansing action of soap, and Formation of delta.).

UNIT-V NANOMATERIALS AND LIQUID CRYSTALS**(9 Hours)**

Nanomaterials- introduction-self assembled mono layers- nano wires- types of nano particles- pure gold, silver and cobalt-metal oxides- alumina and titania- synthesis by physical vapor deposition method-reduction method.

Liquid crystals – classification of thermotropic liquid crystals – nematic, smectic and cholesteric liquid crystals with examples.

Applications of Nanomaterials (Catalysis, Sensors, Nanomedicines, Nano crystal based solar cells, fuel cells, electronic devices, Nanoscale films and nanoengineered materials).

Applications of Liquid Crystals (Technological applications- LCD Display, Computer monitor, smart windows, Liquid crystal thermometer and biosensors).

TEXTBOOKS

1. Textbook of Organic Chemistry by P.L. Soni- Sultan Chand & Sons; 29th edition (2012).
2. Sathyaprakash's Modern Inorganic Chemistry by R.D. Madan;S. Chand Publishing 3rd ed. reprint (2016).
3. Principles of Physical Chemistry- Puri, Sharma and Pathania- Vishal Publishing Co.; 46th 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. KanimaVethiyal by L. Anjana, S.K. Santha, R. Santhanalakshmi, R. Saraswathi N. Vijayathara, Sudha Soundirapandian, D.SaralaThembavani, Published by Madurai Kamaraj University, Madurai, 1998.
6. ArimuraiIyarpuVethiyal by Sudha Soundirapandian, & T.R. Visalakshi, Published by Madurai Kamaraj University, Madurai, 1998.
7. S.Shanmugam, Nanotechnology, 1st Ed., MJP Publishers, 2011.
8. G.Mohankumar, Nanotechnology, nanomaterials and nanodevices, 1st Ed., Narosa Pub. House 2016.

References

1. Organic Chemistry by Morrison & Boyd, Pearson Publishers, 7th edition.
2. Inorganic Chemistry by J. D. Lee, Wiley publishers.
3. T.Pradeep, Nano The Essentials, 1st Ed., McGraw Hill Companies, 2007.

UNITS	TOPIC	LECTURE	MODE OF TEACHING
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		HOURS	
UNIT I: AROMATICITY AND AROMATIC COMPOUNDS			
	aromaticity	1	ICT
	aromaticity, Aromatic electrophilic substitution, activating and deactivating substituents and Methods of formation and chemical reactions of Naphthalene	7	Lecture
	Application of aromatic compounds in day-to-day life.	1	Seminar/Assignment
UNIT – II: p-BLOCK ELEMENTS – BORON FAMILY			
	Applications of Boron nitride, Aluminium chloride, Alumina, alums and alloys of Aluminium.	2	Group discussion
	Group discussion of p-block elements and their chemistry	7	Lecture with interactive discussion.
UNIT – III: p-BLOCK ELEMENTS – CARBON FAMILY			
	Air Pollution due to CO – Leaded Petrol- Biochemical effect of Lead in its interference with heme synthesis.	2	ICT
	Group discussion and chemistry of carbon family	6	Lecture
	Applications of Silicones, Uses of Charcoal	1	Seminar/ Assignment
UNIT-IV: COLLOIDS			
	Applications of Colloids	2	ICT
	Properties of Colloids	6	Lecture
	Emulsions and gels	1	Quiz
UNIT-V NANOMATERIALS AND LIQUID CRYSTALS			
	nematic, smectic and cholesteric liquid crystals	2	ICT
	Nanomaterials and Liquid crystals	5	Lecture
	Applications of Nanomaterials and liquid crystals	2	Group discussion / 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	5	4	5	4	4	5	4	3	4	3	4.1
CO2	4	5	4	3	3	4	5	4	3	4	3.9
CO3	4	3	5	4	5	4	3	5	4	3	4.0
CO4	5	4	3	3	4	4	5	4	4	4	4.0
CO5	5	4	3	4	5	4	3	5	4	5	4.2
Mean Overall Score											4.0

Result: The Score for this Course is 4.0 (High Relationship)

UNIT	Part A(10X1)	Part B (5 X 5 = 25) Either or Pattern	PART C(5 X 8 = 40) Either or Pattern
I	K1, K1	K1 (5)	K1 (8)
II	K1, K1	K1 (1.5) , K2 (3.5)	K1 (1.5) , K2 (6.5)
III	K2, K3	K1 (1.5) , K3 (3.5)	K1 (1.5) , K3 (3.5)
IV	K2, K2	K1 (1.5) , K2 (3.5)	K1 (2) , K2 (6)
V	K3, K3	K1 (1.5) , K3 (3.5)	K1 (2) , K2 (6)

Programme : B.Sc Chemistry
Semester : III
Sub. Code : U2CC5

Part III: Core paper 5
Hours : 6 /W, 90 hrs. /S
Credits: 5

TITLE OF THE PAPER: GENERAL CHEMISTRY – IV

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Discussion/Problem solving session/Quiz/videos/Demonstration class.	ICT	
	6	4	1	1	
PREAMBLE: The objective of the course is to make the student understand the chemistry of Haloalkanes, alcohols, phenols and ethers, principles of volumetric analysis, gravimetric analysis, adsorption, catalysis and p-block elements.					
COURSE OUTCOME: At the end of the Semester, the students will be able to				Unit	hrs./S
CO1: demonstrate the chemistry of haloalkenes.				1	18
CO2: demonstrate the chemistry of alcohols, phenols and ethers.				2	18
CO3: explain the theory behind the volumetric analysis and perform calculations based on it.				3	18
CO4: explain the principles of gravimetric analysis, error analysis and adsorption.				4	18
CO5: describe the chemistry of Nitrogen.				5	18

UNIT – I: HALOALKANES

(18 Hours)

Classification of alkyl halides - methods of formation from alcohols, alkanes, alkenes – allylic/benzylic bromination and chlorination – Hundiecker reaction, Finkelstein reaction and Swart's reaction - nucleophilic substitution reactions - mechanisms of nucleophilic substitution reactions - SN₂ and SN₁ reactions with energy profile diagrams- dehydrohalogenation with mechanism - Saytzeff's rule - reaction with metals -Wurtz reaction and formation of Grignard reagent - Methods of formation of aryl halides nucleophilic substitution reactions of aryl halides -addition-elimination and the elimination-addition mechanisms - electrophilic substitution -Ullmann reaction – Wurtz-Fittig reaction – Relative reactivities of alkyl, allyl, vinyl and aryl halides - Synthesis and uses of DDT and BHC.

Environmental Awareness: Environmental Issues of DDT – Safe Alternative Neem based insecticide.

UNIT- II: ALCOHOLS, PHENOLS AND ETHERS

(18 Hours)

Preparation of alcohols through reduction, hydroboration, hydration, oxymercuration and Grignard reaction. Reactions of alcohol - with metals, esterification, oxidation, dehydration, conversion to alkyl halides. Preparation of phenols - acidity of phenol vs alcohols - relative acid strength of substituted phenols - reactions of phenols - esterification, oxidation, Kolbe's, Reimer-Tiemann, Gattermann, electrophilic substitution reactions. Ethers – preparation, reactions – epoxide.

Applications: Synthesis of aspirin, t-butyl methyl ether (Gasoline additive to raise octane number) and 1-methyl-1-cyclohexanol.

Uses of Phenols (Phenol Formaldehyde resin (Novalac) as an adhesive – disinfectant – Vaccine preservative- phenol injection for muscle spasticity - Phthalein dyes and picric acid)

UNIT – III PRINCIPLES OF VOLUMETRIC ANALYSIS**(18 Hours)**

General principle: Types of titrations. Requirements for titrimetric analysis. Concentration systems: Molarity, molality formality, normality, wt%, ppm - problems. Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions. Limitation of volumetric analysis, end point and equivalence point. Neutralisation-titration curve, theory of indicators, choice of indicators. Use of phenolphthalein and methyl orange. Complexometric titrations: Stability of complexes, titration involving EDTA. Metal ion indicators and characteristics. Problems based on titrimetric analysis.

Environmental Assessment: Use of titration involving EDTA in assessing water pollution (Principle only)

UNIT IV PRINCIPLES OF GRAVIMETRIC ANALYSIS, ERROR ANALYSIS AND ADSORPTION**((18 Hours)**

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

Error Analysis: Definition of error- Classification of errors – definition of precision and accuracy – significant figures.

Adsorption: Definition of the various terms – adsorption of gases on solids – characteristics of adsorption of gases on solids – Differences between physisorption and chemisorption – factors influencing adsorption – adsorption isotherms – Freundlich and Langmuir adsorption isotherms – BET theory – elementary idea.

Applications of adsorption-Production of high vacuum, gas mask, control of humidity, colour removal, separation of inert gases, heterogenous catalysis, purification of water, curing diseases and adsorption indicators.

UNIT – V: P-BLOCK ELEMENTS – NITROGEN FAMILY**(18 Hours)**

General characteristics of elements of V A Group –Differences between nitrogen and other family members- Chemistry of some compounds of nitrogen – hydrazine, hydroxylamine, hydrazoic acid, nitric acid – nitrogen cycle– Nitrides - Preparation of nitric oxide and nitrogen dioxide – Structure of Nitrous oxide, nitric oxide, dinitrogen trioxide, dinitrogen tetraoxide - Chemistry of phosphorous trioxide, phosphorus pentoxide, orthophosphoric acid and pyrophosphoric acids.

Uses of Nitrogen: in X-ray detector, in pharmaceutical industries, in pollution control, in food packaging, in soldering, as fire extinguisher, as purging gas, as shielding gas in welding, preserve biological specimens, used as an anesthetic.

Environmental Awareness: Nitrogen oxides as pollutants - Acid Rain.

TEXTBOOKS

1. Text book of Organic Chemistry by P.L.Soni- Sultan Chand & Sons; 29th edition (2012).
2. Principles of Physical Chemistry- Puri, Sharma and Pathania - Vishal Publishing Co.; 46th 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. ArimuraiIyarpu Vethiyal 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
UNIT I: HALOALKANES			
	Chemistry of Haloalkanes	14	Lecture
	Environmental Issues of DDT – Safe Alternative Neem based insecticide.	2	Seminar& Peer teaching
	Relative reactivities of alkyl, allyl, vinyl and aryl halides - Synthesis and uses of DDT and BHC.	2	Assignment
UNIT II: ALCOHOLS, PHENOLS AND ETHERS			
	Uses of Phenols	2	ICT
	Chemistry of Alcohols, Phenols and ethers	14	Lecture
	Applications: Synthesis of aspirin, t-butyl methyl ether (Gasoline additive to raise octane number) and 1-methyl-1-cyclohexanol.	2	Seminar
UNIT III: PRINCIPLES OF VOLUMETRIC ANALYSIS			
	Expression of concentrations of a solution, Calculation of equivalent weight for various substances involved in volumetric analysis	6	Lecture Quiz& problem solving
	Principles of volumetric analysis	10	Lecture
	Use of titration involving EDTA in assessing water pollution (Principle only)	2	Seminar/ Group discussion
UNIT IV: PRINCIPLES OF GRAVIMETRIC ANALYSIS, ERROR ANALYSIS AND ADSORPTION			
	Principles of Gravimetric Analysis	3	Demonstration
	Principles of Gravimetric Analysis, Error Analysis and Adsorption	9	Lecture
	Applications of adsorption	3	ICT
	Applications of adsorption	3	Seminar
UNIT V :P-BLOCK ELEMENTS – NITROGEN FAMILY			
	General characteristics of elements of V A Group –Differences between nitrogen and other family members- Chemistry of some compounds of nitrogen – hydrazine, hydroxylamine, hydrazoic acid, nitric acid – nitrogen cycle– Oxides of nitrogen and Phosphorous – oxyacids of phosphorus. Nitrides	8	Lecture / ICT
	Uses of Nitrogen: in X-ray detector, in pharmaceutical industries, in pollution control, in food packaging, in soldering, as fire extinguisher, as purging gas, as shielding gas in welding, preserve biological specimens, used as an anesthetic.	8	Lecture
	Environmental Awareness: Nitrogen oxides as pollutants Acid Rain	2	Group discussion

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	3	4	3	4	4	3	3	3	3.5
CO2	4	4	3	3	4	4	4	4	3	3	3.6
CO3	4	4	3	4	3	4	3	4	3	4	3.6
CO4	4	4	3	3	4	4	4	3	3	4	3.6
CO5	4	4	4	3	4	4	4	3	3	3	3.6
Mean Overall Score											3.58

Result: The Score for this Course is 3.58 (High Relationship)

UNIT	Part A(10X1)	Part B (5 X 5 = 25) Either or Pattern	PART C(5 X 8 = 40) Either or Pattern
I	K1, K3	K2 / K3	K3 / K2
II	K2, K3	K3 / K1	K2 / K1
III	K1, K3	K1 / K3	K3 / K3
IV	K2, K3	K3 / K3	K1 / K3
V	K1, K2	K3 / K2	K3 / K3

Programme :B.Sc Chemistry
Semester : III & IV

Part III: Core Paper 6
Hours: 3 / W, 45 / S

3 hours per week in III semester
and 3 hours in IV semester

Credits : 3

Sub. Code : U22CC6P

**TITLE OF THE PAPER: PRACTICAL – II,
VOLUMETRIC ANALYSIS AND ORGANIC ESTIMATION**

Pedagogy	Hours	Lab session//Demonstration class/Viva voce
	3	3
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.		
COURSE OUTCOME: At the end of the Semester, the students will be able to		Unit Hours
CO1: estimate the given inorganic solution, volumetrically		1 60
CO2: estimate the given organic solution, volumetrically		2 30

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

Titration 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	LAB HOURS	MODE OF TEACHING
UNIT 1: VOLUMETRIC ANALYSIS			
	Volumetric Estimation	60	Lab session
	Volumetric Estimation	10	Demonstration
	Volumetric Estimation	10	Viva-Voce
UNIT 11: ORGANIC ESTIMATION			
	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
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	5	5	4	5	4	4	4	5	4	4	4.4
CO2	5	5	4	5	4	4	4	4	4	4	4.3
Mean Overall Score											4.35

Result: The Score for this Course is 4.35 (Very High Relationship)

Programme : B.Sc Chemistry
Semester : IV
Sub. Code : U22CC7

Part III: Core paper 7
Hours : 4 /W, 60 Hrs. /S
Credits: 4

TITLE OF THE PAPER: PHYSICAL AND INORGANIC CHEMISTRY

Pedagogy	Hours	Lecture	Peer Teaching/ Seminar/Discussion/Problem Solving session/Quiz/Videos/ Demonstration class
	4	3	1
PREAMBLE: The objective of the course is to make the student understand Raoult's law, non-ideal solutions and Colligative properties iii) Phase equilibria iv) Nuclear Chemistry and v) Solid state Chemistry			
COURSE OUTCOME: At the end of the Semester, the students will be able to			Unit
CO1: explain Raoult's law, non-ideal solutions and Colligative properties			Hours
CO2: describe the concepts of phase rule.			1
CO3: demonstrate the composition and stability of the nucleus and types of nuclear reactions.			2
CO4: explain the Natural and artificial radioactivity and applications.			3
CO5: explain crystal structures and crystal defects.			4
			5

UNIT –I: SOLUTIONS AND COLLIGATIVE PROPERTIES (12 Hours)

Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes. Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications. Colligative properties- elevation of boiling point, depression in freezing point – Abnormal behavior of solutions of electrolytes.

