PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM – 636 011

DEGREE OF BACHELOR OF SCIENCE

CHOICE BASED CREDIT SYSTEM

SYLLABUS FOR BRANCH IV – B.Sc., CHEMISTRY

FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR

2023 – 2024 ONWARDS

CONTENTS

I. INTRODUCTION

B.Sc., Chemistry: Programme Outcome, Programme Specific Outcome and Course Outcome

Chemistry is the study of composition and transformation of matter. Science is central to energy production, healthcare, new material development for electronics and other applied fields and environmental protection. Bachelor's degree in chemistry is the culmination of in-depth knowledge of Inorganic, Organic and Physical chemistry and specialized courses such as Pharmaceutical Chemistry, Spectroscopy, Nanoscience, Forensic Science, Cosmetics & Personal Grooming, Food Chemistry, Dairy Chemistry and so on. Thus, this programme inculcates learners in building a solid foundation for higher studies in Chemistry. The hands-on experience the students gain in practical's enables the students to apply theory to solve problems in everyday life, think critically and innovatively. An aptitude for research is instilled through project work and industrial internship.

Students completing this program will be able to present the concepts of Chemistry clearly and precisely. They can find solutions to solve problems that mankind is facing today. They can interpret data and present their findings to both scientific community as well as laymen can work as a team and evolve to become an entrepreneur.

The completion of this programme will also enable the learners to join teaching profession, conducting research in Industry and Government run research labs. A B.Sc., chemistry student has the option to diversify to other branches such as Biochemistry, Biotechnology and Forensic Science etc. They have employability opportunities in public and private sector jobs in Energy, Pharmaceutical, Food, Cosmetic industries etc…

REGULATIONS

1. Condition for Admission

A candidate who has passed the Higher Secondary Examination of Tamil Nadu Higher Secondary Board or an examination of some other board accepted by the syndicate as equivalent there with Chemistry and Physics and any one of the following subjects namely Maths, Botany, Zoology or Biology shall be eligible for admission into B.Sc., course in Chemistry.

2. Duration of the Course

The course for the degree of Bachelor of Science shall consist of three academic years divided into six semesters.

3. Course of study

The course of study for the B.Sc., degree in the Branch IV-Chemistry shall comprise of the following subjects according to the syllabus and books prescribed from time to time. The Syllabus for various subjects shall be demarcated into five units in each subject.

Part – I – Tamil / Other languages
Part – II – English
Part – III – Core Courses
Elective Courses
Project with viva voce

Part – IV – Foundation course
Skill Enhancement courses (Non-Major Elective)
Skill Enhancement courses (Discipline Specific)
Skill Enhancement courses
Environmental Studies
Value Education
Internship / Industrial Visit / Field Visit
Professional Competency Skill

Part – V – Extension Activity
NSS / NCC / Sports / YRC and other co and extra curricular activities offered under part – V of the programmes

The two Elective (Allied) subjects may be chosen by the respective colleges and the same must be communicated to the University.

Skill Enhancement Courses (Non-Major Elective) may be chosen by the respective colleges and the same must be communicated to the University.

The College may also choose the Elective (Allied) of their choice in the first and second year.

4. Examinations

There shall be six examinations - two in the first year, two in the second year and two in the third year. Candidates failing in any subject / subjects will be permitted to appear for such failed subject / subjects at subsequent examinations.

The syllabus has been divided into six semesters. Examinations (theory and practical) for I, III and V semesters will be held in November / December and Examinations (theory and practical) for II, IV and VI semesters will be held in April / May.

Requirement to appear for the examination

A candidate shall be permitted to appear for the University examinations for any semester (theory or practical) if He / She secures not less than 75% of attendance in the number of working days during the semester.

5. Passing Minimum

A candidate who secures not less than 40% in the University (external) Examination and 40% marks in the external examination and continuous internal assessment put together in any course of Part I, II, III & IV shall be declared to have passed the examination in the subject (theory or practical). For practical, the minimum for a pass includes the record notebook marks also. There is no passing minimum for the record note book. However, submission of a record note book is a must.

6. Classification of Successful Candidates

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in First Class. All other successful candidates shall be declared to have passed in the Second Class. Candidates who obtain 75% of the marks in the aggregate shall be declared to have passed the examination in First Class with Distinction provided they pass all the examinations prescribed for the course at the first appearance.

Grading:

Conversion of marks to Grade points and letter grade (Performance in a course / paper)

Range of marks	Grade Points	Letter Grade	Description
90-100	9.0-10.0	O	Outstanding
80-89	8.0-8.9	D+	Excellent
75-79	7.5-7.9	D	Distinction
70-74	7.0-7.4	A+	Very Good
60-69	6.0-6.9	A	Good
50-59	5.0-5.9	B	Average
40-49	4.0-4.9	C	Satisfactory
00-39	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

Ci = Credits earned for course I in any semester

Gi = Grade point obtained for course I in any semester

N = Refers to the semester in which such course was credited

Grade point average (for a Semester):

Calculation of grade point average semester wise and partwise is as follows: GRADE POINT AVERAGE [GPA] = ΣiCi Gi/ΣiCi

$$GPA = \frac{\text{Sum of the multiplication of grade points by the credits of the courses offered under each part}}{\text{Sum of the credits of the courses under each part in a semester}}$$

Calculation of grade point average (CGPA) (for the entire programme)

A candidate who has passed all the examinations under different parts (Part – I to V) is eligible for the following part wise computed final grades based on the range of CGPA.

CUMULATIVE GRADE POINT AVERAGE [CGPA] = $\Sigma n \Sigma_i Cn_i Gn_i / \Sigma n \Sigma_i Cni$

$$CGPA = \frac{\text{Sum of the multiplication of grade points by the credits of the entire programme under each part}}{\text{Sum of the credits of the courses of the entire programme under each part}}$$

Classification of successful candidates:

A candidate who passes all the examinations in Part I to Part V securing following CGPA and Grades shall be declared as follows for Part I or Part II or Part III:

CGPA	GRADE	Classification of Final Result
9.5-10.0	O+	First Class – Exemplary
9.0 and above but below 9.5	O	
8.5 and above but below 9.0	D++	First Class with Distinction
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A++	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	
4.5 and above but below 5.0	C+	Third Class
4.0 and above but below 4.5	C	

7. Ranking

Candidates who pass all the examinations prescribed for the course in the first instance and within a period of three academic years from the year of admission to the course only are eligible for University Ranking.

8. Maximum Duration for the completion of the UG Programme

The maximum duration for completion of the UG Programme shall not exceed twelve semesters.

9. Commencement of this Regulation

These regulations shall take effect from the academic year 2023-2024, i.e., for students who are to be admitted to the first year of the course during the academic year 2023-2024 and thereafter.

II. PO AND PSO DESCRIPTIONS

LEARNING OUTCOMES-BASED ON CURRICULUM FRAMEWORK GUIDELINES AND REGULATIONS FOR UNDERGRADUATE PROGRAMME	
Programme:	**B.Sc., Chemistry**
Programme Code:	
Duration:	**3 Years (UG)**
Programme Outcomes:	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study. **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. **PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. **PO4: Problem solving: Capacity** to extrapolate from what one has learned and applies their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation. **PO7: Cooperation/Teamwork:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team. **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.