Application of colligative property, depression in freezing point in the determination of molecular weight.

UNIT –II: PHASE EQUILIBRIA (12 Hours)

Phase Rule: Concepts of phase, component and degrees of freedom, with examples. Gibb's phase rule – derivation. One-component system: Phase diagrams: Water and sulphur systems. Two component system: (i) Simple eutectic: Lead-silver system- Formation of compound with congruent melting point: Ferric chloride – water system. Clausius - Clapeyron equations and their applications to equilibria in phase transitions. (Solid – liquid, liquid – vapour, solid – vapour).

UNIT –III: NUCLEAR CHEMISTRY I**(12 Hours)**

Introduction – composition of nucleus and nuclear forces – nuclear stability – mass defect – binding energy – packing fraction – N/P ratio – magic numbers – nuclear models – liquid drop – Shell and collective model. 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.

Places of Nuclear reactors in India.**UNIT –IV: NUCLEAR CHEMISTRY II****(12 Hours)**

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. Particle accelerators: Linear accelerators – cyclotron and synchrotron.

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.

UNIT V: SOLID STATE CHEMISTRY & STRUCTURE OF SOLIDS**(12 Hours)**

Ionic bonding – lattice energy – Born equation and its derivation, radius ratio rules –Bragg's equation - superconductors

Classification of solids – amorphous and crystalline solids – Van der Waals crystals – covalent crystals (Diamond and Graphite) – Laws of crystallography – Elements of symmetry – Weiss and Miller indices – Crystal systems and Bravais lattices. Structure of ionic solids – crystal structures – Sodium chloride, Zinc blende, wurtzite, rutile, Cesium chloride, fluorite – antiferite – Identification of simple cubic, bcc, fcc lattices. Crystal defects – Schottky and Frenkel defects – F-center.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
Unit –I: SOLUTIONS AND COLLIGATIVE PROPERTIES			
	Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes. Partial miscibility of liquids: Immiscibility of liquids- Nernst distribution law and its applications. Colligative properties- elevation of boiling point, depression in freezing point –	7	Lecture

	Principle of steam distillation	2	Seminar & Peer teaching
	Critical solution temperature; effect of impurity on partial miscibility of liquids.	2	ICT & Lecture
	Application of colligative property, depression in freezing point in the determination of molecular weight.	1	Demonstration
UNIT –II: PHASE EQUILIBRIA			
	Phase rule and explaining phase diagrams	7	Lecture
	Clapeyron equations and their applications to equilibria in phase transitions.	3	Lecture
	Phase diagrams	2	Chart preparation
UNIT –III: NUCLEAR CHEMISTRY I			
	Introduction – composition of nucleus and nuclear forces – nuclear stability – mass defect – binding energy – packing fraction – N/P ratio – magic numbers	2	Lecture
	Shell model and liquid drop model and collective model. Theory of radioactivity – laws of radioactivity – Soddy's Group Displacement law.	6	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
	Places of Nuclear reactors in India.		Seminar/Assignment
UNIT –IV: NUCLEAR CHEMISTRY II			
	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 and in the investigation of reaction mechanisms in analytical chemistry.	8	Lecture
	Application of radioactivity: radioactive isotopes as tracer elements - applications in medicine, agriculture and industry, carbon dating	2	Seminar
	Particle accelerators: cyclotron and synchrotron	2	ICT
UNIT V: SOLID STATE CHEMISTRY & STRUCTURE OF SOLIDS			
	crystal structures – Sodium chloride, Zinc blende, wurtzite, rutile, Cesium chloride, fluorite – antiferite – Identification of simple cubic, bcc, fcc lattices.	1	ICT & Group discussion
	Ionic bonding – lattice energy – Born equation and its derivation, radius ratio rules – Bragg's equation - Classification of solids – amorphous and crystalline solids – Van der Waals crystals – covalent crystals (Diamond and Graphite) – Laws of crystallography – Elements of symmetry – Weiss and Miller indices – Crystal systems and Bravais lattices. Structure of ionic solids – crystal structures – Sodium chloride, Zinc blende, wurtzite, rutile, Cesium chloride, fluorite – antiferite – Identification of simple cubic, bcc, fcc	8	Lecture

	lattices.		
	Crystal defects – Schottky and Frenkel defects – F-center.	2	ICT&Lecture
	superconductors	1	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	3	3	4	3	4	3	3	3	4	3.4
CO2	4	4	3	3	4	4	4	3	3	4	3.6
CO3	4	4	4	3	4	4	4	4	3	3	3.7
CO4	4	4	4	3	4	4	4	4	3	4	3.8
CO5	4	4	3	3	4	4	4	3	3	3	3.5
Mean Overall Score											3.6

Result: The Score for this Course is 3.6 (High Relationship)

UNIT	Part A(10X1m)	Part B (5 X 5 = 25m) Either or Pattern	PART C(5 X 8 = 40m) Either or Pattern
I	K1, K3	K2 / K3	K3 / K2
II	K2, K3	K3 / K1	K2 / K1
III	K1, K3	K1 / K3	K3 / K3
IV	K2, K3	K3 / K3	K1 / K3
V	K1, K2	K3 / K2	K3 / K3

Programme :B.Sc Chemistry
Semester : IV
Sub. Code : U22SEC1

Part IV: SEC– I
Hours : 2 /W, 30 /S
Credits : 2

SKILL ENHANCEMENT COURSE I

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
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.			
COURSE OUTCOME: At the end of the Semester, the Students will be able to			Unit
			Hrs. /S
CO1: discuss General characteristics of alkanes, alkenes, alkynes, stereochemistry, Explain carbohydrates, hybridization, polar effects.			1
CO2: describe the periodic properties, metallurgical processes, types of chemical bonding and nuclear chemistry.			2
CO3: explain Colligative properties, Phase rule, Catalysis, chemical kinetics and electrochemistry.			3
CO4: apply the concepts of volumetric analysis, thermo gravimetric analysis.			4
CO5: discuss the properties of Paints, varnishes, cement, fuels soaps and detergents, insecticides.			5

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
UNIT 1: ORGANIC CHEMISTRY			
	General characteristics of alkanes, alkenes, alkynes.	4	Lecture
	Stereochemistry.	1	ICT
	Carbohydrates, hybridization, polar effects.	1	Quiz

UNIT II: INORGANIC CHEMISTRY			
	periodic properties, metallurgical processes	3	Lecture
	types of chemical bonding	2	Quiz
	Nuclear chemistry	1	ICT
UNIT III: PHYSICAL CHEMISTRY			
	Colligative properties	1	Lecture
	Phase rule	1	ICT
	Catalysis	1	Lecture
	chemical kinetics	1	Lecture
	electrochemistry	2	ICT and Quiz.
UNIT IV: ANALYTICAL CHEMISTRY			
	concepts of volumetric analysis.	3	Demo
	thermogravimetric analysis	3	ICT, Lecture, & Assignment.
UNIT V: APPLIED CHEMISTRY			
	properties of Paints, varnishes, cement, fuels, soaps and detergents, insecticides.	3	Lecture & Group Discussion

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	5	4	5	3	4	4	5	4	3	5	4.2
CO2	4	5	3	4	4	5	4	3	4	5	4.1
CO3	5	3	4	5	4	4	3	5	4	4	4.1
CO4	5	3	3	4	4	4	5	4	3	5	4.0
CO5	5	4	3	4	5	3	4	3	5	4	4.0
Mean Overall Score											4.08

Result: The Score for this Course is 4.08 (Very High Relationship)

Programme : B.Sc Chemistry
Semester : V
Sub. Code : U22CC8

Part III: Core paper 8
Hours : 5 /W, 75/S
Credits : 5

TITLE OF THE PAPER: ORGANIC CHEMISTRY- I

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/ Discussion/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 to make 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.

COURSE OUTCOME: At the end of Semester V, the students will be able to demonstrate thorough and clear knowledge of the following given below.	Unit	hrs. /S
CO1: Stereochemistry of organic compounds	1	15
CO2: Chemistry of Aldehydes and Ketones	2	15
CO3: Chemistry of Aliphatic and Aromatic Carboxylic acids	3	15
CO4: Chemistry of Aliphatic and Aromatic Nitrogen compounds	4	15
CO5: Chemistry of Carbohydrates	5	15

UNIT-I: STEREOISOMERISM

(15 Hours)

Optical isomerism:

i) Optical activity – specific rotation and its polarimetric determination – definition of optical isomerism – elements of symmetry. Representation of molecules in sawhorse, Fischer, and Newman formulae and their inter-translations.

ii) Optical isomerism of compounds containing asymmetric carbon atom – lactic and tartaric acids, enantiomers and diastereomers – racemization 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.

Optical activity of compounds without asymmetric carbon atoms: allenes, spiranes and biphenyl compounds.

Geometrical isomerism – nomenclature of geometrical isomers – cis/trans, E-Z notation and syn-anti for C=C, C=N compounds - Stereospecific addition to double and triple bonds – definition of stereospecific and stereoselective reactions – addition of Br₂ to E and Z Butene-2.

Conformational analysis of ethane, n-butane, cyclohexane and mono substituted cyclohexanes.

Significance of Stereochemistry in drugs: Thalidomide disaster in 1957- Need for strict testing of optical isomer and its drug action.

UNIT-II: ALDEHYDES AND KETONES

(15 Hours)

General methods of synthesis of aldehydes and ketones - synthesis of aldehydes from acid chlorides, Stephen's reduction - Gattermann-Kosch and Etard reactions - synthesis of ketones from nitriles, dialkyl cadmium, alkyl lithium and lithium dialkylcuprate and Friedel-Crafts and Hoesch reactions. Mechanism of nucleophilic additions to carbonyl group -addition of HCN, alcohols, thiols, sodium bisulfite, Grignard reagents -condensation with ammonia and its derivatives - Aldol, Perkin, Benzoin and Knoevenagel condensations, Wittig reaction, Mannich reaction, Reformatsky reaction and Cannizzaro reaction. Oxidation by Tollen's reagent, KMnO_4 , SeO_2 and peracids. Reduction by H_2/Ni , $\text{H}_2\text{-Pd-C}$, NaBH_4 , LiAlH_4 , MPV, Clemmensen and Wolff-Kishner reductions.

UNIT III: CARBOXYLIC ACIDS

(15 Hours)

General methods of preparation of carboxylic acids, acidity of carboxylic acids, effects of substituents on acid strength, acidity of aliphatic vs aromatic acids. Reactions of carboxylic acids - Hell-Volhard-Zelinsky reaction (Mechanism needed), Synthesis of acid chlorides, esters and amides, Reduction of carboxylic acids, methods and mechanism of decarboxylation. Methods of preparation and chemical reactions of a) halo acids -Monochloroacetic acid b) Hydroxy acids - lactic and tartaric acid. Action of heat on hydroxy acids c) unsaturated monocarboxylic acids- crotonic acid, cinnamic acid d) dicarboxylic acids. Preparation and reactivity of carboxylic acid derivatives - acid chlorides, esters, amides and anhydrides - Mechanisms of esterification and hydrolysis (acid and base catalyzed reactions) – Bouveault Blanc Reduction - Synthesis of active methylene compounds – diethyl malonate and ethyl acetoacetate.

Uses of Lactic acid, tartaric acid, crotonic acid, cinnamic acid, monochloro acetic acid

UNIT-IV: NITROGEN CONTAINING COMPOUNDS

(15 Hours)

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 and structure of urea. Estimation of urea.

Aromatic nitro compounds: 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**.

Uses of TNT, TNB and Urea.

UNIT V : CARBOHYDRATES

(15 Hours)

Carbohydrates: Definition - Classification with suitable examples - Classification of sugars as reducing and nonreducing sugars - Stereochemistry of carbohydrates: D- and L- configurations - Anomers and epimers with suitable examples - Monosaccharides: Glucose –chemical properties of glucose - Epimerization of glucose - Anomers of glucose and mutarotation - Fructose and its

properties - Conversion glucose into fructose and vice-versa - Formation of osazone and glycosides - Fischer open structure and evidences for open structure - Haworth projection cyclic structures (pyranose and furanose) and evidences for cyclic structures of glucose and fructose - Stepping up - Kiliani- Fischer synthesis and stepping down - Ruff degradation of monosaccharides.

Disaccharides –General Reactions - Structure of Sucrose.

Polysaccharides: Starch and cellulose [structural discussion not needed]–

Applications of cellulose derivatives.

TEXTBOOKS

1. Text book of Organic Chemistry by P.L.Soni-SultanChand & Sons; 29th edition (2012)
2. Advanced Organic Chemistry by B.S.Bahl and Arun Bahl ; S. Chand Publishing 20th edition
3. Organic Chemistry by Morrison and Boyd; Pearson Education India; 7th edition (2010)
4. Organic Chemistry Vol. 1 by I. L. Finar; Pearson Education India; 6th 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, 8th edition (2015)
2. Modern Organic Chemistry by M K Jain and S C Sharma, 4th edition (2014).