	PO10: Information/digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO11: Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO12: Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO13: Moral and ethical awareness/reasoning**: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. **PO14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO15: Lifelong learning:** Ability to acquire knowledge and skills, including learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.
Programme Specific Outcomes:	On successful completion of Bachelor of Chemistry programme, the student should be able to: **PSO1: Disciplinary Knowledge:** Understand the fundamental principles, concepts, and theories related to physics and computer science. Also, exhibit proficiency in performing experiments in the laboratory. **PSO2: Critical Thinking:** Analyse complex problems, evaluate information, synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions, and communicate effectively. **PSO3: Problem Solving:** Employ theoretical concepts and critical reasoning ability with physical, mathematical, and technical skills to solve problems, acquire data, analyze their physical significance and explore new design possibilities. **PSO4: Analytical & Scientific Reasoning:** Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models. **PSO5: Research related skills:** Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects. **PSO6: Self-directed & Lifelong Learning:** Set learning goals, manage their own learning, reflect on their learning, adapt to new contexts, seek out new knowledge, collaborate with others and to continuously improve their skills and knowledge, through ongoing learning and professional development, and contribute to the growth and development of their field.

PO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
PO1	✓					
PO2		✓				
PO3			✓			
PO4				✓		
PO5					✓	
PO6						✓

2. Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project and project with viva voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application-oriented content wherever required.
- The core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising statistical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced statistical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The general studies and statistics based problem solving skills are included as mandatory components in the 'Training for Competitive Examinations' course at the final semester.
- The curriculum is designed so as to strengthen the Industry-Academia interface to provide more job opportunities for the students.
- The statistical quality control course is included to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The internship during the second-year vacation will help the students gain valuable work experience that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva voce component in the fifth semester enables the students to apply conceptual knowledge to practical situations. The state of art technologies in conducting experiments in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over their counterparts in the job market.
- State-of-the-Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as elective courses, covering conventional topics to the latest DBMS and Computer software for analytics.

Value additions in the Revamped Curriculum:

Semester	Newly introduced components	Outcome / Benefits
I	**Foundation Course** To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract Statistics and simulating mathematical concepts to real world.	• Instil confidence among students. • Create interest in the subject
I, II, III, IV	**Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial)	• Industry ready graduates • Skilled human resource • Students are equipped with essential skills to make them employable
		• Training on computing / computational skills enable the students gain knowledge and exposure on latest computational aspects
		• Data analytical skills will enable students to gain internships, apprenticeships, field work involving data collection, compilation, analysis etc.
		• Entrepreneurial skill training will provide an opportunity for independent livelihood • Generates self – employment • Create small scale entrepreneurs • Training to girls leads to women empowerment
		• Discipline centric skill will improve the technical knowhow of solving real life problems using ICT tools
III, IV, V & VI	**Elective papers** An open choice of topics categorized under Generic and Discipline Centric	• Strengthening the domain knowledge • Introducing the stakeholders to the state-of-the-Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature • Students are exposed to Latest topics on Computer Science / IT, that require strong statistical background • Emerging topics in higher education / industry / communication network / health sector etc. are introduced with hands-on-training, facilitates designing of statistical models in the respective sectors
IV	DBMS and Programming	• Exposure to Industry moulds students into solution

	skill, Biostatistics, Statistical Quality Control, Official Statistics, Operations Research	providers • Generates Industry ready graduates • Employment opportunities enhanced
II Year Vacation activity	Internship / Industrial Training	• Practical training at the Industry / Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students to gain professional experience and also become responsible citizens
V	Project with viva voce	• Self-learning is enhanced • Application of the concept to real situation is conceived resulting in tangible outcome
VI	Introduction of Professional Competency Component	• Curriculum design accommodates all category of learners; 'Statistics for Advanced Explain' component will comprise of advanced topics in Statistics and allied fields, for those in the peer group / aspiring researchers; • 'Training for Competitive Examinations' –caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, ISS, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.
Extra Credits: **For advanced Learners / Honors degree**		• To cater to the needs of peer learners / research aspirants
Skills acquired from the Courses		• Knowledge, Problem solving, Analytical ability, Professional competency, Professional communication and Transferrable skill

III. CREDIT DISTRIBUTION FOR UG PROGRAMME

Sem I	Credit	Sem II	Credit	Sem III	Credit	Sem IV	Credit	Sem V	Credit	Sem VI	Credit
1.1 Language – Tamil	3	2.1 Language – Tamil	3	3.1 Language – Tamil	3	4.1 Language– Tamil	3	5.1 Core Course – CCIX	4	6.1 Core Course – CCXIV	3
1.2 English	3	2.2 English	3	3.2 English	3	4.2 English	3	5.2 Core Course – CCX	4	6.2 Core Course – CCXV	3
1.3 Core Course – CC I	5	2.3 Core Course – CC III	5	3.3 Core Course – CC V	5	4.3 Core Course – CC VII Core Industry Module	5	5. 3 Core Course – CC XI	4	6.3 Core Course – CCXVI	3
1.4 Core Course – CC II	3	2.4 Core Course – CC IV	3	3.4 Core Course – CC VI	3	4.4 Core Course – CC VIII	3	5.4 Core Course – CCXII	2	6.4 Core Course – CCXVII	3
1.5 Elective–I Generic/Discipline Specific	4	2.5 Elective–II Generic/Discipline Specific	6	3.5 Elective–III Generic/ Discipline Specific	5	4.5 Elective–IV Generic/ Discipline Specific	5	5. 5 Core Course – Project with viva- voce CCXIII	2	6.5 Elective–VII Generic/ Discipline Specific	3
1.6 Skill Enhancement Course SEC–1 (NME)	2	2.6 Skill Enhancement Course SEC–2 (NME)	2	3.6 Skill Enhancement Course SEC–4, (Entrepreneurial Skill)	1	4.6 Skill Enhancemen t Course SEC–6	2	5.6 Elective–V Generic/ Discipline Specific	3	6.6 Elective– VIII Generic/ Discipline Specific	3
1.7 Skill Enhancement- (Foundation Course in Chemistry)	2	2.7 Skill Enhancement Course SEC–3	2	3.7 Skill Enhancement Course SEC–5	2	4.7 Skill Enhancement Course SEC–7	2	5.7 Elective–VI Generic/ Discipline Specific	3	6.7 Professional Competency Skill	2
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.	**22**		**24**		**22**		**25**		**26**		**21**
										Total Credit Points	**140**

Curriculum Design and Credit Distribution for UG Programme in Chemistry

B.Sc., Chemistry

First Year

Semester - I

Part	List of Courses	Credit	Hours Per week (L/T/P)
Part-I	Language - Tamil	3	6
Part-II	English	3	6
Part-III	Core Courses 2 (CC1, CC2)	8	8
	Elective Course 1 (Generic/Discipline Specific) EC1	4	6
Part-IV	Skill Enhancement Course SEC-1 (Non-Major Elective)	2	2
	Foundation Course in Chemistry FC	2	2
		22	**30**

Semester - II

Part	List of Courses	Credit	Hours Per week (L/T/P)
Part-I	Language - Tamil	3	6
Part-II	English	3	6
Part-III	Core Courses 2 (CC3, CC4)	8	8
	Elective Course 1 (Generic/Discipline Specific) EC2	6	6
Part-IV	Skill Enhancement Course - SEC-2 (Non-Major Elective)	2	2
	Skill Enhancement Course - SEC-3 (Discipline Specific/Generic)	2	2
		24	**30**

Second Year

Semester - III

Part	List of Courses	Credit	Hours Per week (L/T/P)
Part-I	Language - Tamil	3	6
Part-II	English	3	6
Part-III	Core Courses 2 (CC5, CC6)	8	9
	Elective Course 1 (Generic/Discipline Specific) EC3	5	5
Part-IV	Skill Enhancement Course - SEC - 4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course - SEC - 5 (Discipline Specific/Generic)	2	2
	Environmental Studies (EVS)	-	1
		22	**30**

Semester - IV

Part	List of Courses	Credit	Hours Per week (L/T/P)
Part-I	Language - Tamil	3	6
Part-II	English	3	6
Part-III	Core Courses 2 (CC7, CC8)	8	8
	CC7: Core Industry Module-1		
	CC8: Any Core paper		
	Elective Course 1 (Generic/Discipline Specific) EC4	5	5
Part-IV	Skill Enhancement Course - SEC- 6	2	2
	Skill Enhancement Course - SEC - 7 (Discipline Specific/Generic)	2	2
	Environmental Studies EVS	2	1
		25	**30**

Third Year

Semester - V

Part	List of Courses	Credit	Hours Per week (L/T/P)
Part-III	Core Courses 4 (CC9, CC10, CC11, CC12)	14	17
	Elective Courses 2 (Generic/Discipline Specific) EC5, EC6	6	8
	Core/Project with Viva voce CC13	2	3
Part-IV	Value Education	2	2
	Internship/Industrial Training (Carried out in II Year Summer vacation) (30 hours)	2	_
		26	**30**

Semester - VI

Part	List of Courses	Credit	Hours Per week (L/T/P)
Part-III	Core Courses 4 (CC14, CC15, CC16, CC17)	12	19
	Elective Courses 2 (Generic/Discipline Specific) EC7, EC8	6	9
Part-IV	Professional Competency Skill	2	2
Part-V	Extension Activity (Outside College hours)	1	-
		21	**30**

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	12	14	13	13	22	18	92
Part IV	4	4	3	6	4	2	23
Part V	-	-	-	-	-	1	1
Total	22	24	22	25	26	21	**140**

***Part I, II and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components IV, V have to be completed during the duration of the programme as per the norms, to be eligible to obtain the UG degree.**

V. METHODS OF EVALUATION & METHODS OF ASSESSMENT

Methods of Evaluation-Theory		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
	Total	**100 Marks**
Methods of Evaluation-Practical		
Internal Evaluation	Continuous Internal Assessment Test	40 Marks
	Attendance and Class Participation	
External Evaluation	End Semester Examination	60 Marks
	Record	
	Total	**100 Marks**
Methods of Assessment		
Recall(K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend(K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or Over view	
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain	
Analyze(K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate	
	Between various ideas, Map knowledge	
Evaluate(K5)	Longer essay/Evaluation essay, Critique or justify with pros and cons	
Create(K6)	Check knowledge in specific or off beat situations, Discussion, Debating or Presentations	

PATTERN OF QUESTION PAPER

Time: 3 Hours **Maximum: 75 Marks**

Part A: 15x 1=15 (Answer all questions)
Choose the correct answer
(Three questions from each unit)

Part B: 2 x 5 = 10 (Answer any two questions)
(One question from each unit with internal choice)

Part C: 5 x 10= 50 (Answer All questions)
(One question from each unit with internal choice)

INTERNSHIP 2 WEEKS

The students have the option to select any organization – Government / private like industry, R & D organizations, scientific companies, etc., in consultation with the staff coordinator & Head of the Department. The students have to undergo training for a period of two weeks at the end of semester- IV during vacation. The students must maintain a work diary and prepare a report of the training undergone and submit the same.

SEMESTER INDEX
B.Sc., CHEMISTRY CURRICULUM DESIGN

FIRST YEAR

Semester -I

Part	List of Courses	Credit	Per week (L/T/P)	Exam Hours	University Examination		
					Internal	External	Total
Part I	Language : Tamil-I	3	6	3	25	75	100
Part II	English-I	3	6	3	25	75	100
Part III	General Chemistry-I CC1	5	5	3	25	75	100
	Quantitative Inorganic Estimations (Titrimetry) and Inorganic Preparations CC2	3	3	3	40	60	100
	Mathematics (or) Botany (or) Zoology EC-1 (Theory)	4	4	3	25	75	100
	Mathematics (or) Botany (or) Zoology EC-1 (Practical)	-	2	-	-	-	-
Part IV	Skill Enhancement Course SEC-1 (Non-Major Elective)	2	2	3	25	75	100
	Foundation Course in Chemistry - FC	2	2	3	25	75	100
Total		**22**	**30**				

Semester - II

Part	List of Courses	Credit	Per week (L/T/P)	Exam Hours	University Examination		
					Internal	External	Total
Part I	Language : Tamil-II	3	6	3	25	75	100
Part II	English-II	3	4	3	25	75	100
Part II	Language Proficiency for Employability-Overview of English Communication	2	2	-	25	75	100
Part III	General Chemistry-II CC3	5	5	3	25	75	100
	Qualitative Organic Analysis and Preparation of Organic Compounds CC4	3	3	3	40	60	100
	Mathematics (or) Botany (or) Zoology EC-2 (Theory)	4	4	3	25	75	100
	Mathematics (or) Botany (or) Zoology EC-2 (Practical)	2	2	3	40	60	100
Part IV	Skill Enhancement Course SEC-2 (Non-Major Elective)	2	2	3	25	75	100
	Skill Enhancement Course SEC-3 (Discipline Specific) Cosmetics and Personal Care Products	2	2	3	25	75	100
	Total	**26**	**30**				

SECOND YEAR

Semester - III

Part	List of Courses	Credit	Per week (L/T/P)	Exam Hours	University Examination		
					Internal	External	Total
Part I	Language : Tamil-III	3	6	3	25	75	100
Part II	English-III	3	6	3	25	75	100
Part III	General Chemistry-III CC5	4	4	3	25	75	100
	Qualitative Inorganic Analysis CC6	3	3	3	40	60	100
	Physics EC-3 (Theory)	3	4	3	25	75	100
	Physics EC-3 (Practical)	2	2	3	40	60	100
Part IV	**NMSDC-Digital Skills for Employability-Digital Skills**	**2**	**2**	**-**	**100**	**-**	**100**
	Skill Enhancement Course SEC-5 (Discipline Specific) Pesticide Chemistry	2	2	3	25	75	100
	Environmental Studies - EVS	-	1	-	-	-	-
	Total	**22**	**30**				

*Skill Enhancement Course SEC-4: Internal Examination Only

Semester - IV

Part	List of Courses	Credit	Per week (L/T/P)	Exam Hours	University Examination		
					Internal	External	Total
Part I	Language : Tamil-IV	3	6	3	25	75	100
Part II	English-IV	3	6	3	25	75	100
Part III	General Chemistry-IV CC7	5	4	3	25	75	100
	Physical Chemistry Practical-I CC8	3	3	3	40	60	100
	Physics EC-4 (Theory)	3	4	3	25	75	100
	Physics EC-4 (Practical)	2	2	3	40	60	100
Part IV	Skill Enhancement Course SEC-6: Instrumental methods of Chemical Analysis	2	2	3	25	75	100
	Skill Enhancement Course SEC-7: (Discipline Specific) Forensic Science	2	2	3	25	75	100
	Environmental Studies - EVS	2	1	3	25	75	100
	Total	**25**	**30**				