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1: STEREOISOMERISM			
	Representation of molecules in sawhorse, Fischer, and Newman formulae and their inter-translations. Elements of symmetry.	3	ICT
	Optical Isomerism and Geometrical isomerism.	9	Lecture
	Conformational analysis of ethane, n-butane, cyclohexane and mono substituted cyclohexanes.	2	Seminar/ Assignment
	Significance of Stereochemistry in drugs: Thalidomide disaster in 1957- Need for strict testing of optical isomer and its drug action.	1	Discussion
UNIT-II: ALDEHYDES AND KETONES			
	Chemistry of Aldehydes	8	Lecture
	Chemistry of Ketones	7	Lecture
UNIT III: CARBOXYLIC ACIDS			
	General methods of preparation of carboxylic acids, Reactions of carboxylic acids - HVZ reaction (Mechanism needed), Synthesis of acid chlorides, esters and amides, Reduction of carboxylic acids, methods and mechanism of decarboxylation. Methods of preparation and chemical reactions of a) halo acids - Monochloroacetic acid b) Hydroxy acids c) unsaturated monocarboxylic acids- Preparation and reactivity of carboxylic acid derivatives - acid chlorides, esters, amides and anhydrides - Mechanisms of esterification and hydrolysis (acid and base catalyzed reactions) –	12	Lecture

	Bouveault Blanc Reduction - Synthesis of active methylene compounds – diethyl malonate and ethyl acetoacetate.		
	acidity of carboxylic acids, effects of substituents on acid strength, acidity of aliphatic vs aromatic acids.	2	ICT
	Uses of Lactic acid, tartaric acid, crotonic acid, cinnamic acid, monochloro acetic acid.	1	Group discussion
UNIT IV: NITROGEN CONTAINING COMPOUNDS			
Aliphatic Nitrogen Compound	General methods of preparation, properties of Cyanides and Isocyanides. Distinction between Ethyl Cyanide and Isocyanide.	3	Lecture & Demonstration
Alkyl nitrites and nitroalkan	General methods of preparation and properties of Ethyl Nitrite and Nitroethane. Distinction between Ethyl Nitrite and Nitroethane.	3	Lecture & Discussion
	Preparation, Properties and Structure of Diazomethane and Diazo acetic ester.	2	Lecture & Discussion
carbonic acids	Manufacture, properties, structure, estimation and uses of Urea.	3	Lecture & Videos. Library
	Reduction products of Nitrobenzene - TNT and TNB.	1	Seminar
Aromatic amino compounds	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
UNIT V: CARBOHYDRATES			
	Study of Glucose and Fructose - Structure and Configuration, Concept of Mutarotation and Epimerization	11	Lecture, Demonstration class, ICT.
	Structure of Sucrose.	2	Lecture & videos
	Starch and Cellulose, Applications of Cellulose derivatives, Polysaccharides	2	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	3	4	3	4	4	3	3	3	3.5
CO2	4	4	3	3	4	4	4	4	3	3	3.6
CO3	4	4	3	4	3	4	3	4	3	2.5	3.45
CO4	4	4	3	3	3	4	4	3	3	2	3.3
CO5	4	4	4	3	3	4	4	3	3	3	3.6
Mean Overall Score											3.49

Result: The Score for this Course is 3.49 (High Relationship)

UNIT	Part A(10X1m)	Part B (5 X 5 = 25m) Either or Pattern	PART C(5 X 8 = 40m) Either or Pattern
I	K1, K3	K2 / K3	K3 / K2
II	K2, K3	K3 / K1	K2 / K1
III	K1, K3	K1 / K3	K3 / K3
IV	K2, K3	K3 / K3	K1 / K3
V	K1, K2	K3 / K2	K3 / K3

Programme : B.Sc Chemistry
Semester : V
Sub. Code : U22CC9

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

TITLE OF THE PAPER: PHYSICAL CHEMISTRY I

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Discussion//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 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.					
COURSE OUTCOME: At the end of the Semester, the students will be able to				Unit	hrs. /S
CO1: explain the basic terminologies and laws of thermodynamics and calculations of enthalpy, entropy and free energies.				1	15
CO2: demonstrate the different ways of stating II law of thermodynamics and its significance, Entropy, free energy function and Partial molar quantities.				2	15
CO3: explain the III law of thermodynamics				3	15
CO4: derive the rate constants for 1 st , 2 nd , 3 rd and zero order reactions				4	15
CO5: 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: THERMODYNAMICS –I

(15 Hours)

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 ΔE , ΔH 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 ΔE , q , w and ΔH 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: THERMODYNAMICS – II**(15 Hours)**

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: THERMODYNAMICS – III**(15 Hours)**

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.

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, N₂O, H₂O, NO and H₂

UNIT – IV: CHEMICAL KINETICS I**(15 Hours)**

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

Reactions of first order and pseudo 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 FeCl₃ and SnCl₂.

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: CHEMICAL KINETICS II**(15 Hours)**

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.

Magnetic properties: Types of magnetic behavior, dia, para, ferro, antiferro and ferrimagnetism – Hysteresis – Solid state lasers – inorganic phosphors – ferrites.

Catalysis: Definition – characteristics – Theories of catalysis – promoters and poisons – enzyme catalysis – acid-base catalysis – auto catalysis with suitable examples.

TEXTBOOKS

1. Principles of Physical Chemistry- Puri, Sharma and Pathania- Vishal Publishing Co. 46th edition.
2. Text book of physical chemistry by P.L.Soni., O.P.Dharmarha, U.V.Dash., S.Chand., 2016.
3. ArimurailiyarpuVethiyal 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 changes 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, Le Chatelier'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 st , 2 nd , 3 rd and zero order reactions	9	
	Order and molecularity of a reaction, Types of chemical reactions (complex, parallel, consecutive.) Examples for 1 st , 2 nd , 3 rd 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, Magnetic properties: Types of magnetic behavior, dia, para, ferro, antiferro and ferrimagnetism – Hysteresis – Solid state lasers – inorganic phosphors – ferrites.	3	ICT

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	3	3	2	3	2	4	4	2	3	4	3
CO2	3	3	2	3	3	4	4	2	3	4	3.1
CO3	3	3	2	3	2	4	4	3	3	4	3.1
CO4	4	2	2	4	3	4	4	3	3	4	3.3
CO5	4	3	3	4	3	4	3	2	3	4	3.3
Mean Overall Score											3.16

Result: The Score for this Course is 3.16 (High Relationship)

UNIT	Part A(10X1)	Part B (5 X 5 = 25) Either or Pattern	PART C(5 X 8 = 40) Either or Pattern
I	K3, K1	K1/K3	K3/K3
II	K3, K2	K1/K3	K2/K1
III	K2, K1	K3/K2	K1/K3
IV	K3, K1	K2/K3	K3/K2
V	K3, K2	K3/K1	K3/K3

Programme : B.Sc Chemistry
Semester : V
Sub. Code : U22CC10

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

TITLE OF THE PAPER– ANALYTICAL TECHNIQUES

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Discussion/Problem solving session/Quiz/videos/Demonstration class.	ICT	
	5	3	1	1	
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 ¹³C spectroscopy.					
COURSE OUTCOME: At the end of the Semester, the students will be able to				Unit	hrs./ S
CO1: explain the basic concepts of chromatography, its classification, the techniques of column and thin layer chromatography & their applications.				1	15
CO2: explain the basic concepts, techniques of Paper and ion exchange chromatography and the basic concepts of Gas Chromatography & HPLC.				2	15
CO3: demonstrate the basic concepts of spectroscopy, IR and Raman spectroscopy and their applications in structural diagnosis.				3	15
CO4: demonstrate the basic principles in UV and PMR spectroscopy.				4	15
CO5: demonstrate the basic concepts of ¹³ C NMR, ESR and Mass spectroscopy.				5	15

UNIT- I: CHROMATOGRAPHY I

(15 Hours)

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-

Paper Chromatography – type of paper used – various methods of development (ascending, descending and radial) – identification of components – applications of paper chromatography – Separation of amino acids by Paper chromatography-R_f value – factors affecting R_f value.

Applications of TLC- TLC is superior to other methods of chromatography

UNIT – II: CHROMATOGRAPHY II

(15 Hours)

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**

HPLC – Principle and separation.

Gas chromatography- Differences between GSC and GLC- Gas solid chromatography (Principle) – Gas liquid chromatography, Instrumentation, Detectors of GLC and **Applications of Gas Chromatography.**

UNIT – III: SPECTROSCOPY I

(15 Hours)

Introduction to 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. - mutual exclusion principle – structural diagnosis. **Application of IR and Raman spectroscopy.**

UNIT – IV: SPECTROSCOPY II

(15 Hours)

UV spectroscopy: Instrumentation - Frank-Condon principle- predissociation. Types of electronic transitions, chromophore, auxochrome, λ_{\max} and intensity of absorption bands, factors influencing λ_{\max} and ϵ . identification of conjugation – calculation of λ_{\max} for dienes, α , β -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. **Application of UV and NMR spectroscopy.**

UNIT – V: SPECTROSCOPY III

(15 Hours)

C¹³ 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. McLafferty rearrangement. **Mass spectrum of simple organic compounds (acetaldehyde, ethyl alcohol, methyl amine and toluene).**

Textbooks

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

References:

1. Instrumental methods of Chemical Analysis by B.K.Sharma, Krishna Prakashan Media Pvt Ltd 1/e edition (2011)
2. Fundamentals of Molecular spectroscopy by Colin.N.Banwell and Elaine.M. Mc cash, 4th edition, Mc Graw Hill Edn (Ind) Pvt Ltd, 2016.

3. Elementary of spectroscopy by Gupta, Kumar and Sharma., Pragati Prakashan, 10th edition, 1995.
4. Analytical chemistry by Skoog and West, Holler, HBJ publisher, 6th edition, 1992

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1: CHROMATOGRAPHY I			
	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_f value and its calculation.	9	Lecture
	Applications of Chromatography.	2	Seminar
UNIT II: CHROMATOGRAPHY II			
	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_f value and the factors affecting it, ion exchange chromatography, ion exchangers, Gas chromatography and HPLC.	10	Lecture
UNIT III: SPECTROSCOPY I			
	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
UNIT IV: SPECTROSCOPY II			
	Types of electronic transitions, Principle of PMR spectroscopy, Instrumentation of PMR and UV spectroscopy.	3	ICT
	Calculation of λ_{max} , Finding out the number of signals in NMR spectra.	3	Problem solving session
	Frank Condon principles of UV, pre-dissociation, factors affecting λ_{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: SPECTROSCOPY III			
	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}C NMR spectroscopy	10	Lecture
	Mass spectrum of simple organic compounds, ESR of hydrogen and methyl radical.	2	Lecture

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	3	4	4	4	4	4	4	4	4	3.9
CO2	4	3	4	4	4	4	4	4	4	4	3.9
CO3	4	4	4	4	3	4	4	4	4	4	3.9
CO4	4	4	4	4	3	4	4	4	4	4	3.9
CO5	4	4	4	4	3	4	4	4	4	4	3.9
Mean Overall Score											3.9

Result: The Score for this Course is 3.9 (High Relationship)

UNIT	Part A(10X1)	Part B (5 X 5 = 25) Either or Pattern	PART C(5 X 8 = 40) Either or Pattern
I	K1, K2	K1 / K3	K3 / K2
II	K2, K3	K3 / K1	K3 / K1
III	K1, K3	K2 / K3	K3 / K3
IV	K2, K3	K3 / K3	K1 / K3
V	K1, K3	K3 / K2	K2 / K3

Programme:B.Sc Chemistry
Semester : V
Sub. Code : U22CC11P

Part III: Core paper 11
Hours : 6/W, 90/S
Credits :5

TITLE OF THE PAPER: PRACTICALS -3, GRAVIMETRIC AND ORGANIC ANALYSIS

Pedagogy	Hours	Lab session//Demonstration class/Viva voce
	5	5
PREAMBLE: The objective of the course is to make the student to estimate the weight of the unknown solution gravimetrically and analyse the given organic compound.		
COURSE OUTCOME: At the end of the Semester, the Students will be able to		Unit hrs. /S
CO1: estimate the given inorganic solution gravimetrically.		1 30
CO3: analyse the given organic compound and find out the functional group present in it and prepare its derivatives		3 60

UNIT – I GRAVIMETRIC ANALYSIS

Estimation of Ca as calcium monohydrate
 Estimation of Ba as chromate
 Estimation of Lead as chromate

UNIT –II 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 & Unit II

Internal - 40 marks
 External - 60 marks

Unit I (25 marks)

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

Unit II (25 marks)

Record – 5 marks
 Viva voce – 5 marks

UNITS	TOPIC	LAB HOURS	MODE OF TEACHING
UNIT 1: Gravimetric Analysis			
	Gravimetric Estimation	20	Lab session
	Gravimetric Estimation	5	Demonstration
	Gravimetric Estimation	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
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	5	5	4	5	4	4	4	5	4	3	4.3
CO2	5	5	5	4	4	4	4	4	4	4	4.3
Mean Overall Score											4.3

Result: The Score for this Course is 4.3 (Very High Relationship)

Programme : B.Sc Chemistry
Semester : V
Sub. Code : U22DSC1A

Part III: DSEC-I
Hours : 5 /W, 75 /S
Credits : 5

DISCIPLINE SPECIFIC ELECTIVE COURSE-I
TITLE OF THE PAPER: FOOD CHEMISTRY

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Discussion/Problem solving session/Quiz/videos/Demonstration class	ICT	
	5	3	1	1	
PREAMBLE: The objective of the course is to understand the nutritive value of food stuffs and nutraceuticals, detection of food adulteration, food additives and its restriction, food preservation techniques and dairy chemistry.					
COURSE OUTCOME: At the end of the Semester, the students will be able to				Unit	hrs./S
CO1: demonstrate the nutritive value of food stuffs and nutraceuticals				1	15
CO2: explain the detection of food adulteration				2	15
CO3: discuss on food additives and its restriction				3	15
CO4: demonstrate in detail about different Food preservation techniques				4	15
CO5: display an in-depth knowledge of Dairy chemistry				5	15

UNIT – I: FOOD AND NUTRITION

(15 Hours)

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 Hours)

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

UNIT – III: FOOD ADDITIVES

(15Hours)

Food additives – reasons for adding additives – examples – artificial sweeteners – saccharin, cyclamate and aspartame. 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 PRESERVATION

(15 Hours)

Objective of food preservation -Traditional methods of preservation - Thermal processing – chilling – freezing – canning – Microwave heating – high pressure processing of foods - Edible coating in fruits and vegetables – use of artificial preservatives.

Emerging preservation techniques – use of biotechnology in reducing spoilage of fruits and vegetables - Using membranes in food preservation – Ultrasound as a preservation technology – Modified atmosphere packaging (MAP) – Using MAP and other techniques to preserve processed meat, bakery and other products – High pressure processing.

UNIT – V: DAIRY CHEMISTRY**(15 Hours)**

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, ice cream and Whey protein.

TEXTBOOKS

1. Food Science by Sri Lakshmi; New Age International Publishers; 7th 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. Textbook of Dairy Chemistry, D.D. Roy, P. Dinakar for ICAR, M.P. Mathur – 2008.
2. Textbook of Preventive and Social Medicine by Park and Park; Bhanot; 23rd edition (2015).

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT – I: FOOD AND NUTRITION			
	Nutritive value of food stuffs	8	Discussion
	Nutraceuticals	4	Demowith charts
	Principles, advantages and disadvantages of microwave cooking	3	ICT
UNIT – II: FOOD ADULTERATION			
	Food adulteration	3	Lecture
	Detection of adulterants by simple methods	10	Lab session, ICT
	Prevention of adulteration	2	Discussion
UNIT – III: FOOD ADDITIVES			
	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
UNIT – IV: FOOD PRESERVATION			
	Traditional methods of preservation	6	Lecture, Seminar & ICT
	Emerging preservation techniques	9	Lecture& ICT
UNIT – V: DAIRY CHEMISTRY			
	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&Demonstration
	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 and Whey protein.	3	Lecture

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	3	3	4	4	4	4	4	4	3.8
CO2	4	4	3	3	4	4	4	5	4	4	3.9
CO3	4	4	4	3	4.5	5	4	3	4	4	3.95
CO4	4	4	4	3	4.5	4.5	4	3	4	4	3.6
CO5	4	4	5	3	4	4	4	4	4	4	3.6
Mean Overall Score											3.77

Result: The Score for this Course is 3.77 (High Relationship)

UNIT	Part A(10X1m)	Part B (5 X 5 = 25m) Either or Pattern	PART C(5 X 8 = 40m) Either or Pattern
I	K1, K2	K1/K3	K3 / K1
II	K2, K3	K2/ K3	K3/ K2
III	K1, K3	K3/ K1	K3 / K3
IV	K1, K3	K3/ K2	K2/ K3
V	K3, K2	K3 / K3	K1/ K3

Programme : B.Sc Chemistry
Semester : V
Sub. Code : U22DSC1B

Part III: DSEC-I
Hours : 5/W, 75 /S
Credits : 5

DISCIPLINE SPECIFIC ELECTIVE COURSE-I
TITLE OF THE PAPER: POLYMER CHEMISTRY

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/ Discussion/Problem solving session/Quiz/videos/Demonstration class.	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 reactions, different kinds of polymer reactions and degradation, raw material and preparation of industrial polymers and different polymer processing techniques.					
COURSE OUTCOME: At the end of the Semester, the students will be able to				Unit	Hrs /S
CO1: describe the chemistry behind structure and bonding of polymers and various methods of determining the molecular mass of polymers				1	15
CO2: characterize the type of mechanisms and kinetics involved in synthesis of polymers.				2	15
CO3: exhibit knowledge of various polymer reactions and methods of degradation.				3	15
CO4: discuss the raw materials and methods of preparing industrially important polymers and elastomers.				4	15
CO5: analyze the additives involved in processing polymers and various processing techniques of polymers.				5	15

Unit – I INTRODUCTION TO POLYMERS (15 Hours)

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 Hours)

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 Hours)

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 Hours)

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 Hours)

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

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

TEXTBOOKS

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) 18thedn

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I: INTRODUCTION TO POLYMERS			
	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
UNIT II: KINETICS AND MECHANISM OF POLYMERIZATION			
	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

UNIT III: POLYMER REACTIONS AND DEGRADATION			
	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
UNIT IV: INDUSTRIAL POLYMERS			
	Raw material, preparation, fiber forming 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
UNIT V: POLYMER PROCESSING			
	Polymer Additives: Fillers, Plasticizers antioxidants and thermal stabilizers fire retardants and colourants.	5	Lecture
	Processing Techniques: Calendaring, Diecasting, Foaming, Spinning of fibers and Mercerization	5	Lecture followed by Seminar
	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
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	3	4	4	2	4	4	3.5	3.5	4	3.6
CO2	4	3	3.5	4	2.5	4	4	3	3	4	3.5
CO3	4	3.5	3	4	2.5	4	3	3	4	4	3.5
CO4	4	3	3	4	3	4	4	3	3	4	3.5
CO5	4	3.5	3.5	4	2	4	4	3	3	4	3.5
Mean Overall Score											3.45

Result: The Score for this Course is 3.45 (High Relationship)

UNIT	Part A(10X1)	Part B (5 X 5 = 25) Either or Pattern	PART C(5 X 8 = 40) Either or Pattern
I	K1, K2	K1 / K3	K3 / K2
II	K2, K3	K3 / K1	K3 / K1
III	K1, K3	K2 / K3	K3 / K3
IV	K2, K3	K3 / K3	K1 / K3
V	K1, K3	K3 / K2	K2 / K3

Programme : B.Sc Chemistry
Semester : V
Sub. Code : U22GEC1

Part IV: GEC I
Hours : 2 / W, 30 / S
Credits : 2

GENERIC ELECTIVE COURSE
TITLE OF THE PAPER: INVENTIONS AND INNOVATIONS IN CHEMISTRY

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Discussion/Problem solving session/Quiz/videos/Demonstration class/ICT
	2	1	1
PREAMBLE: The objective of the course is to make the students appreciate the history of modern chemistry and to know about Intellectual property rights, nanomedicines, smart materials and future of energy.			
COURSE OUTCOME: At the end of the Semester, the Students will be able to			Unit hrs. / S
CO1: discuss the history of modern chemistry.			1 6
CO2: discuss the Intellectual property rights.			2 6
CO3: explain the Indian system of medicine, nanomedicine Proteomics and genomics.			3 6
CO4: demonstrate piezoelectric material- Conducting polymers- Biopolymers- Shape memory polymers- chromoactive material- Sensors			4 6
CO5: explain Solar cells and Fuel Cells and Energy efficiency ratio.			5 6

UNIT I: HISTORY OF MODERN CHEMISTRY (6 Hours)

Revolutionary Scientists of modern chemistry – Wohler- Marie Curie- Alexander Fleming- Haber -Bosch - Alfred Nobel. Honours and Awards- Royal Society of Chemistry- American Chemical Society- Society of Chemical Industry- Indian Chemical Society - Nobel prizes in chemistry (past 5 years)-Women and science – serendipity in science.

UNIT II: INTELLECTUAL PROPERTY RIGHTS (6 Hours)

Definition - Types- Difference between patent and copyright – Utility patent – Requirement for patent protection- Design patent – copyright- Registering a copyright- benefits of patent and copyright holders.

UNIT III: CHEMISTRY AND MEDICINE (6 Hours)

Indian system of medicine- - Classification of drugs - Drug Development- target and lead molecule-Clinical study- Drug approval- Nanomedicine- Proteomics and genomics.

UNIT IV: SMART MATERIALS (6 Hours)

Definition- types- Piezoelectric material- Conducting polymers- Biopolymers- Shape memory polymers- chromoactive material- Sensors – trending Innovations that can change the world.

UNIT V: FUTURE OF ENERGY (6 Hours)

Energy Crisis- Need for green energy- Solar cells- Fuel Cells-Definition - working, Type- Applications. Energy efficiency ratio, renewable energy industries.

References

UNIT 1

1. https://rucforsk.ruc.dk/ws/portalfiles/portal/57533464/The_Birth_of_Modern_Chemistry.pdf
2. <http://www.columbia.edu/itc/chemistry/chem-c2507/navbar/chemhist.html>
3. <https://www.arvindguptatoys.com/arvindgupta/asimov-chemistry.pdf>
4. <https://www.nobelprize.org/womenwhochangedscience/stories/marie-curie#:~:text=Indefatigable%20despite%20a%20career%20of,changed%20our%20understanding%20of%20radioactivity.&text=Curie%20was%20born%20Marya%20Sk%C5%82odowska%20in%201867%20in%20Warsaw.>
5. <https://www.worldcat.org/title/madame-curie-a-biography/oclc/609355556>
6. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4520913/>
7. <https://www.pharmacytimes.com/view/alexander-fleming-and-the-discovery-of-penicillin>
8. <https://www.thoughtco.com/overview-of-the-haber-bosch-process-1434563>
9. <https://www.thoughtco.com/alfred-nobel-biography-4176433>
10. https://en.wikipedia.org/wiki/List_of_chemistry_awards
11. <https://newhumanist.org.uk/articles/4852/science-and-serendipity-famous-accidental-discoveries>

Unit II

1. <https://www.slideshare.net/prreem/patent-ppt>
2. <https://swaritadvisors.com/learning/advantages-of-copyright-registration/>

UNIT III

1. <https://www.fda.gov/patents/learn-about-drug-and-device-approvals/drug-development-process>
2. <https://www.technologynetworks.com/drug-discovery/articles/exploring-the-drug-development-process-331894>
3. <https://www.technologynetworks.com/drug-discovery/articles/exploring-the-drug-development-process-331894>
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2816487/#:~:text=India%20has%20the%20unique%20distinction,and%20Yoga%2C%20Naturopathy%20and%20Homoeopathy.>
5. <https://byjus.com/chemistry/classification-drugs/>
6. <https://www.basu.org.in/wp-content/uploads/2020/11/Pharmacology-II.pdf>
7. <https://www.slideshare.net/ibadali14/applications-of-genomics-and-proteomics-ppt>

UNIT IV

1. https://en.wikipedia.org/wiki/Smart_material#:~:text=Smart%20materials%20have%20properties%20that,can%20be%20repeated%20many%20times.
2. <https://www.sciencedirect.com/science/article/pii/B9780081007419000036>
3. <https://archive.nptel.ac.in/courses/112/104/112104251/>
4. <https://www.degruyter.com/document/doi/10.1515/ci-2020-0402/html?lang=en>

UNIT V

1. https://en.wikipedia.org/wiki/Energy_policy
- 2.
3. <https://www.fujielectric.com/company/tech/pdf/r49-2/06.pdf>
4. <https://nptel.ac.in/courses/103107157>
5. <https://archive.nptel.ac.in/courses/121/106/121106014/>
6. <https://justenergy.com/blog/why-alternative-energy-sources-are-future/>

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I HISTORY OF MODERN CHEMISTRY			
	Revolutionary Scientists of modern chemistry. Honours and Awards Women and science serendipity in science	1 2 2 1	Assignment Lecture seminar ICT/Group discussion
UNIT II INTELLECTUAL PROPERTY RIGHTS			
	Definition - Types- Difference between patent and copyright – Utility patent – Requirement for patent protection- Design patent – copyright- Registering a copyright- benefits of patent and copyright holders.	6	Lecture
UNIT III CHEMISTRY AND MEDICINE			
	Indian system of medicine- - Classification of drugs - Drug Development- target and lead molecule-Clinical study- Drug approval- Proteomics and genomics. Nanomedicine	5 1	Lecture Assignment
UNIT IV SMART MATERIALS			
	Definition- types- Piezoelectric material- Conducting polymers- Biopolymers- Shape memory polymers- chromoactive material- Sensors - trending Innovations that can change the world	4 2	Lecture ICT/Assignment

UNIT V FUTURE OF ENERGY			
	Solar cells - Fuel Cells-Definition - working, Type-Applications. Energy efficiency ratio, renewable energy industries. Energy Crisis- Need for green energy	2 4	ICT& Lecture Lecture and Discussion 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	5	4	5	4	4	5	4	3	4	3	4.1
CO2	4	5	4	3	3	4	5	4	3	4	3.9
CO3	4	3	5	4	5	4	3	5	4	3	4.0
CO4	5	4	3	3	4	4	5	4	4	4	4.0
CO5	5	4	3	4	5	4	3	5	4	5	4.2
Mean Overall Score											4.0

Result: The Score for this Course is 4.0 (High Relationship)

UNIT	Part A (10X1)	Part B (5 X 5 = 25) Either or Pattern	PART C (5 X 8 = 40) Either or Pattern
I	K1, K2	K1 / K3	K3 / K2
II	K2, K3	K3 / K1	K3 / K1
III	K1, K3	K2 / K3	K3 / K3
IV	K2, K3	K3 / K3	K1 / K3
V	K1, K3	K3 / K2	K2 / K3

Programme : B.Sc Chemistry
Semester : V
Sub. Code : U22SEC2

Part IV: SEC II
Hours : 2 /W, 30 /S
Credits : 2

SKILL ENHANCEMENT COURSE II
TITLE OF THE PAPER: SMALL SCALE INDUSTRIES

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Discussion/Problem solving session/Quiz/videos/Demonstration class/ICT
	2	1	1
PREAMBLE: The objective of the course is to inspire the students 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.			
COURSE OUTCOME: At the end of the Semester, the Students will be able to			Unit hrs./S
CO1: 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
CO2: discuss the Indian organizations assisting small scale industries.			2 6
CO3: 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
CO4: demonstrate the wax products, candles, boot polish, furniture polish paste. describe Inks, blue, red, blue black, white board marker, printing inks and inks for stamp pad.			4 6
CO5: 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 Hours)

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.

UNIT II: (6 Hours)

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

UNIT III: (6 Hours)

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

UNIT IV: (6 Hours)

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

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

UNIT V:**(6 Hours)**

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.

Reference books:

1. Reference book and Directory for small industries – Malik and Aggarwal, Small Industry Research Institute, New Delhi (1975-1976)
2. Siruthozhilhal sila --- oru arimugam, Vasan, New Century Book House Pvt.Ltd., Chennai, 1985.
3. Entrepreneurial Development, Dr. L. Rangarajan, Sree Ranga Publications, Rajapalayam.
www.techno-preneur.net
4. Small scale industries, B.S.Sekar, Jaime Publications, Bombay, 1975.
5. Neengalum Siruthozhil nadathalam, S. A.Soosai raja, New Century Book House Pvt. Ltd., Chennai, 1983.
6. Handbook of Soap Industries, Malik and Dhingra, Small Industry Research Institute, Delhi (1974-1975)

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT-I			
	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,	2	Assignment
		3	Lecture
		1	ICT
UNIT -II			
	Know about the Indian organizations assisting small scale industries, describe agencies promoting industries, such as IDBI, SISI, SIPCOT etc.	3 3	ICT Group discussion&
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	ICT
		2	Lecture
		2	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	ICT
		3	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
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	5	4	5	4	4	5	4	3	4	3	4.1
CO2	4	5	4	3	3	4	5	4	3	4	3.9
CO3	4	3	5	4	5	4	3	5	4	5	4.2
CO4	5	4	3	3	4	4	5	4	4	4	4.0
CO5	5	4	3	4	5	4	3	5	4	5	4.2
Mean Overall Score											4.08

Result: The Score for this Course is 4.08 (Very High Relationship)

UNIT	Part A(10X1)	Part B (5 X 5 = 25) Either or Pattern	PART C(5 X 8 = 40) Either or Pattern
I	K1, K3	K2 / K3	K3 / K2
II	K2, K3	K3 / K1	K2 / K1
III	K1, K3	K1 / K3	K3 / K3
IV	K2, K3	K3 / K3	K1 / K3
V	K1, K2	K3 / K2	K3 / K3

Programme: B.Sc Chemistry
Semester : VI
Sub. Code : U22CC12

Part III: Core paper 12
Hours : 4 /W, 60/S
Credits :4

TITLE OF THE PAPER: INORGANIC CHEMISTRY

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/ /Discussion/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.					
COURSE OUTCOME: At the end of the Semester, the students will be able to				Unit	Hrs. /S
CO1: discuss the oxygen family, ozone, H₂O₂, peracids and the extraction of Se and				1	12
CO2: discuss the halogen family and noble gases.				2	12
CO3: discuss the d and f block elements.				3	12
CO4: discuss the basic concepts of coordination compounds VBT theory involved in coordination chemistry.				4	12
CO5: demonstrate the CFT theory, structure of carbonyls and nitrosyls and discuss the applications of coordination compounds.				5	12

UNIT I OXYGEN FAMILY

(12 hours)

Group Discussion –Oxides- Classification-

Hydrogen per oxide- Preparation-properties-structure-estimation-problems on its estimation

Ozone- Preparation – properties – structure

Peracid and persalts –sulphur, permono and perdi sulphuricacids- preparation and structure.

Potassium perdi sulphate- preparation and structure.

Ores- extraction –properties and uses of Selenium and Tellurium

UNIT – II: HALOGEN FAMILY AND NOBLE GASES

(12 Hours)

General characteristics of halogen with reference to electronegativity, electron affinity, oxidation states and oxidizing power – peculiarities of fluorine.

Chlorine: Oxides and oxyacids – bleaching powder – estimation of available chlorine, manufacture, properties and uses– basicity of iodine

Interhalogen compounds – polyhalides – psuedohalogens -preparation, properties and structure of interhalogen compounds.

Inert gases – position in the periodic table – General characteristics – Structure and shape of xenon compounds – XeF₂, XeF₄, XeF₆, XeOF₂, XeOF₄

Uses of noble gases.

UNIT -III: d-BLOCK & f-BLOCK ELEMENTS

(12 Hours)

General characteristics of d block elements

Occurrence, extraction of the following metals: Iron, Nickel, Cobalt, chromium and zinc

Preparation, properties and uses of the following compounds: potassium permanganate, potassium dichromate, ammonium molybdate, Vanadium pentoxide, chloroplatinic acid.

General characteristics of f-block elements – comparative account of lanthanides and

actinides – lanthanide series–lanthanide contraction–actinide series –oxidation states and general properties – Uranium –occurrence and metallurgy.

Applications of Interstitial compounds –Industrial uses of nitrides, carbides, hydrides, borides of Ti, V, Cr, W.