THIRD YEAR

Semester - V

Part	List of Courses	Credit	Per week (L/T/P)	Exam Hours	University Examination		
					Internal	External	Total
Part III	Organic Chemistry-I CC9	4	5	3	25	75	100
	Inorganic Chemistry-I CC10	4	4	3	25	75	100
	Physical Chemistry-I CC11	4	5	3	25	75	100
	Biochemistry EC-5	3	4	3	25	75	100
	Industrial Chemistry EC-6	3	4	3	25	75	100
	Physical Chemistry Practical-II CC12	2	3	3	40	60	100
	*Group project with Viva-voce CC13	2	3	3	40	60	100
Part IV	Value Education	2	2	3	25	75	100
	Internship / Industrial Visit / Field Visit (Carried out in II year summer vacation-2 weeks)	2	-	-	-	-	-
	Total	**26**	**30**				

*(3-5 members, not exceeding 5 members per group)

Semester - VI

Part	List of Courses	Credit	Per week (L/T/P)	Exam Hours	University Examination		
					Internal	External	Total
Part III	Organic Chemistry-II CC14	3	5	3	25	75	100
	Inorganic Chemistry-II CC15	3	4	3	25	75	100
	Physical Chemistry-II CC16	3	5	3	25	75	100
	Gravimetric Estimation Practical CC17	3	5	5	40	60	100
	Fundamentals of Spectroscopy EC-7	3	5	3	25	75	100
	Nano science (or) Polymer science (or) Pharmaceutical Chemistry (Elective based) EC-8	3	4	3	25	75	100
Part IV	Professional Competency Skill	2	2	3	25	75	100
Part V	Extension Activity	1	-	-	-	-	-
	Total	**21**	**30**				

<table>
<tr><td>Title of the Course</td><td colspan="8">GENERAL CHEMISTRY-I</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UCHCC01</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at giving an overall view of the
various atomic models and atomic structure
wave particle duality of matter
periodic table, periodicity in properties and its application in explaining the chemical behaviour
nature of chemical bonding, and
fundamental concepts of organic chemistry</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="8">UNIT-I

Atomic structure and Periodic trends

History of atom (J.J.Thomson, Rutherford); Moseley’s Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck’s quantum theory - Bohr's model of atom; The Franck-Hertz Experiment; Interpretation of H-spectrum; Photoelectric effect, Compton effect; Dual nature of Matter- De-Broglie wavelength-Davisson and Germer experiment Heisenberg’s Uncertainty Principle; Electronic Configuration of Atoms and ions - Hund’s rule, Pauli’ exclusion principle and Aufbau principle;
Numerical problems involving the core concepts.</td></tr>
<tr><td colspan="8">UNIT-II

Introduction to Quantum mechanics
Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wave functions, formulation of Schrodinger wave equation (derivation not needed) - Probability and electron density-visualizing the orbitals -probability density and significance of Ψ and Ψ^2.

Modern Periodic Table

Cause of periodicity; Features of the periodic table; classification of elements - Periodic trends for atomic size- Atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electro negativity-electro negativity scales, applications of electro negativity.

Problems involving the core concepts</td></tr>
</table>

UNIT-III: Structure and bonding - I

Ionic bond

Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle - lattice energies, Madelung constant; relative effect of lattice energy and solvation energy; Ion polarisation - polarising power and polarizability; Fajans' rules - effects of polarisation on properties of compounds; problems involving the core concepts.

Covalent bond

Shapes of orbitals, overlap of orbitals - σ and π bonds; directed valency - hybridization; VSEPR theory - shapes of molecules of the type AB_2, AB_3 and AB_4.

Partial ionic character of covalent bond - dipole moment, application to molecules of the type A_2, AB and AB_2. Percentage ionic character - numerical problems based on calculation of percentage ionic character.

UNIT-IV: Structure and bonding - II

VB theory application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species - CO_2, NO_2, CO_3^{2-}, NO_3^- ; limitations of VBT; MO theory - bonding, antibonding and nonbonding orbitals, bond order; MO diagrams of H_2, O_2, O_2^+, N_2, HF, CO.

Magnetic characteristics, comparison of VB and MO theories.

Coordinate bond: Definition, Formation of BF_3, NH_3 - properties

Band theory - mechanism of conduction in solids; conductors, insulator, semiconductor - types, applicationsof semiconductors

Weak Chemical Forces - Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces; Hydrogen bonding and its types.

UNIT-V:

Basic concepts in Organic Chemistry and Electronic effects

Types of bond cleavage - heterolytic and homolytic; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction intermediates - carbanions, carbocations,carbenes, arynes and nitrynes.

Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductomeric and electromeric effects.

	Resonance - resonance energy, conditions for resonance - acidity of phenols, basicity of aromatic amines, stability of carbonium ions, carbanions and free radicals. Hyperconjugation - stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitromethane
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Madan, R. D. and Sathya Prakash, *Modern Inorganic Chemistry*, 2nd ed.; S. Chand and Company: New Delhi, 2003. 2. Rao, C.N. R. University General Chemistry, Macmillan Publication: New Delhi, 2000. 3. Puri, B. R. and Sharma, L. R. *Principles of Physical Chemistry*, 38th ed.;Vishal Publishing Company: Jalandhar, 2002. 4. Bruce, P. Y. and PrasadK. J. R. *Essential Organic Chemistry*, Pearson Education: New Delhi, 2008. 5. Dash UN, Dharmarha OP, Soni P.L. Textbook of Physical Chemistry, Sultan Chand & Sons: New Delhi,2016
Reference Books	1. Maron, S. H. and Prutton C. P. *Principles of Physical Chemistry*,4th ed.; The Macmillan Company: Newyork,1972. 2. Lee, J. D. *Concise Inorganic Chemistry*, 4th ed.; ELBS William Heinemann: London,1991. 3. Gurudeep Raj, *Advanced Inorganic Chemistry*, 26th ed.; Goel Publishing House: Meerut, 2001. 4. Atkins, P.W. & Paula, J. *Physical Chemistry*, 10th ed.; Oxford University Press:New York, 2014. 5. Huheey, J. E. *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th ed .; Addison, Wesley Publishing Company: India,1993.
Website and e-learning source	1) https://onlinecourses.nptel.ac.in 2) http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm 3) http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html 4) https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding 5) https://www.chemtube3d.com/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.

CO2: classify the elements in the periodic table, types of bonds, reaction intermediates electronic effects in organic compounds, types of reagents.

CO3: apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, Δx, Δp electro negativity, percentage ionic character and bond order.