Important uses of transition metals (Fe, Cu, Ni, Ag, Ti, Cr and Zn)

Composition and uses of alloys: Stainless steel, Brass, Rolled Gold, Delta metal, Bell metal.

UNIT – IV: COORDINATION CHEMISTRY I

(12 Hours)

Basic Concepts of Coordination Chemistry: Double salts and complexes, Classification of Ligands, chelation– applications. Coordination number and stereochemistry of complexes, IUPAC Nomenclature, Isomerism- structural and stereoisomerism,

Theories of coordination compounds - Werner’s theory and its demerits, Sidgwick’s EAN rule.

Valence bond Theory -Formation of inner and outer orbital octahedral complexes, tetrahedral, square planar complexes on the basis of valence bond theory [VBT] Limitations of VBT.

UNIT – V: COORDINATION CHEMISTRY II

(12 Hours)

Crystal field theory of Coordination compounds– 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 Δ_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. Stability of complexes -factors affecting the stability of complexes – General methods of preparations of carbonyls and nitrosyls.

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.

TEXTBOOKS

1. Principles of Inorganic Chemistry, Puri & Sharma, Vishal Publishing Co.; 46th edition
2. Advanced Inorganic Chemistry by Tuli, Basu and Madan S.Chand publishing; 19th 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, 5th edition, 2009
3. Advanced Inorganic Chemistry by F.Albert Cotton, Geoffrey Wilkinson et al., Wiley India, 6th edition 2012.
4. Principles, structure and reactivity by James E Huheey, Harper and Raw, 5th edition, 2012.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT - I GROUP 16/VI A ELEMENTS			
	Group Discussion –Oxides- Classification- Hydrogen peroxide- Preparation- properties- structure- estimation-problems on its estimation	2	Seminar
	Ozone- Preparation – properties – structure Peracid and persalts –sulphur,- permono and perdi sulphuricacids- preparation and structure.	8	Lecture
	Potassium perdi sulphate- preparation and structure. Ores- extraction –properties and uses of Selenium and Tellurium	2	ICT
UNIT -II: HALOGEN FAMILY AND NOBLE GASES			
	General characteristics of halogen with reference to electronegativity, electron affinity, oxidation states and oxidizing power – peculiarities of fluorine.	3	Lecture
	Chlorine: Oxides and oxyacids – bleaching powder – estimation of available chlorine, manufacture, properties and uses– basicity of iodine	3	Group discussion
	Interhalogen compounds – polyhalides – psuedohalogen- preparation, properties and structure of interhalogen compounds. Inert gases – position in the periodic table – General characteristics – Structure and shape of xenon compounds – XeF ₂ , XeF ₄ , XeF ₆ , XeOF ₂ , XeOF ₄ Uses of noble gases.	6	Lecture
UNIT – III: d- block and f- block elements			
	General characteristics of d block elements Occurrence, extraction of the following metals: Iron, Nickel, Cobalt, chromium and zinc Preparation, properties and uses of the following compounds: potassium permanganate, potassium dichromate, ammonium molybdate, Vanadium pentoxide, chloroplatinic acid.	4	Lecture and Problem solving
	General characteristics of f-block elements – comparative account of lanthanides and actinides – lanthanide series–lanthanide contraction–actinide series –oxidation states and general properties – Uranium –occurrence and metallurgy.	5	Lecture
	Applications of Interstitial compounds –Industrial uses of nitrides, carbides, hydrides, borides of Ti, V, Cr, W. Important uses of transition metals (Fe, Cu, Ni, Ag, Ti, Cr and Zn)	2	ICT
	Composition and uses of alloys: Stainless steel, Brass, Rolled Gold, Delta metal, Bell metal.	1	Discussion

UNIT IV COORDINATION CHEMISTRY I			
	Basic Concepts of Coordination Chemistry: Double salts and complexes, Classification of Ligands, chelation–applications. Coordination number and stereochemistry of complexes, IUPAC Nomenclature, Isomerism- structural and stereoisomerism	7	Lecture
	Theories of coordination compounds - Werner’s theory and its demerits, Sidgwick’s EAN rule. Valence bond Theory -Formation of inner and outer orbital octahedral complexes, tetrahedral, square planar complexes on the basis of valence bond theory [VBT] Limitations of VBT.	5	ICT
UNIT V: COORDINATION CHEMISTRY II			
	Crystal field theory of Coordination compounds– 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 Δ_o -spectrochemical series – high spin and low spin complexes, some applications of CFT.	5	Lecture
	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. Stability of complexes - factors affecting the stability of complexes – General methods of preparations of carbonyls and nitrosyls	5	ICT
	Applications of coordination compounds: Estimation of nickel using DMG and aluminium using oxine – estimations of hardness of water using EDTA	1	discussion
	Biologically important coordination compounds: Functions of chlorophyll, haemoglobin and vitamin B12	1	Discussion

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	3	4	4	3	4	3	4	4	4	3.7
CO2	4	4	3	4	4	4	4	4	4	4	3.9
CO3	4	3	4	4	3	4	4	4	3	4	3.7
CO4	4	4	4	4	3	4	4	4	4	4	3.9
CO5	4	4	4	4	4	4	4	4	4	4	4.0
Mean Overall Score											3.84

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

UNIT	Part A(10X1m)	Part B (5 X 5 = 25m) Either or Pattern	PART C(5 X 8 = 40m) Either or Pattern
I	K1, K3	K2 / K3	K3 / K2
II	K2, K3	K3 / K1	K2 / K1
III	K1, K3	K1 / K3	K3 / K3
IV	K2, K3	K3 / K3	K1 / K3
V	K1, K2	K3 / K2	K3 / K3

Programme : B.Sc Chemistry
Semester : VI
Sub. Code : U22CC13

Part III: Core paper 13
Hours : 4 /W, 60 /S
Credits : 4

TITLE OF THE PAPER: ORGANIC CHEMISTRY - II

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Discussion/Problem solving session/Quiz/videos/Demonstration class/ICT
		4	3
PREAMBLE: The objective of the course is to make the student understand, learn and gain knowledge about the 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.			
COURSE OUTCOME: At the end of the Semester VI, the students will be able to			Unit /S
CO1: explain the rearrangement reactions.			1 12
CO2 : explain the chemistry of Heterocyclic compounds with one hetero atom.			2 12
CO3: discuss the chemistry of alkaloids –Coniine, Piperine and Nicotine& the chemistry of Terpenoids – Citral, Menthol and preparation of α -Terpeniol, Dipentene, Limonene.			3 12
CO4: describe the 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
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: REARRANGEMENTS

(12 Hours)

Rearrangement to electron-deficient carbon - 1,2 shift (Wagner- Meerwein rearrangement, pinacol rearrangement, benzil- benzilic acid rearrangement.
 Aromatic rearrangements from oxygen to ring carbon – Fries, Claisen and benzidine rearrangement.
 Rearrangement to electron-deficient nitrogen – Beckmann, Hofmann, Curtius rearrangement.
 Rearrangement to electron-deficient oxygen: Baeyer-Villiger oxidation, hydroperoxide rearrangement, cumene hydroperoxide- phenol rearrangement.

UNIT-II: HETEROCYCLIC COMPOUNDS

(12 Hours)

Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine - Comparison between basicity of pyridine, piperidine and pyrrole. Reactions of pyrrole, furan, thiophene -Mechanism of electrophilic substitution reactions of pyrrole, furan and thiophene. Synthesis of pyridine -mechanism of electrophilic substitution and nucleophilic reactions of pyridine - Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis.

UNIT – III ALKALOIDS & TERPENOIDS**(12 Hours)**

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 of α - terpeniol, dipentene, limonene.

Applications of α - terpeniol, dipentene, limonene.

UNIT – IV AMINO ACIDS, PROTEINS, ENZYMES AND NUCLEIC ACIDS**(12 Hours)**

Amino acids: Classification, preparation, properties of glycine, alanine and phenyl alanine – action of heat on α , β and γ – amino acids.

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

Enzymes: Definition – Chemical nature of enzymes - role of enzymes in biological systems.

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

Unit –V TAUTOMERISM & POLYMERS**(12 Hours)**

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.

Eco Friendly Plastics: Green synthesis of a compostable and widely applicable plastic
Polylactic acid made from corn.

TEXTBOOKS

1. Text book of Organic chemistry by P.L.Soni- Sultan Chand & Sons; 29th edition (2012)
2. Advanced Organic Chemistry by B.S.Bahl and Arun Bahl ; S. Chand Publishing 2nd edition
3. Industrial Chemistry by B.K.Sharma Krishna prakashan (p) Ltd 2011
4. Stereochemistry by Kalsi, New Age International, 7th 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; 7th edition (2010)
2. Organic Chemistry vol 1 by Finar; Pearson Education India; 6th edition (2002)
3. Stereochemistry of organic compounds by Eliel., Wiley Publisshers, 2008.
4. Organic chemistry by Morrison and Boyd., PHI, 6th edition, 2008.
5. Organic chemistry Concept and Application by Dr. Jagdamba Singh, 6th edition, Pragati Prakashan publisher, 2008.

UNITS	TOPICS	LECTURE HOURS	MODE OF TEACHING
UNIT-I: REARRANGEMENTS			
	Rearrangements	8	Lecture
	Revision of rearrangements	4	Seminar/Assignment
UNIT-II: HETEROCYCLIC COMPOUNDS			
	Heterocyclic compounds with one hetero atom	12	Lecture, ICT, Assignment, discussion.
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 α -Terpeniol, Dipentene, Limonene.	8	Lecture
	Naming, drawing the structures and identifying the types of alkaloids and terpenoids.	2	Quiz/Seminar/Assignment
UNIT – IV AMINO ACIDS, PROTEINS, ENZYMES AND NUCLEIC ACIDS			
	Classification, synthesis, properties of glycine alanine and phenyl alanine and definition classification and properties of proteins	3	Lecture
	Colour reactions of proteins	1	Demonstration and lab session
	Primary and secondary structures of proteins	1	Video
	Action of heat on α , β , γ -amino acids, Zwitter ion, isoelectric point, essential amino acids definition, sources and examples.	1	Seminar/assignment/tutorial
	Definition, classification, role of enzymes in biological systems.	3	Lecture, seminar, quiz
	Nucleosides, nucleotides, RNA and DNA - general structure.	3	Lecture and assignment
UNIT V: TAUTOMERISM AND POLYMERS			
	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.

	Definition of monomer, polymer, repeating units, degree of polymerization, types of polymers 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. Ecofriendly plastics.	6	Lecture, Videos, Demonstration class and seminar
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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	3	4	3	4	4	3	3	3	3.5
CO2	4	4	3	3	4	4	4	4	3	3	3.6
CO3	4	4	3	4	3	4	3	4	3	4	3.6
CO4	4	4	3	3	4	4	4	3	3	4	3.6
CO5	4	4	4	3	4	4	4	3	3	3	3.6
Mean Overall Score											3.58

Result: The Score for this Course is 3.58 (High Relationship)

UNIT	Part A(10X1m)	Part B (5 X 5 = 25m) Either or Pattern	PART C(5 X 8 = 40m) Either or Pattern
I	K1, K3	K2 / K3	K3 / K2
II	K2, K3	K3 / K1	K2 / K1
III	K1, K3	K1 / K3	K3 / K3
IV	K2, K3	K3 / K3	K1 / K3
V	K1, K2	K3 / K2	K3 / K3

Programme: B.Sc Chemistry
Semester : VI
Sub. Code : U22CC14

Part III: (Core) Major paper 14
Hours : 4 /W, 60/S
Credits :4

TITLE OF THE PAPER: PHYSICAL CHEMISTRY -II

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Discussion/Problem solving session/Quiz/videos/Demonstration class (Library session is conducted after the class hours).	ICT	
	4	2	1	1	
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.					
COURSE OUTCOME: At the end of the Semester, the students will be able to				Unit	Hrs. /S
CO1 describe conductance, significance of Ostwald's dilution law, Kohlrausch law and applications of conductivity measurements.				1	12
CO2: explain the theories of acids and bases, concept of hydrolysis constant, principles of buffer action and applications of common ion effect and solubility product.				2	12
CO3: explain the concept of electrode potential, electrochemical cells and application semf measurements.				3	12
CO4: demonstrate the basic terminologies and laws of of photochemistry, Photochemical reactions and photo chemical processes				4	12
CO5: demonstrate the basic ideas of symmetry operations, point group, matrix representations and construction of group multiplication tables.				5	12

UNIT – I: ELECTROCHEMISTRY-I

(12Hours)

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: IONIC EQUILIBRIA

(12 Hours)

Acid Base Chemistry: Theories of acids and bases – Arrhenius, Bronsted-Lowry theory proton donor - acceptor system, Lewis-electron dot system and HSAB principle.

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

Hydrolysis: definition – nature of solutions of salts undergoing hydrolysis – degree of hydrolysis (α) – 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 – Hasselbalch equation.

UNIT- III: ELECTROCHEMISTRY – II**(12 Hours)**

Electrode potentials - single electrode potential – oxidation and reduction potentials. Thermodynamics and electromotive force (emf) – relation between chemical and electrical energies – calculation of ΔG , ΔS and ΔH 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: PHOTOCHEMISTRY**(12Hours)**

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 – photosensitization – chemiluminescence.

UNIT – V: GROUP THEORY**(12Hours)**

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_{2v} , C_{3v} example H_2O , NH_3

TEXTBOOKS

1. Principles of Physical Chemistry by Puri, Sharma and Pathania - Vishal Publishing Co.; 46th edition
2. Group theory by Gopinathan Vishal publishing Co 2nd (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. Arimurai Iyarpuvethiyal 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 textbook of physical chemistry by K. L.Kapoor, Vol 6, 2nd edition.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1: ELECTROCHEMISTRY I			
	Debye Huckel Onsager equation, Ostwald's 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
UNIT II: IONIC EQUILIBRIA			
	Theories of acids and bases, 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
UNIT III: ELECTROCHEMISTRY-II			
	Single electrode potential, Oxidation and reduction potentials, Thermodynamics and electromotive force, Nernst equation, Types of electrodes, Chemical and voltaic cells	5	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	2	ICT
UNIT IV: PHOTOCHEMISTRY			
	Comparative study of thermal and Laws of Photochemistry, Determination of Quantum efficiency, Kinetics of photochemical reactions, Flash photolysis, Photosensitization, Chemiluminescence.	9	Lecture
	Photophysical processes-Fluorescence and Phosphorescence.	3	ICT
UNIT V: GROUP THEORY			
	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
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	3	4	4	2	4	4	4	4	4	3.7
CO2	4	3	4	3	3	4	3	3	3	4	3.4
CO3	4	3	4	4	3	4	4	4	3	4	3.7
CO4	4	4	4	4	3	4	3	3	3	4	3.6
CO5	4	2	4	2	2	4	2	3	3	4	3
Mean Overall Score											3.48

Result: The Score for this Course is 3.48 (High Relationship)

UNIT	Part A(10X1m)	Part B (5 X 5 = 25m) Either or Pattern	PART C(5 X 8 = 40m) Either or Pattern
I	K3,K1	K2/K3	K3/K2
II	K3,K1	K3/ K1	K1/K3
III	K3,K2	K3/ K2	K2/K3
IV	K3,K2	K3/ K3	K3/K1
V	K1,K2	K1/ K3	K3/K3

Programme: B.Sc Chemistry
Semester : VI
Sub. Code : U22CC15P

Part III: Core paper 15
Hours : 6/W, 90/S
Credits : 5

TITLE OF THE PAPER: PRACTICALS -4, PHYSICAL CHEMISTRY EXPERIMENTS

Pedagogy	Hours	Lab session//Demonstration class/Viva voce
	6	6
PREAMBLE: The objective of the course is to make the student to handle physical experiments.		
COURSE OUTCOME: At the end of the Semester, the students will be able to		Unit hrs. /S
CO2: demonstrate the physical experiments and handle instruments		1 90

Unit – II Physical Chemistry:

1. Determination of K_f of a solute by Rast method (cryoscopy)
2. Determination of molecular weight of a solvent by Rast method
3. Simple eutectic phase diagram
4. Determination of transition temperature of a salt hydrate
5. Determination of molecular weight by transition temperature method
6. Determination of C.S.T. of phenol – water system
7. Study of effect of impurities on C.S.T
8. Partition Coefficient: Determination of partition coefficient of iodine in CCl_4 and watersystem. (Demonstration)
9. Determination of equilibrium constant of $\text{KI} + \text{I}_2 \rightarrow \text{KI}_3$ system (Demonstration)
10. Determination of strength of potassium iodide (Demonstration)
11. Determination of rate constant of a first order reaction – ester hydrolysis
12. Comparison of strengths of two acids by ester hydrolysis method
13. Electrochemistry: Conductivity titration between an acid and a base
14. Potentiometric titration between ferrous sulphate and potassium dichromate.

Internal - 40 marks

Attendance –10 marks Experiment and Results – 30 marks

Unit I (External - 60 marks)

Experiment – 25marks Result – 20 marks

Record – 10 marks

Viva voce – 5 marks

UNITS	TOPIC	LAB HOURS	MODE OF TEACHING
UNIT 1: Physical Chemistry			
	Physical Chemistry experiments	70	Lab session
	Physical Chemistry experiments	10	Demonstration
	Physical Chemistry experiments	10	Viva-Voce

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	5	4	4	4	3	4	4	4	4	4	4.0
Mean Overall Score											4.0

Result: The Score for this Course is 4.0 (High Relationship)

Programme : B.Sc Chemistry
Semester : VI
Sub. Code : U22DSC2A

Part III: DSEC-II
Hours : 4/W, 60/S
Credits : 4

DISCIPLINE SPECIFIC ELECTIVE COURSE-III
TITLE OF THE PAPER: APPLIED CHEMISTRY

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Discussion/ /Quiz/Videos Demonstration class	ICT	
	4	2	1	1	
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, Water Technology and to know about insecticides, fertilizers, construction chemistry and corrosion and protective coatings.					
COURSE OUTCOME: At the end of the Semester, the Students will be able to				Unit	Hours
CO1: demonstrate the knowledge about fuels and fire prevention				1	12
CO2: discuss the preparation and uses of various dyes and process involved in photography.				2	12
CO3: 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
CO4: 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
CO5: discuss the manufacturing process of soya bean oil, candles, soaps, shampoo and understand the classification of detergents.				5	12

UNIT – I: FUELS & FIRE PREVENTION

(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, anti-knocking 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: ORGANIC DYES & PHOTOGRAPHY

(12 Hours)

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

a) Azo dyes: Preparation of methyl orange, Congo red and Bismark brown.

- b) Triphenyl methane dyes: Preparation of malachite green, rosaniline and crystal violet.
- c) Phthalein dyes: phenolphthalein, fluorescein and eosin – preparation and uses.
- d) Vat dyes: preparation and structure of indigo.
- e) Anthraquinone dye: preparation and structure of alizarin.

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

UNIT – III WATER TECHNOLOGY

(12 Hours)

Hardness definition-Types of Hardness – Estimation of temporary and permanent hardness of water by EDTA method- Water analysis: physical examination – Chemical examination - bacteriological examination – BOD, COD.

Boiler feed water - Boiler troubles: Priming, foaming, scales, sludges and caustic embrittlement - Methods of softening – boiling, lime soda process – Zeolite method–

Demineralization method – treatment of water for domestic use – sterilization – Dechlorination – Desalination of brackish water - electro dialysis method, reverse osmosis methods.

UNIT – IV INSECTICIDES, FUNGICIDES, PESTICIDES, FERTILIZERS, CEMENT AND REFRACTORY

(12 Hours)

Insecticides, fungicides and pesticides: Definition – classification according to method of application and actions – Brief idea about 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.

Cement and refractory: Cement: Composition- Chemistry of setting – Concrete – Reinforced concrete – (Manufacture of cement not necessary) Refractories – Definition –Requirements of good refractory - Chemical Classification – Fire Clay bricks, Properties and uses of Fire Clay bricks.

UNIT - V CORROSION AND PROTECTIVE COATINGS

(12 Hours)

Introduction – types of corrosion – Factors influencing the rate of corrosion – Methods of prevention of corrosion - Surface coatings – Metal coatings – Electroplating, Galvanization and Tinning – Inorganic coating – Anodizing – Cathodic Protection – Sacrificial Anode Method and Impressed Voltage Method.

Protective coatings – Classification – paints – characteristics and constituents of paints - Varnish – Definition – Differences between Paint and Varnish – Special Paints – Luminescent Paints, Fire Retardant Paints, Water retardant Paints and Distemper.

TEXTBOOKS

1. Ancillary Chemistry for Home science students by Thankamma Jacob.

- Textbook of Organic Chemistry by P.L. Soni- SultanChand & Sons; 29th edition (2012).
- Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Company.

References:

- Industrial Chemistry by B.K.Sharma; Krishna Prakashan Media (P) Ltd. (2011)
- Engineering Chemistry by S.S.Dara;S. Chand & Company

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT – I: FUELS & FIRE PREVENTION			
	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: ORGANIC DYES & PHOTOGRAPHY			
	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 WATER TECHNOLOGY			
	Types of Hardness –Water analysis: physical examination – Chemical examination - bacteriological examination – BOD, COD.Boiler feed water - Methods of softening – boiling, addition of lime – addition of sodium carbonate – Zeolite method Demineralization method – treatment of water for domestic use – sterilization – Dechlorination – Desalination of brackish water - electro dialysis method, reverse osmosis methods.	9	Lecture
	Boiler feed water - Boiler troubles: Priming, foaming, scales, sludges and caustic embrittlement	1	ICT & Discussion
	Zeolite method Demineralization method.	1	ICT & Lecture
	Estimation of temporary and permanent hardness of water by EDTA method.	1	Demonstration
UNIT – IV INSECTICIDES, FUNGICIDES, PESTICIDES, FERTILIZERS CEMENT AND REFRACTORY			
	Insecticides, fungicides and pesticides.	3	Seminar / Assignment

	Chemistry of setting of cement.	2	ICT
	Fertilizers & Refractories	6	Lecture
	Cement composition, concrete and reinforced concrete.	1	Lecture & Discussion
UNIT - V CORROSION AND PROTECTIVE COATINGS			
	Corrosion	6	ICT with Lecture and Discussion
	Protective coatings	6	Peer teaching / Assignment

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	5	4	5	4	4	5	4	3	4	3	4.1
CO2	4	5	4	3	3	4	5	4	3	4	3.9
CO3	4	3	5	4	5	4	3	5	4	3	4.0
CO4	5	4	3	3	4	4	5	4	4	4	4.0
CO5	5	4	3	4	5	4	3	5	4	5	4.2
Mean Overall Score											4.04

Result: The Score for this Course is 4.04 (High Relationship)

UNIT	Part A(10X1m)	Part B (5 X 5 = 25m) Either or Pattern	PART C(5 X 8 = 40m) Either or Pattern
I	K1, K3	K2 / K3	K3 / K2
II	K2, K3	K3 / K1	K2 / K1
III	K1, K3	K1 / K3	K3 / K3
IV	K2, K3	K3 / K3	K1 / K3
V	K1, K2	K3 / K2	K3 / K3

Programme : B.Sc Chemistry
Semester : VI
Sub. Code : U22DSC2B

Part III: DSEC-II
Hours : 4 / W, 60 / S
Credits : 4

DISCIPLINE SPECIFIC ELECTIVE COURSE-II
TITLE OF THE PAPER: BIOCHEMISTRY

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Discussion//Problem solving session/Quiz/videos/Demonstration class /ICT		
	4	3	1	1	
PREAMBLE: The objective of the course is to make the concepts of carbohydrates, amino acids and proteins, lipids, nucleic acids and enzymes.					
COURSE OUTCOME: At the end of the Semester, the students will be able to				Unit	Hrs. / S
CO1: CARBOHYDRATES explain the basic concepts of carbohydrates and Glycolysis, TCA cycle, energy yield, HMP pathway.				1	12
CO2: AMINO ACIDS AND PROTEINS demonstrate the basic concepts of amino acids, catabolism of amino acids and urea cycle.				2	12
CO3: LIPIDS describe the basic concepts, importance of fatty acids and their functions.				3	12
CO4: NUCLEIC ACIDS explain Nucleosides and nucleotides, Watson and Crick model, Replication, Transcription, Mutations and mutants, DNA repair, DNA sequencing and PCR, Recombinant DNA technology.				4	12
CO5: ENZYMES demonstrate the properties and action of enzymes				5	12

UNIT I: CARBOHYDRATES

(12 Hours)

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

(12 Hours)

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) – Classification – 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

(12 Hours)

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, phosphatidyl inositol and phosphatidyl serine) sphingomyelin, plasmalogens. Structure and function of glycolipids, cholesterol.

UNIT IV NUCLEIC ACIDS

(12 Hours)

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

(12 Hours)

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.Sathyannarayana and U. Chakrapani, Books and Allied(P) Ltd., 2nd ed.,

REFERENCES

1. Fundamentals of Biochemistry, J.L.Jain 4th revised Edition, S. Chand & Company Ltd.,
2. Advances in Bio Chemistry, S.N.Sriharsha Sonali Publications, New Delhi.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1 CARBOHYDRATES			
	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.	8	Lecture
	Biological importance of mono, di and polysaccharide (esp. starch, glycogen and cellulose).	2	Discussion
	Glycolysis, TCA cycle, energy yield, HMP pathway.	2	ICT
UNIT 11 AMINO ACIDS AND PROTEINS			
	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.	8	Lecture
	Essential amino acids, biologically important peptides.	2	Seminar
	3D structure of proteins	2	ICT

UNIT III: LIPIDS			
	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.	8	Lecture
	Importance of EFA	1	Discussion
	saturated fatty acids, unsaturated fatty acids (examples), structure and function of glycolipids, cholesterol.	3	ICT
UNIT IV NUCLEIC ACIDS			
	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.	6	Lecture
	Mutations and mutants	1	Seminar
	Watson and Crick model, Replication, Transcription, Mutations and mutants, DNA repair, DNA sequencing and PCR, Recombinant DNA technology.	5	ICT
UNIT V ENZYMES			
	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.	8	Lecture
	Mechanism of enzyme action, Lock and key model and induced fit models. Coenzymes, Mechanism of inhibition (Competitive, non & uncompetitive and allosteric),	4	ICT

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	3	3	4	3	4	3	3	3	4	3.4
CO2	4	4	3	3	4	4	4	3	3	4	3.6
CO3	4	4	4	3	4	4	4	4	3	3	3.7
CO4	4	4	4	3	4	4	4	4	3	4	3.8
CO5	4	4	3	3	4	4	4	3	3	3	3.5
Mean Overall Score											3.6

Result: The Score for this Course is 3.6 (High Relationship)

UNIT	Part A(10X1m)	Part B (5 X 5 = 25m) Either or Pattern	PART C(5 X 8 = 40m) Either or Pattern
I	K1, K3	K2 / K3	K3 / K2
II	K2, K3	K3 / K1	K2 / K1
III	K1, K3	K1 / K3	K3 / K3
IV	K2, K3	K3 / K3	K1 / K3
V	K1, K2	K3 / K2	K3 / K3

Programme : B.Sc., Chemistry
Semester : VI
Sub. Code : U22DSC3A

Part III: DSEC-III
Hours : 4/W,60/S
Credits: 4

DISCIPLINE SPECIFIC ELECTIVE COURSE-III
TITLE OF THE PAPER: PHARMACEUTICAL CHEMISTRY

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/ Discussion/ Problem solving session/Quiz/videos/Demonstration class /ICT
	4	3	1
PREAMBLE: The objective of the course is to know about terminologies involved in Pharma Chemistry, different drugs and their action, functions of vitamins, hormones			
COURSE OUTCOME: At the end of the Semester, the Students will be able to			Unit
			Hrs./S
CO1: discuss the terminologies in Pharma Chemistry, different drugs anemia, jaundice, cholera, malaria and filarial and Indian Medicinal plants and uses.			1
CO2: explain Sulpha drugs, Antibiotics and their classifications, Antiseptics and Disinfectants.			2
CO3: discuss the basic information about Analgesics, Anti pyretic drugs, and the drugs affecting CNS; and its examples.			3
CO4: describe Anesthetics and its significance, and the importance of the drugs for cancer, Diabetes, AIDS and Blood related diseases.			4
CO5: explain the Vitamins and its classifications; Hormones and their physiological functions.			5

UNIT I : BASIC PHARMACEUTICAL CHEMISTRY (12 Hours)

Definition of the following terms: drug, pharmacophore, pharmacology, Pharmacopeia, bacteria, virus and vaccine. Causes, symptoms and drugs for anemia, jaundice, cholera, malaria and filarial.

Indian Medicinal plants and uses – Thulasi, Neem, Keezhaanelli, Mango, Semparuthi, Adadhodai and Thoothuvalai.

UNIT II: ANTIBACTERIALS (12 Hours)

Sulpha drugs-examples and actions-prontosil, sulphathiazole, sulphafurazole. Antibiotics-definition and action of penicillin, streptomycin, chloramphenicol, erythromycin-tetracycline – SAR of chloramphenicol only. Antiseptics and disinfectant – definition and distinction – phenolic compounds, chloro compounds and cationic surfactant.

UNIT III: ANALGESICS AND CNS STIMULANTS (12 Hours)

Analgesics: Definition and Actions – narcotic and non-narcotic – morphine and its derivatives, pethidine and methadone – disadvantages and uses. Antipyretic analgesics - salicylic derivative, paracetamol, ibuprofen. Drugs affecting CNS – Definition, distinction and examples for tranquilizers, sedatives, hypnotics, psychedelic drugs – LSD, Hashish – their effects.

UNIT IV: ANAESTHETICS AND DRUGS FOR CHRONIC DISEASES (12 Hours)

Anaesthetics - definition – local and general – volatile nitrous oxide, ether, Chloroform, cyclopropane – uses and disadvantages – non – volatile intravenous – thiopental sodium, methohexitone, propanidid.

Causes of cancer - medicines and their mode of action for the treatment of cancer – antineoplastics. Diabetes, Types – hypoglycemic agents.

AIDS (brief idea) – Drugs AZT (azidothymidine or Zidovudine), DDC (Zalcitabine).

Blood: Grouping, composition, Rh factor, blood pressure, hypertension and hypotension.