CO4: evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects

CO5: construct MO diagrams, predict trends in periodic properties, assess the properties of elements, and explain hybridization in molecules, nature of H – bonding and organic reaction mechanisms.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO 5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">QUANTITATIVE INORGANIC ESTIMATIONS (TITRIMETRY) AND INORGANIC PREPARATIONS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td>23UCHCC02</td></tr>
<tr><td>Semester</td><td>I</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">3</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on
• laboratory safety
• handling glass wares
• Quantitative estimation
• preparation of inorganic compounds</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT- I (Not for Examination)

Chemical Laboratory Safety in Academic Institutions

Introduction - importance of safety education for students, common laboratory hazards, assessment and minimization of the risk of the hazards, prepare for emergencies from uncontrolled hazards; concept of MSDS; importance and care of PPE; proper use and operation of chemical hoods and ventilation system; fire extinguishers-types and uses of fire extinguishers, demonstration of operation; chemical waste and safe disposal.

Common Apparatus Used in Quantitative Estimation (Volumetric)

Description and use of burette, pipette, standard flask, measuring cylinder, conical flask, beaker, funnel, dropper, clamp, stand, wash bottle, watch glass, wire gauge and tripod stand.

Principle of Quantitative Estimation (Volumetric)

Equivalent weight of an acid, base, salt, reducing agent, oxidizing agent; concept of mole, molality, molarity, normality; primary and secondary standards, preparation of standard solutions; theories of acid-base, redox, complexometric, iodimetric and iodometric titrations; indicators – types, theory of acid–base, redox, metal ion and adsorption indicators, choice of indicators.</td></tr>
</table>

	UNIT-II **Quantitative Estimation(Volumetric)** **Acidimetry and Alkalimetry** Estimation of hydrochloric acid using standard oxalic acid Estimation of sodium hydroxide using standard sodium carbonate
	Permanganometry Estimation of oxalic acid using standard ferrous ammonium sulphate Estimation of ferrous iron using standard oxalic acid **Dichrometry** Estimation of ferric alum using standard dichromate (external indicator) Estimation of ferrous iron using standard standard ferrous sulphate (internal indicator-diphenyl amine) **Iodometry** Estimation of copper in copper sulphate using standard dichromate
	Unit-III **Complexometry** Estimation of Zn and Mg using EDTA Estimation of hardness of water **Estimations** Estimation of iron in iron tablets Estimation of ascorbic acid **Preparation of Inorganic compounds-** Potash alum Tetraammine copper(II) sulphate Microcosmic salt Mohr's Salt
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	**Reference Books:** 1. Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. *Basic Principles of Practical Chemistry*,2nd ed.; Sultan Chand &Sons: New Delhi, 1997. *2.* Nad, A. K.; Mahapatra, B.; Ghoshal, A.; *An advanced course in Practical Chemistry,* 3rd ed.; New Central Book Agency: Kolkata, 2007.
Reference Books	1. Mendham, J.; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.; *Vogel's Textbook of Quantitative Chemical Analysis*, 6th ed.; Pearson Education Ltd: New Delhi, 2000.
Website and e-learning source	**Web References:** 1) http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis 2) https://chemdictionary.org/titration-indicator/

Course Learning Outcomes (for Mapping with POs and PSOs)

On successful completion of the course the students should be able to

CO1: explain the basic principles involved in titrimetric analysis and inorganic preparations.
CO2: compare the methodologies of different titrimetric analysis.
CO3: calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution.
CO4: assess the yield of different inorganic preparations and identify the end point of various titrations.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M

CO-PO Mapping (Course Articulation Matrix)

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="8">FOOD CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="8">SEC-1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">NME</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UCHSE01A</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="3">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Chemistry</td></tr>
<tr><td>Objectivesof the course</td><td colspan="8">This course aims at giving an overall view of the
● Types of food
● Food adulteration and poisons
● Food additives and preservation</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="8">UNIT-I

Food Adulteration
Sources of food, types, advantages and disadvantages. Food adulteration - contamination of wheat, rice, milk, butter etc. with clay stones, water and toxic chemicals -Common adulterants, Ghee adulterants and their detection. Detection of adulterated foods by simple analytical techniques.</td></tr>
<tr><td colspan="8">UNIT-II
Food Poison
Food poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion) - Chemical poisons - First aid for poison consumed victims.</td></tr>
<tr><td colspan="8">UNIT-III

Food Additives
Food additives -artificial sweeteners - Saccharin - Cyclomate and Aspartate Food flavours -esters, aldehydes and heterocyclic compounds - Food colours - Emulsifying agents - preservatives -leavening agents. Baking powder - yeast - tastemakers - MSG - vinegar.</td></tr>
<tr><td colspan="8">UNIT-IV

Beverages
Beverages-soft drinks-soda-fruit juices - alcoholic beverages-examples. Carbonation-addiction to alcohol - diseases of liver and social problems.</td></tr>
<tr><td colspan="8">UNIT-V
Edible Oils
Fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventing heart diseases-determination of iodine value, RM value, saponification values and their significance.</td></tr>
</table>

Recommended Text	1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010. 2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co.Publishers, second edition, 2006. 3. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishning house, 2010. 4. Food Chemistry, Dr. L. Rakesh Sharma, Evincepub publishing, 2022. 5. Food processing and preservation, G. Subbulakshmi, Shobha A Udipi, Pdmini S Ghugre, New age international publishers, second edition, 2021.
Reference Books	1. H.-D. Belitz, Werner Grosch, Food Chemistry Springer Science & Business Media, 4th Edition, 2009. 2. M.Swaminathan, Food Science and Experimental Foods, Ganesh and Company,1979. 3. Hasenhuettl, Gerard. L.; Hartel, Richard. W. Food Emulsifiers and their applications Springer New York 2nd ed. 2008. 4. Food Chemistry, H.-D. Belitz, W. Grosch, P. Schieberle, Springer, fourth revised and extended edition, 2009. 5. Principles of food chemistry, John M. deMan, John W. Finley, W. Jefferey Hurst, Chang Yong Lee, Springer, Fourth edition, 2018.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: learn about Food adulteration - contamination of Wheat, Rice, Milk, Butter.

CO 2: get an awareness about food poisons like natural poisons (alkaloids - nephrotoxin) pesticides, DDT, BHC, Malathion

CO 3: get an exposure on food additives, artificial sweeteners, Saccharin, Cyclomate and Aspartate in the food industries.

CO 4: acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages examples.

CO 5: study about fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats –MUFA and PUFA

-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="8">ROLE OF CHEMISTRY IN DAILY LIFE</td></tr>
<tr><td>Paper No.</td><td colspan="8">SEC-1</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">NME</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UCHSE01B</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="3">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims at providing an overall view of the
• importance of Chemistry in everyday life
• chemistry of building materials and food
• chemistry of Drugs and pharmaceuticals</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="8">UNIT-I
General survey of chemicals used in everyday life. Air - components and their importance; photosynthetic reaction, air pollution, green - house effect and the impact on our life style. Water - Sources of water, qualities of potable water, soft and hard water, methods of removal of hardness-water pollution</td></tr>
<tr><td colspan="8">UNIT-II
Building materials - cement, ceramics, glass and refractories - definition, composition and application only. Plastics - polythene, PVC, bakelite, polyesters, melamine-formaldehyde resins -preparation and uses only.</td></tr>
<tr><td colspan="8">UNIT-III
Food and Nutrition - Carbohydrates, Proteins, Fats - definition and their importance as food constituents - balanced diet - Calories minerals and vitamins (sources and their physiological importance). Cosmetics - tooth paste, face powder, soaps and detergents, shampoos, nail polish, perfumes - general formulation and preparations - possible hazards of cosmetic use.</td></tr>
<tr><td colspan="8">UNIT-IV
Chemicals in food production - fertilizers - need, natural sources; urea, NPK fertilizers and super phosphate. Fuel – classification - solid, liquid and gaseous; nuclear fuel examples and uses.</td></tr>
<tr><td colspan="8">UNIT-V
Pharmaceutical drugs - analgesics and antipyretics - paracetamol and aspirin. Colour chemicals - pigments and dyes - examples and applications. Explosives - classification and examples.</td></tr>
<tr><td>Recommended Text</td><td colspan="8">1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
2. A textbook of pharmaceutical chemistry by Jayashree Ghosh, S Chand publishing, 2012.
3. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
4. B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.Introduction to forensic chemistry, Kelly M. Elkins, CRC Press Taylor & Francis Group, 2019.
5. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co.Publishers, second edition, 2006.</td></tr>
</table>