UNIT V: VITAMINS, HORMONES AND ENZYMES (12 Hours)

Vitamins – water soluble and fat-soluble vitamins – (i) vitamin A; (ii) vitamin D; (iii) vitamin B complex; (iv) vitamin C; (V) vitamin E; (vi) vitamin K; (vii) vitamin P.

Hormones – Introduction, properties and function of hormones, chemical nature of hormones. Physiological function of some hormones: Adrenaline, thyroxin, oxytocin, insulin, the sex hormones.

Enzymes –classification of enzymes, properties of enzymes, mechanism of enzyme action. Action of Co-enzymes.

TEXTBOOKS

1. Pharmaceutical chemistry by Dr. S. Lakshmi
2. Industrial Chemistry by B.K.Sharma; Krishna Prakashan Media(p) Ltd 2011.
3. Jayashree Ghosh, A Text Book of Pharmaceutical Chemistry, 3rd Edition, S.Chand& Company Ltd., New Delhi, 2003.

References:

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

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1 BASIC PHARMACEUTICAL CHEMISTRY			
	Terminologies in Pharma chemistry	4	Lecture
	Causes, symptoms and drugs for anemia, jaundice, cholera, malaria and filarial.	5	Lecture
	Indian Medicinal Plants	3	ICT and group discussion/ Assignment
UNIT II ANTIBACTERIALS			
	Sulpha drugs-examples and actions-prontosil, sulphathiazole, sulphafurazole. Antibiotics- definition and action of penicillin, streptomycin, chloramphenicol, erythromycin-tetracycline – SAR of chloramphenicol	9	Lecture
	Antiseptics and disinfectant	3	ICT, Seminar.
UNIT III: ANALGESICS AND CNS STIMULANTS			
	Analgesics	4	Lecture
	Antipyretic analgesic	4	Lecture
	Drugs affecting CNS	4	Group discussion/Seminar

UNIT IV: ANAESTHETICS AND DRUGS FOR CHRONIC DISEASES			
	Anaesthetics	2	Lecture
	Diabetes, Types. Causes of cancer.	2	Group discussion
	Diabetes, Types - Hypoglycemic agents. Causes of cancer - medicines and their mode of action for the treatment of cancer – antineoplastics. AIDS – drugs.	4	Lecture
	blood pressure, hypertension and hypotension	2	Lecture
	Blood: Grouping, composition, Rh factor.	2	Seminar/Group discussion
UNIT V: VITAMINS, HORMONES AND ENZYMES			
	Vitamins	4	Lecture and Assignment
	Hormones	3	Lecture
	Enzymes	3	Lecture
	mechanism of enzyme action	2	ICT

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	4	3	4	4	3.9
CO2	4	3	4	3	4	4	4	4	4	4	3.8
CO3	4	3	3	3	4	4	4	4	4	4	3.7
CO4	4	4	3	3	4	4	4	4	4	4	3.8
CO5	4	4	3	3	4	4	4	4	4	4	3.8
Mean Overall Score											3.8

Result: The Score for this Course is 3.8 (High Relationship)

UNIT	Part A(10X1m)	Part B (5 X 5 = 25m) Either or Pattern	PART C(5 X 8 = 40m) Either or Pattern
I	K1, K2	K1/K3	K3 /K2
II	K2, K3	K2/K1	K3/K3
III	K1, K3	K3/K3	K3 /K2
IV	K1, K3	K3/K2	K2/K1
V	K3, K2	K3 /K3	K1/K3

Programme: B.Sc., Chemistry
Semester: VI
Code : U22DSC3B

Part III: DSEC-III
Hours : 4 / W, 60 / S
Credits: 4

DISCIPLINE SPECIFIC ELECTIVE COURSE-III
TITLE OF THE PAPER: AGRICULTURAL CHEMISTRY

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/Role play/Discussion/Tutorial/Problem solving session/Quiz/videos/Demonstration class /ICT
	4	3	1
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.			
COURSE OUTCOME: At the end of the Semester, the Students will be able to			Unit
CO1: 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.			hrs. /S
CO2: explore the types of manures and analyze the importance of using various ecological farming techniques to preserve soil's natural composition			1
CO3: assess the need and effects of using artificial fertilizers, describe the preparation and properties of some industrially important artificial fertilizers			2
CO4: describe various chemical materials developed to assist in the production of food such as insecticides, fungicides and herbicides			3
CO5: apply analytical procedures and methods in the analysis of soil and plants and recommend soil remediation based on the analysis.			4
			5

Unit –I SOIL CHEMISTRY

(12Hours)

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

(12Hours)

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 – Farmyard 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

(12Hours)

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

(12Hours)

Insecticides – natural insecticides – organic insecticides – DDT, Alderin & dieldrin, 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 – V SOIL TESTING**(12Hours)**

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

TEXTBOOKS

- 1.Elements of agriculture chemistry – Thomas Anderson, Andesite press (2015)
- 2.Industrial chemistry – B.K.Sharma, Krishna prakashan Media(P) Ltd(2014) 18thedn

Reference books

1. Agricultural chemistry – B.A.Yagodin, Mir publishers (Moscow) 1976.
2. Soil sampling and methods of analysis – M.R.Cartar, Gregorich (2ndedn, 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) 14thedn.
5. Principles of inorganic chemistry, Puri, Sharma, Kalia, Shoban Lal Naginchand & co., 24thedn, 1990.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I: SOIL CHEMISTRY			
	Components of soil, physical and chemical properties of soil	4	Lecture
	factors controlling soil pH and influence of soil reaction on availability of nutrients	3	Discussion / peer teaching
	soil colloids, soil organic matter, soil air, soil water, retention, soil moisture constant	2	ICT
	macro and micro plant nutrients	3	Seminar / assignment
UNIT II: ORGANIC MANURES AND ORGANIC FARMING			
	General principles of manuring, special and general manures, action of manures on chemical and physical properties of soil, advantages of using manures in farming	3	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	2	Library session followed by discussion/ quiz
	ecological farming – biofertilizers, vermicompost, organic farming	3	ICT
UNIT III: FERTILIZERS			
	Need for fertilizers – essential requirements – classification of fertilizers	4	Lecture
	preparation and importance of artificial fertilizers – urea, ammonium nitrate, calcium cyanamide	3	Seminar /assignment
	phosphate rock, superphosphate, triple superphosphate	3	ICT
	potassium fertilizers – NPK fertilizers – mixed fertilizers –	2	Discussion/

	compound fertilizers – effects of fertilizers		quiz
UNIT IV: PESTICIDES			
	Insecticides, natural insecticides, fumigants, rodenticides	4	Lecture
	organic insecticides – DDT, Alderin&dieltrin, endrin and p – DCB	3	ICT
	Fungicides – inorganic (Bordeaux mixture) organic (dithiocarbamate) – industrial fungicides	2	Peer teaching/ assignment
	Herbicides and weedicides – 2,4-D and 2,4,5 –T (structure and function), treflan	3	Library session/ quiz
UNIT V: SOIL TESTING			
	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	2	ICT
	measuring cation exchange capacity of soil – soil chloride analysis	2	Discussion

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	4	4	3	4	3.9
CO2	4	4	3	4	3	4	4	4	3	4	3.7
CO3	4	4	3	3	4	4	4	4	3	3	3.6
CO4	4	4	4	3	3	4	4	4	3	4	3.7
CO5	4	4	4	3	3	4	4	4	3	4	3.7
Mean Overall Score											3.7

Result: The Score for this Course is 3.7 (High Relationship)

UNIT	Part A(10X1m)	Part B (5 X 5 = 25m) Either or Pattern	PART C(5 X 8 = 40m) Either or Pattern
I	K1, K2	K1	K3
II	K2, K3	K2	K3
III	K1, K3	K3	K3
IV	K1, K3	K3	K2
V	K3, K2	K3	K1

Programme : B.Sc Chemistry
Semester : VI
Sub. Code : U22SEC3P

Part IV: SECIII
Hours : 2 /W, 30 /S
Credits : 2

SKILL ENHANCEMENT COURSE III
TITLE OF THE PAPER: APPLIED CHEMISTRY PRACTICAL

Pedagogy	Hours	Laboratory class /Demonstration
	2	1
PREAMBLE: Make the students to do experiments related to applied chemistry and to prepare commercially useful products like phenoyl and detergents.		
COURSE OUTCOME: At the end of the Semester, the Students will be able to		Unit
CO 1: do experiments related to applied chemistry, prepare phenoyl and detergents.		Hrs./S
		1
		30

- Determination of percent by weight of acetic acid in vinegar.
- Determination of Total hardness in water for a given unknown water sample by EDTA method.
- Determination of Calcium in commercial Milk powder by EDTA method.
- Determination the amount of fat and casein in different types of milk.
- Verification of Beer Lamberts Law for KMnO₄ using photo colorimeter.
- Detection of common adulterants in commercially available milk samples.
- Estimation of free fatty acids present in given oil samples.
- Determination of available organic Carbon in soil.
- Determination of pH of different brands of milk. (Group experiment)
- Making soap using saponification reaction (Demonstration only)
- Estimation of aspirin in commercially available tablets (Demonstration only)
- Preparation of phenoyl, detergent (Group Experiment).

Internal - 40 marks

Attendance – 10 marks. Experiment and Results – 30 marks.

Unit I (External - 60 marks)

Experiment – 25 marks. Result – 20 marks

Record – 10 marks

Viva voce – 5 marks

UNITS	TOPIC	LAB HOURS	MODE OF TEACHING
	Applied Chemistry experiments	30	Lab session

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	5	4	5	5	5	5	5	5	4	5	4.8
Mean Overall Score											4.8

Result: The Score for this Course is 4.8 (Very High Relationship)

Programme : B.Sc (Physics/Zoology/HomeScience /Botany)

Part III: Allied

Semester : III

Code : ACT1

Hours : 4 /W, 60/S

Credits :3

TITLE OF THE PAPER: ALLIED CHEMISTRY – I

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/ Discussion/Problem solving session/Quiz/videos/Demonstration class	ICT	
	4	2	1	1	
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.					
COURSE OUTCOME: At the end of the Semester, the Students will be able to				Unit	hrs. /S
CO1: gain knowledge on purification of organic compounds and summarize chemical reactions involved in organic analysis				1	12
CO2: 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
CO3: 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
CO4: 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
CO5: 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 Hours)

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 Hours)

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 Hours)**

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 Hours)**

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 Hours)****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
UNIT I: ORGANIC CHEMISTRY			
	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
UNIT II: INORGANIC CHEMISTRY			
	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

Preparation, properties and uses of verdigris, blue vitriol, Bordeaux mixture, Epsom salt, gypsum, Plaster of Paris, Green Vitriol, White vitriol,	3	Lecture, Assignment & Quiz
Preparation, properties and uses of Potassium ferrocyanide, Potassium ferricyanide, sodium nitroprusside Sodium borohydride, Lithium aluminium hydride.	3	Lecture
UNIT III: PHYSICAL CHEMISTRY		
Definition of various terms in Adsorption, characteristics of adsorption of gases on solids, physical adsorption and chemisorption, 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
UNIT IV: ANALYTICAL CHEMISTRY		
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
UNIT V: APPLIED CHEMISTRY		
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	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	4	3	3	4	4	4	4	4	4	3.8
CO2	4	4	3	3	4	4	4	5	4	4	3.9
CO3	4	4	4	3	4.5	5	4	3	4	4	3.95
CO4	4	4	4	3	4.5	4.5	4	3	4	4	3.6
CO5	4	4	5	3	4	4	4	4	4	4	3.6
Mean Overall Score											3.8

Result: The Score for this Course is 3.8 (High Relationship)

UNIT	Part A(10X1m)	Part B (5 X 5 = 25m) Either or Pattern	PART C(5 X 8 = 40m) Either or Pattern
I	K1, K3	K2 / K3	K3 / K2
II	K2, K3	K3 / K1	K2 / K1
III	K1, K3	K1 / K3	K3 / K3
IV	K2, K3	K3 / K3	K1 / K3
V	K1, K2	K3 / K2	K3 / K3

Programme : B.Sc (Physics/Zoology/Home Science /Botany)
Semester : IV
Code : ACT2

Part III: Allied
Hours : 4 /W, 60 /S
Credits :4

TITLE OF THE PAPER: ALLIED CHEMISTRY II

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/ Discussion/ Problem solving session/Quiz/videos/Demonstration class	ICT	
	4	2	1	1	
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 & 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.					
COURSE OUTCOME: At the end of the Semester, the Students will be able to				Unit	Hrs /S
CO1: recognize the concept of hybridization and gain knowledge about reaction types and stability of reaction intermediates.				1	12
CO2: describe the chemistry of preparation, properties, structure and application of hydrogen peroxide and ozone.				2	12
CO3: discuss artificial radioactivity, nuclear fission and fusion.				3	12
CO4: explain the principles of chromatography.				4	12
CO5: 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 Hours)

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 Hours)

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 Hours)**

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 Hours)**

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, R_f value, general applications of chromatography.

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

UNIT – V APPLIED CHEMISTRY**(12 Hours)**

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
UNIT I: ORGANIC CHEMISTRY			
	Tetrahedral arrangement of valencies of carbon atom, Concept of hybridization in organic molecules.	3	ICT, 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 polymerization with suitable examples	3	Lecture & assignment
	Isomerism–stereoisomerism, definition, classification with suitable examples	3	ICT

UNIT II: INORGANIC CHEMISTRY			
	Preparation, manufacture, purification, properties and uses of hydrogen peroxide and ozone.	5	Lecture
	Estimation of H ₂ O ₂ 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
UNIT III: PHYSICAL CHEMISTRY			
	Artificial radioactivity: 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
	Isotopes and isobars: Definitions and consequences of isotopy	1	Peer teaching
	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	2	Seminar, discussion& assignment
UNIT IV: ANALYTICAL CHEMISTRY			
	Chromatography	7	Lecture
	Applications of chromatography	3	seminar& assignment
	Column chromatography and thin layer chromatography, Gas chromatography –principles and applications	2	ICT
UNIT V: APPLIED CHEMISTRY			
	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
	Petrochemicals: 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	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	4	3	3	4	3	4	3	3	3	4	3.4
CO2	4	4	3	3	4	4	4	3	3	4	3.6
CO3	4	4	4	3	4	4	4	4	3	3	3.7
CO4	4	4	4	3	4	4	4	4	3	4	3.8
CO5	4	4	3	3	4	4	4	3	3	3	3.5
Mean Overall Score											3.6

Result: The Score for this Course is 3.6 (High Relationship)

UNIT	Part A(10X1)	Part B (5 X 5 = 25) Either or Pattern	PART C(5 X 8 = 40) Either or Pattern
I	K1, K2	K1 / K3	K3 / K2
II	K2, K3	K3 / K1	K3 / K1
III	K1, K3	K2 / K3	K3 / K3
IV	K2, K3	K3 / K3	K1 / K3
V	K1, K3	K3 / K2	K2 / K3

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

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

TITLE OF THE PAPER: ALLIED CHEMISTRY - PRACTICAL

Pedagogy	Hours	Lab session//Demonstration class
	3	3
PREAMBLE: The objective of the course is to make the student to estimate the solution of unknown strength and analyze the given organic compound.		
COURSE OUTCOME: At the end of the Semester, the Students will be able to		Unit hrs. / S
CO1: analyze and find out the given organic compound and report the functional group present in it.		1 45
CO2: 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_2CO_3
- Titration between sodium hydroxide against oxalic acid.