Reference Books	1. Randolph. Norris Shreve, Chemical Process Industries, McGraw-Hill, Texas, fourthedition, 1977. 2. W.A.Poucher,JosephA.Brink,Jr.Perfumes,Cosmetics and Soaps,Springer,2000. 3. A.K.De,EnvironmentalChemistry,NewAge InternationalPublicCo.,1990.

Course Learning Outcomes (for Mapping with POs and PSOs)On completion of the course the students should be able to

CO1: learn about the chemicals used in everyday life as well as air pollution and water pollution.

CO2: get knowledge on building materials cement, ceramics, glass and plastics, polythene,PVC bakelite, polyesters,

CO3: acquire information about Food and Nutrition. Carbohydrates, Proteins, Fats Alsohave an awareness about Cosmetics Tooth pastes, face powder, soaps and detergents.

CO4: discuss about the fertilizers like urea, NPK fertilizers and super phosphate. Fuel classification solid, liquid and gaseous; nuclear fuel - examples and uses

CO5: have an idea about the pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin and also about pigments and dyes and its applications.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">FOUNDATION COURSE IN CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Foundation Course</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>1</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23UCHFC01</td></tr>
<tr><td>Semester</td><td>1</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td></td><td></td><td>Total</td><td></td></tr>
<tr><td>2</td><td></td><td>-</td><td></td><td></td><td>2</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The Course aims to make the students to
1. Understand the lab safety measures
2. Outline the basic concepts of organic chemistry
3. Describe the importance of periodic table
4. Explain the fundamentals of physical properties
5. Understand the importance of redox chemistry</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="7">Unit-I : Chemistry Lab-General Awareness and First Aid Techniques
Safety in chemistry lab- introduction to laboratory glass wares-storage and handling of chemicals-carcinogenic chemicals - handling of ethers - toxic and poisonous chemicals.
Burns and damages due to organic substances- acids, alkalies - burns in the eye-inhalation of toxic vapours-hazardous chemicals-dealing with bromine, phenol and hot objects.</td></tr>
<tr><td colspan="7">Unit-II: Introduction to Organic Chemistry
Catenation-Classification - Homologous Series - General Molecular Formula-Functional Groups - General and IUPAC Nomenclature - Modern concept of bonding in organic molecules, sp^3, sp^2 and sp hybridization in carbon by taking methane, ethane and benzene as examples.</td></tr>
<tr><td colspan="7">Unit-III : Introduction to Inorganic Chemistry
Atomic orbitals and concept of atomic orbitals - shape of s,p and d orbitals-periodic table and the classification of elements - Electronic configuration of elements up to atomic number 30, Types of Chemical bonds - Schematic Illustration of bonds.</td></tr>
<tr><td colspan="7">Unit-IV: Introduction to Physical Chemistry
Units - Fundamental units - derived units and SI Units - Significant Figures-States of matter - types - properties of solids, liquids and gases - solid state - types of solids - amorphous and crystalline solids - properties of liquids and gases.</td></tr>
<tr><td colspan="7">Unit-V: Basic concepts of Redox Chemistry
Definition - oxidation and reduction reactions-calculation of oxidation numbers-Equivalent weight-definition-calculation of equivalent weight of acids, bases and salts. Reduction potential and electrochemical series.</td></tr>
</table>

Extended Professional Component (is a part of internal component only, not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC and others to be solved (To be discussed during the tutorial hours)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, professional Communication and Transferable skills.
Recommended Text Books	1. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, 33rd Edition, Milestone Publishers and Distributors, New Delhi, India (2020) 2. Arub Bahl, B.S. Bahl, A Text Book of Organic Chemistry, 22nd Edition, S. Chand & Co (2019). 3. B.R. Puri, L.R. Sharma & M.S. Pathania, Principles of Physical Chemistry, 48th Edition, Vishal Publishing Co (2020).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">GENERAL CHEMISTRY - II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2">23UCHCC03</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry-I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing an overall view of the
• chemistry of acids, bases and ionic equilibrium
• properties of s and p-block elements
• chemistry of hydrocarbons
• applications of acids and bases
• compounds of main block elements and hydrocarbons</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT-I

Acids, bases and Ionic equilibria
Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant; ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degreeof dissociation.

Buffer solutions - types, mechanism of buffer action in acid and basic buffer, Henderson - Hasselbach equation.

Salt hydrolysis - salts of weak acids and strong bases, weak bases and strong acids, weak acids and weak bases - hydrolysis constant, degree of hydrolysis and relation between hydrolysis constant and degree of hydrolysis;
Solubility product - determination and applications; numerical problems involving the core concepts.

UNIT-II
Chemistry of s - Block Elements
Hydrogen: Position of hydrogen in the periodic table. Alkali metals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Preparation, properties and uses of NaOH, Na_2CO_3, KBr, $KClO_3$ alkaline earth metals. Anomalous behaviour of Be.

Chemistry of p- Block Elements (Group 13 & 14)
Preparation and structure of diborane and borazine - Chemistry of borax - Extraction of Al and its uses - Alloys of Al.
Comparison of carbon with silicon - Carbon-di-sulphide - Preparation, properties, structure and uses - Per carbonates, per monocarbonates and per dicarbonates.</td></tr>
</table>

	UNIT-III **Chemistry of p- Block Elements (Group 15-18)** General characteristics of elements of Group - 15; Chemistry of H_2N-NH_2 and NH_2OH. Chemistry of PH_3, PCl_3 and PCl_5 - Oxy acids of phosphorous H_3PO_3 and H_3PO_4. General properties of elements of Group - 16 - Structure and allotropy of elements - chemistry of ozone - Classification and properties of oxides - oxides of sulphur and selenium - Oxy acids of sulphur (Caro's and Marshall's acids). Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI), oxides and oxy acids ($HClO_4$). Inter-halogen compounds (ICl, ClF_3, BrF_5 and IF_7). Noble gases: Position in the periodic table. Preparation, properties and structure of XeF_2, XeF_4 and $XeOF_4$.
	UNIT-IV **Hydrocarbon Chemistry-I** **Alkenes** Nomenclature, general methods of preparation - Mechanism of β- elimination reactions - E_1 and E_2 mechanism - Hofmann and Saytzeff rules. Reactions of alkenes - addition reactions - mechanisms - Markownikoff's rule, Kharasch effect, oxidation reactions - hydroxylation, epoxidation, ozonolysis. **Alkadienes** Nomenclature - classification - isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2 and 1, 4 additions; free radical addition to conjugated dienes - Diels-Alder reactions. **Alkynes** Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerisation and isomerisation. **Cycloalkanes:** Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations. Conformational analysis of cyclohexane. Geometrical isomerism in cyclohexanes.

	UNIT-V **Hydrocarbon Chemistry – II** **Benzene:** Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's (4n+2) rule and its applications. Electrophilic substitution reactions - General mechanism of aromatic electrophilic substitution - nitration, sulphonation, halogenation, Friedel-Craft's alkylation and acylation. **Polynuclear Aromatic hydrocarbons**: Naphthalene - nomenclature, Haworth synthesis; physical properties, reactions - electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel - Crafts acylation and alkylation. Anthracene - synthesis by Elbs reaction, Diels - Alder reaction and Haworth synthesis; physical properties; reactions - Diels - Alder reaction, preferential substitution at C-9 and C-10; uses.
Extended Professional Component (is a part of internal component only,Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nded, S.Chand and Company, New Delhi. 2. Sathya Prakash, Tuli G D,Basu S K and Madan R D, (2003), Advanced Inorganic Chemistry, 17th ed., S.Chand and Company, New Delhi. 3. Bahl B S, Arul Bhal, (2003), Advanced Organic Chemistry, 3rd ed., S.Chand and Company, New Delhi. 4. Tewari K S, Mehrothra S N and Vishnoi N K, (1998), Text book of Organic Chemistry, 2nd ed., Vikas Publishing House, New Delhi. 5. Puri B R, Sharma L R, (2002), Principles of Physical Chemistry,38th ed., Vishal Publishing Company, Jalandhar.
Reference Books	1. Maron S H and Prutton C P, (1972), Principles of Physical Chemistry, 4th ed., The Macmillan Company, Newyork. 2. Barrow G M, (1992), Physical Chemistry, 5th ed., Tata McGraw Hill, NewDelhi. 3. Lee J D, (1991), Concise Inorganic Chemistry, 4thed., ELBS William Heinemann, London. 4. Huheey J E, (1993), Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed., Addison Wesley Publishing Company, India. 5. Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol – I, 26th ed.,Goel Publishing House, Meerut. 6. Agarwal O P, (1995), Reactions and Reagents in Organic Chemistry, 8thed., Goel Publishing House,Meerut.

Website ande-learning source	https://onlinecourses.nptel.ac.inhttp://cactus.dixie.edu/smblack/chem1010/lecture_notes/4B.html http://www.auburn.edu/~deruija/pdareson.pdfhttps://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding **MOOC components** http://nptel.ac.in/courses/104101090/ Lecture 1: Classification of elements and periodic properties http://nptel.ac.in/courses/104101090/

Course Learning Outcomes (for Mapping with POs and PSOs)
On completion of the course the students should be able to

CO1: explain the concept of acids, bases and ionic equilibria; periodic properties of s and p block elements, preparation and properties of aliphatic and aromatic hydrocarbons

CO2: discuss the periodic properties of sand p- block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids

CO3: classify hydrocarbons, types of reactions, acids and bases, examine the properties s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons

CO4: explain theories of acids, bases and indicators, buffer action and important compounds of s-block elements

CO5: assess the application of hard and soft acids indicators, buffers, compounds of s and p-block elements and hydrocarbons

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">QUALITATIVE ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td>23UCHCC04</td></tr>
<tr><td>Semester</td><td>II</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">3</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry-II</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on
• laboratory safety
• handling glass wares
• analysis of organic compounds
• preparation of organic compounds</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT-I (Not for Examination)

Safety rules, symbols and first-aid in chemistry laboratory
Basic ideas about Bunsen burner, its operation and parts of the flame.
Chemistry laboratory glassware - basis information and uses</td></tr>
<tr><td colspan="7">UNIT-II

Qualitative Organic Analysis
Preliminary examination, detection of special elements - Nitrogen, Sulphur and Halogens
Aromatic and Aliphatic nature, Test for Saturation and Unsaturation,
Identification of functional groups using solubility tests
Confirmation of functional groups
• Monocarboxylic acid, Dicarboxylic acid
• Monohydric phenol, Dihydric phenol
• Aldehyde, Ketone, Ester
• Carbohydrate (Reducing and Non-reducing sugars)
• Primary, Secondary, Tertiary amine
• Monoamide, Diamide, Thioamide
• Anilide, Nitro compound
• Preparation of derivatives for the functional groups</td></tr>
<tr><td colspan="7">UNIT-III

Preparation of Organic Compounds

• Nitration - Picric acid from Phenol
• Halogenation - p-Bromo acetanilide from Acetanilide
• Oxidation - Benzoic acid from Benzaldehyde
• Methyl benzoate to Benzoic acid
• Salicylic acid from Methyl Salicylate
• Hydrolysis of Benzamide to Benzoic Acid</td></tr>
</table>

	Separation and Purification Techniques (Not for Examination) i) Purification of organic compounds by crystallization (from water / alcohol)and distillation ii) Determination of melting and boiling points of organic compounds. iii) Steam distillation - Extraction of essential oil from citrus fruits/eucalyptusleaves. **Chromatography (Group experiment - Not for Examination)** Separation of amino acids by Paper Chromatography (i) Thin Layer Chromatography - mixture of sugars / plant pigments /permanganatedichromate. (ii) Column Chromatography - extraction of carotene, chlorophyll and xanthophyll from leaves / separation of anthracene - anthracene picrate.
Reference Books	1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. *Basic Principles of Practical Chemistry*, 2nd ed.; Sultan Chand: New Delhi, 2012. 2. Manna, A.K. *Practical Organic Chemistry*, Books and Allied: India, 2018. 3. Gurtu, J. N; Kapoor, R. *Advanced Experimental Chemistry (Organic)*, Sultan Chand: New Delhi, 1987. 4. Furniss,B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R. *Vogel's Textbook of Practical Organic Chemistry*, 5th ed.; Pearson: India,1989.
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: observe the physical state, odour, colour and solubility of the given organic compound.

CO2: identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.

CO3: compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non-reducing sugars and explain the reactions behind it.

CO4: exhibit a solid derivative with respect to the identified functional group.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">DAIRY CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC-2</td></tr>
<tr><td>Category</td><td>NME</td><td>Year</td><td>I</td><td>Credits</td><td>2</td><td>Course Code</td><td>23UCHSE02</td></tr>
<tr><td></td><td></td><td>Semester</td><td>II</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td>Total</td></tr>
<tr><td></td><td>2</td><td>-</td><td colspan="3">-</td><td>2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing an overall view of the
• chemistry of milk and milk products
• processing of milk
• preservation and formation of milk products.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT-I
Composition of Milk
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 - adulterants, preservatives with neutralizer-examples and their detection- estimation of fat, acidity and total solids in milk.</td></tr>
<tr><td></td><td colspan="7">UNIT-II
Processing of Milk
Microbiology of milk - destruction of micro - organisms in milk, physico - chemical changes taking place in milk due to processing - boiling, pasteurization - types of pasteurization - Bottle, Batch and HTST (High Temperature Short Time) - Vacuum pasteurization - Ultra High Temperature Pasteurization.</td></tr>
<tr><td></td><td colspan="7">UNIT-III
Major Milk Products
Cream - definition - composition - chemistry of creaming process - gravitational and centrifugal methods of separation of cream - estimation of fat in cream. Butter - definition – composition - theory of churning - estimation of acidity and moisture content in butter. Ghee - major constituents - common adulterants added to ghee and their detection - rancidity - definition - prevention - antioxidants and synergists - natural and synthetic.</td></tr>
<tr><td></td><td colspan="7">UNIT-IV:
Special Milk
Standardised milk - definition - merits - reconstituted milk - definition - flow diagram of manufacture - Homogenised milk - flavoured milk - vitaminised milk - toned milk -Incitation milk - Vegetable toned milk - humanized milk - condensed milk - definition, composition and nutritive value.</td></tr>
</table>