II. Permanganometry:

- Titrations between KMnO_4 against oxalic acid
- Titrations between KMnO_4 against ferrous sulphate
- Titrations between KMnO_4 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
UNIT 1: Qualitative analysis			
	Analysis of organic compound	40	Lab session
	Analysis of organic compound	5	Demonstration
UNIT II: Volumetric analysis			
	Volumetric analysis	40	Lab session
	Volumetric analysis	5	Demonstration

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	5	4	4	4	4	5	4	5	4	4	4.3
CO2	5	4	5	4	4	5	4	4	4	4	4.2
Mean Overall Score											4.25

Result: The Score for this Course is 4.25 (Very High Relationship)

Programme: BSc/BCom/BA/BBA/BCA
Semester: III
Code: U22NMC1

Part IV: Non- Major Elective
Hours -2 / W, 30 /S
Credit: 2

TITLE OF THE PAPER– CHEMISTRY IN LIFE

Pedagogy	Hours	Lecture	Peer Teaching/Seminar/ /Discussion/Problem solving session/Quiz/videos/Demonstration class (Library session is conducted after the class hours).	ICT	
	2	1	1 hr. (if needed)	1	
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, adulterants, manures & compost and gain knowledge on toxicology.					
COURSE OUTCOME: At the end of the Semester, the Students will be able to				Unit	hrs. /S
CO1: acquire knowledge on characteristics of fuels.				1	6
CO2: identify the differences between oils, fats and waxes and their classifications.				2	6
CO3: discuss on various food additives, preservatives and adulterants and demonstrate various tests to find adulteration.				3	6
CO4: analytical methods used in crime investigation, poisons, toxins and antidotes.				4	6
CO5: appreciate the value of manures and compost.				5	6

UNIT – I: FUELS

(6Hours)

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

UNIT – II: OILS, FATS AND WAXES

(6 Hours)

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

UNIT –III: FOOD CHEMISTRY

(6 Hours)

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

UNIT –IV: INDIAN MEDICINAL PLANTS AND USES

Indian Medicinal plants and uses – Thulasi, Neem, Kizhaanelli, Mango, Semparuthi, Adadhodai and Thoothuvalai.

UNIT – V FORENSIC CHEMISTRY AND TOXICOLOGY

(6 Hours)

Introduction – Significance – Chemicals used in forensic science – Analytical methods used in crime investigation – Toxicology – Poisons and toxins – Antidotes.

References

Course material supplied by the department

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I: FUELS			
	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
UNIT II: OILS, FATS AND WAXES:			
	Definition, distinction between oils and fats, properties, classification,	3	Lecture
	vegetable oils, hydrogenation of oil,	2	Group discussion
	Manufacture of aroma candle.	1	ICT
UNIT III: FOOD CHEMISTRY:			
	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
UNIT –IV: INDIAN MEDICINAL PLANTS AND USES			
	Indian Medicinal plants and uses – Tulasi, Neem, Kizhanelli, Mango, Semparuthi, Adadodai and Thoothvelai.	6	Lecture, ICT and group discussion.
UNIT – V FORENSIC CHEMISTRY AND TOXICOLOGY			
	Introduction – Significance – Chemicals used in forensic science – Analytical methods used in crime investigation – Toxicology – Poisons and toxins – Antidotes.		

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	3.5	3	3.5	3	4	3	3	4	4	3.5
CO2	4	3	3	3.5	3	4	4	3	3	4	3.0
CO3	4	3	4	4	2	4	4	3.5	3.5	4	3.6
CO4	4	3	3.5	4	2.5	4	4	3	3	4	3.5
CO5	4	3	3.5	4	4	4	3	5	4	3.5	3.8
Mean Overall Score											3.5

Result: The Score for this Course is 3.5 (High Relationship)

UNIT	Part A(10X1)	Part B (5 X 5 = 25) Either or Pattern	PART C(5 X 8 = 40) Either or Pattern
I	K3,K1	K1/ K3	K3/ K3
II	K3,K2	K3/ K3	K2/ K1
III	K3,K1	K3/ K2	K1/ K3
IV	K3,K1	K2/ K3	K3/ K2
V	K3,K2	K3/ K1	K3/ K3

Programme : BSc/BCom/BA/BBA/BCA
Semester: IV
Code: U22NMC2
Offered for all arts and science students

Part IV: Non Major Elective
Hours -2 / W, 30 /S
Credit: 2

TITLE OF THE PAPER: DAY TO DAY CHEMISTRY

Pedagogy	Hours	Lecture	Seminar/Discussion/Tutorial/Problem solving Quiz/videos/Demonstration class /ICT		
	2	1	-	1	
PREAMBLE: The objective of the course is to make the student understand. Soaps, detergents, shampoo, dairy products, energy storage devices, chemical industries and water treatment.					
COURSE OUTCOME: At the end of the Semester, the students will be able to				Unit	hrs. /S
CO1: describe the idea about soaps, detergents and shampoo.				1	6
CO2: describe the nutritive value of milk, Pasteurization, Homogenization and different milk products.				2	6
CO3: describe the importance of water management and impart ideas on various water treatment methods.				3	6
CO4: explain the sources of energy and energy storage devices.				4	6
CO5: explain different chemical industries.				5	6

UNIT – I: SOAPS, DETERGENTS AND SHAMPOO

(6 Hours)

Soaps – Manufacture of soaps- Detergents – Advantages of detergents over soap- Ingredients used in toilet soaps –Brief idea of shaving soaps and creams and Shampoo.

UNIT –II: DAIRY PRODUCTS

(6 Hours)

Nutritive value of milk - Pasteurization of Milk – Advantages of pasteurized milk- Homogenization- Homogenized milk- Cream- Butter – Milk Powder - Ice cream -Khoa – Toned milk- Sterilized milk.

UNIT – III: DRINKING WATER

(6 Hours)

Sources - Bore water- rainwater - rainwater 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.

UNIT – IV: ENERGY STORAGE DEVICES

(6 Hours)

Energy – sources of energy – Classification – Methods of energy storage – Grid energy storage – Batteries – fuel cells - energy storage applications.

UNIT – V: CHEMICAL INDUSTRIES

(6 Hours)

Introduction – Categories of chemical industries – Agrochemical Industry – Ceramic products and raw material used – composition and uses of glass, cement and paint.

References

Course material supplied by the department

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT - I SOAPS, DETERGENTS AND SHAMPOO			
	Soaps – Manufacture of soaps- Detergents – Advantages of detergents over soap- Ingredients used in toilet soaps –Brief idea of shaving soaps and creams and Shampoo.	6	Lecture& Discussion
UNIT –II: DAIRY PRODUCTS			
	Nutritive value of milk - Pasteurization of Milk	2	Lecture
	Homogenization- Homogenized milk	2	ICT
	Advantages of pasteurized milk- Cream- Butter – Milk Powder - Ice cream -Khoa – Toned milk- Sterilized milk.	1	Interactive discussion
UNIT – III: DRINKING WATER			
	Availability and portability, sources-artificial rain, rainwater harvesting, potable water quality.	4	Lecture
	water treatment (methods of softening), ion exchange	2	ICT
UNIT – IV: ENERGY STORAGE DEVICES			
	Energy – sources of energy – Classification – Methods of energy storage – Grid energy storage – Batteries – fuel cells - energy storage applications.	3	Lecture
	Energy – sources of energy	1	Discussion
UNIT – V: CHEMICAL INDUSTRIES			
	Introduction – Categories of chemical industries – Agrochemical Industry – Ceramic products and raw material used – composition.	4	Lecture
	uses of glass, cement and paint.	2	Assignment

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	3	2	3	2	4	3	3	2	3	2.9
CO2	4	2	3	4	4	4	4	4	2	3	3.4
CO3	4	4	4	3	3	4	4	3	3	4	3.6
CO4	4	3	4	3	3	4	4	3	3	4	3.5
CO5	4	3	3	4	3	4	3	3	3	4	3.4
Mean Overall Score											3.4

Result: The Score for this Course is 3.4 (High Relationship)

UNIT	Part A(10X1)	Part B (5 X 5 = 25) Either or Pattern	PART C(5 X 8 = 40) Either or Pattern
I	K1, K2	K1 / K3	K3 / K2
II	K2, K3	K3 / K1	K3 / K1
III	K1, K3	K2 / K3	K3 / K3
IV	K2, K3	K3 / K3	K1 / K3
V	K1, K3	K3 / K2	K2 / K3

VALUE ADDED COURSE

Code:
Programme : B.Sc Chemistry

Hours: 30 Hours (6 weeks)

TITLE OF THE PAPER: CHEMISTRY OF HEALTH AND HERBS

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.		
COURSE OUTCOME: At the end of the Course, the students will be able to	Unit	hrs. / S
CO1: describe the important phytochemicals in our day today life and the role of phytochemical in modern medicine.	1	6
CO2: explain the Soxhlet extraction and isolation by GC and HPLC.	2	6
CO3: describe the chemical tests for various secondary metabolites.	3	6
CO4: describe the medicinal properties of alkaloids such as Caffeine, Quinine and Reserpine.	4	6
CO5: discuss the chemical structure and medicinal properties of flavonoids Luteolin, Quercetin and kaempferol	5	6

UNIT – I : DRUG DISCOVERY AND DEVELOPMENT (6 Hours)

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 Hours)

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 Hours)

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

UNIT – IV: MEDICINAL PROPERTIES OF ALKALODS (6 Hours)

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

UNIT V: FLAVONOIDS AS MEDICINE (6 Hours)

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

TEXTBOOK

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, Abraham,
4. Plant drug analysis by Wagner
5. Clarke's isolation & identification of drugs by AC Mottal

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT 1: DRUG DISCOVERY AND DEVELOPMENT			
	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
UNIT II EXTRACTION AND ISOLATION OF ACTIVE PRINCIPLE			
	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
UNIT III DETECTION OF SECONDARY METABOLITES			
	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
UNIT IV MEDICINAL PROPERTIES OF ALKALOIDS			
	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
UNIT V: FLAVONOIDS AS MEDICINE			
	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

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	3	3	3	4	4	4	4	4	4	3.7
CO2	4	4	3	3	4	4	4	4	4	4	3.8
CO3	4	4	3	3	4	4	4	4	4	4	3.8
CO4	4	4	4	4	4	4	4	3	4	4	3.9
CO5	4	3	4	3	4	4	4	4	4	4	3.8
Mean Overall Score											3.8

Result: The Score for this Course is 3.8 (High Relationship)

VALUE ADDED COURSE

Programme: B.Sc Chemistry
Code:

Hours: 30 Hours (6 weeks)

TITLE OF THE PAPER: INDUSTRIAL CHEMISTRY

PREAMBLE: 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		
COURSE OUTCOME	Unit	hrs. / S
At the end of the Semester, the Students will be able to		
CO1: demonstrate the basic concepts in industrial chemistry such as structure of the global chemical industry, raw materials, chemical processes and flow diagrams	1	6
CO2: describe the unit operations like size reduction, size enlargement and separation of materials	2	6
CO3: discuss the unit processes like polymerization, alkylation and other unit processes	3	6
CO4: 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
CO5: implement the usage of analytical tools, chromatography and perform various chromatographic techniques.	5	6

UNIT I: BASIC CONCEPTS IN INDUSTRIAL CHEMISTRY**(6 Hours)**

- Introduction- Classification of Industries- Classification of Manufacturing industries – Manufacturing sub- sectors
- The structure of the global chemical industry – Commodity chemicals – Special 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: UNIT OPERATIONS**(6 Hours)**

- 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: UNIT PROCESSES**(6 Hours)**

- 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: ORGANIC CHEMICALS, FERMENTATION AND PHARMACEUTICAL INDUSTRIES**(6 Hours)**

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

UNIT V: INDUSTRIAL APPLICATIONS OF CHROMATOGRAPHY**(6 Hours)**

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, 17th edition, 2013, Goel Publishing house, Meerut
2. Industrial Chemistry, Loufty Madkour, Helen Njenga
3. Instrumental methods of Chemical analysis, Chatwal & Sam K Anand, 2019, Himalayan PublishingHouse, New Delhi.

UNITS	TOPIC	LECTURE HOURS	MODE OF TEACHING
UNIT I: 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	4	Lecture
	Chemical Processes- Unit processes, unit operations Flow diagrams-	1	ICT
	Block diagrams, process flow diagram / flow sheet	1	Assignment/ Seminar

UNIT II: UNIT OPERATIONS			
	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: UNIT PROCESSES			
	Polymerization – Addition Polymerization, condensation 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 CHEMICALS, FERMENTATION AND PHARMACEUTICAL INDUSTRIES			
	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: INDUSTRIAL APPLICATIONS OF CHROMATOGRAPHY			
	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	5	4	5	4	4	5	4	3	4	3	4.1
CO2	4	5	4	3	4	4	5	4	3	4	4.0
CO3	4	3	5	4	5	4	3	5	4	5	4.2
CO4	5	4	3	3	4	4	5	4	4	4	4.0
CO5	5	4	3	4	5	4	3	5	4	5	4.2
Mean Overall Score											4.1

Result: The Score for this Course is 4.1 (Very High Relationship)

VALUE ADDED COURSE**Programme: Common for B.Sc /B.A/B.B.A/B.Com/B.C.A****Code:****Hours: 30 /S****TITLE OF THE PAPER:****INTRODUCTION TO CHEMICAL PRODUCTS AROUND US**

PREAMBLE: The objective of the course is to make the student understand the basic concepts of everyday usage products, food adulteration and medicinal importance of herbal plants.		
COURSE OUTCOME: At the end of the Course, the students will be able to	Unit	hrs. / S
CO1: describe the key ingredients of cosmetic items and the preparation of some cosmetic items.	1	6
CO2: explain the properties of milk and describe milk products	2	6
CO3: describe the medicinal value of herbal plants	3	6
CO4: identify the natural toxins and adulterants in the food items.	4	6
CO5: 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 Toothpaste.

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 (Keezhanelli)-Solanum Trilobatum (Thooduvalai)- Grass Cyanodon dactylon (Arugampullu) – Greens – Portulaca oleracea (Pulli-kirai),

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

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)

TEXTBOOKS

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
UNIT I: EVERYDAY CONSUMER ITEMS			
	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
UNIT II: MILK AND MILK PRODUCTS			
	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
UNIT III: MEDICINAL PLANTS AND HERBS IN THE KITCHEN			
	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

UNIT IV: FOOD COLOURINGS, ADULTERATION, TESTING AND SAFETY			
	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
UNIT V: FIBRES AND POLYMER PRODUCTS IN HOME			
	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	2	ICT

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	5	4	5	3	4	4	5	4	3	5	4.2
CO2	4	5	3	4	4	5	4	3	4	5	4.1
CO3	5	3	4	5	4	4	3	5	4	4	4.1
CO4	5	3	3	4	4	4	5	4	3	5	4.0
CO5	5	4	3	4	5	3	4	3	5	4	4.0
Mean Overall Score											4.1

Result: The Score for this Course is 4.1 (Very High Relationship)