	UNIT-V **Fermented and other Milk Products** Fermented milk products - fermentation of milk - definition, conditions, cultured milk - definition of culture - example, conditions - cultured cream, butter milk - acidophilous milk - Ice cream - definition - percentage composition - types - ingredients-manufacture of ice cream, stabilizers - emulsifiers and their role-milk powder-definition - need for making milk powder - drying process - types of drying.
Recommended Text	1. K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, first edition, 2006. 2. K. S. Rangappa and K.T. Acharya, Indian Dairy Products, Asia Publishing House New Delhi, 1974. 3. Text book of dairy chemistry, M.P. Mathur, D. Datta Roy, P. Dinakar, Indian Council of Agricultural Research, 1 st edition, 2008. 4. A Text book of dairy chemistry, Saurav Singh, Daya Publishing house, 1 st edition,2013. 5. Text book of dairy chemistry, P. L. Choudhary, Bio-Green book publishers, 2021.
Reference Books	1. Robert Jenness and S. Patom, Principles of Dairy Chemistry, S.Wiley, New York, 2005. 2. F.P.Wond, Fundamentals of Dairy Chemistry,Springer,Singapore,2006. 3. Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi, 1980. 4. P.F.Fox and P.L.H. Mcsweeney, Dairy Chemistry and Biochemistry, Springer, Second edition, 2016. 5. Dairy chemistry and biochemistry, P. F. Fox, T. Uniacke-Lowe, P.L.H. McSweeney, J.A. OMahony, Springer, Second edition, 2015.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: understand about general composition of milk – constituents and its physical properties.
CO 2: acquire knowledge about pasteurization of Milk and various types of pasteurization - Bottle, Batch and HTST Ultra High Temperature Pasteurization.
CO 3: learn about Cream and Butter their composition and how to estimate fat in cream and Ghee
CO 4: explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk.
CO 5: have an idea about how to make milk powder and its drying process - types of drying process

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">COSMETICS AND PERSONAL CARE PRODUCTS</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC-3 (Discipline Specific)</td></tr>
<tr><td>Category</td><td>SEC</td><td>Year
Semester</td><td>I
I/II</td><td>Credits</td><td>2</td><td>Course Code</td><td>23UCHSE03</td></tr>
<tr><td>Instructional hours per week</td><td>Lecture
2</td><td>Tutorial
-</td><td colspan="2">Lab Practice
-</td><td colspan="3">Total
2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at familiarizing the students with
• formulations of various types of cosmetics and their significance
• hair, skin and dental care
• makeup preparations and personal grooming</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="7">UNIT-I
Skin care
Nutrition of the skin, skin care and cleansing of the skin; face powder - ingredients; creams and lotions - cleansing, moisturizing all purpose, shavingand sunscreen (formulation only); Gels - formulation and advantages; astringent and skin tonics - key ingredients, skin lightness, depilatories.</td></tr>
<tr><td colspan="7">UNIT-II
Hair care
Shampoos - types - powder, cream, liquid, gel – ingredients; conditioner –types - ingredients
Dental care
Tooth pastes - ingredients - mouth wash</td></tr>
<tr><td colspan="7">UNIT-III
Make up
Base - foundation - types - ingredients; lipstick, eyeliner, mascara, eyeshadow, concealers, rouge</td></tr>
<tr><td colspan="7">UNIT-IV
Perfumes
Classification - Natural - plant origin - parts of the plant used, chief constituents; animal origin - amber gries from whale, civetone from civet cat, musk from musk deer; synthetic - classification emphasizing characteristics - esters - alcohols - aldehydes - ketones</td></tr>
<tr><td colspan="7">UNIT-V
Beauty treatments
Facials - types - advantages - disadvantages; face masks - types; bleach - types - advantages - disadvantages; shaping the brows; eyelash tinting; perming - types; hair colouring and dyeing ; permanent waving - hair straightening; wax -types - waxing; pedicure, manicure - advantages - disadvantages</td></tr>
</table>

Reference Books	1. Wilkinson J B E and Moore R J, (1997) Harry's cosmeticology, 7th ed., Chemical Publishers, London. 2. George Howard, (1987) Principles and practiceof perfumes and cosmetics, Stanley Therones, Chettenham
Website and e-learning source	1. http://www.khake.com/page75.html 2. Net.foxsm/list/284

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- **CO1:** know about the composition of various cosmetic products
- **CO2** understand chemical aspects and applications of hair care and dental care and skin care products.
- **CO3** understand chemical aspects and applications of perfumes and skin care products.
- **CO4** to understand the methods of beauty treatments their advantages and disadvantage
- **CO5** understand the hazards of cosmetic products.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="8">GENERAL CHEMISTRY - III</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UCHCC05</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">General Chemistry – I and II</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims to provide a comprehensive knowledge on
• the physical properties of gases, liquids, solids and X-ray diffraction of solids.
• fundamentals of nuclear chemistry and nuclear waste management.
• applications of nuclear energy
• basic chemistry of halo - organic compounds, phenol and other aromaticalcohols.
• preparation and properties of phenols and alcohols.</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="8">UNIT-I
Gaseous state
Kinetic molecular model of a gas: postulates and derivation from the kinetic gas equation; The Maxwell - Boltzmann distribution of speed of molecules - average, root mean square and most probable velocity and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Collision frequency; collision diameter; mean free path.

Real gases: Deviations from ideal gas behaviour, compressibility factor, Z, and its variation with pressure for different gases. equations of states for real gases- Vander Waal’s equation; Virial equation; Boyle temperature; law of corresponding states - liquefaction of gases; numerical problems involving the core concepts.</td></tr>
<tr><td colspan="8">UNIT-II
Liquid and Solid State
Properties of Liquids - Surface tension, viscosity and their applications. Crystalline and amorphous - differences - geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism.
Symmetry elements - plane, centre and axis; Miller indices, unit cells and space lattices; classification of crystal systems; Bravais lattices; X - ray diffraction - Bragg’s equation

Packing in atomic solids - simple cubic, body centered cubic, face centered and hexagonal close packing; Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO_2; comparison of structure and properties of diamond and graphite;. numerical problems involving core concepts
Defects in solids - stoichiometric and nonstoichiometric defects.

Liquid crystals - classification and applications</td></tr>
</table>

	UNIT-III **Nuclear Chemistry** Natural radioactivity - α, β and γ rays; half-life period; Fajan-Soddy group displacement law; Geiger-Nattal rule; isotopes, isobars, isotones, mirror nuclei, iso diaphers; nuclear isomerism; radioactive decay series; magic numbers; units - Curie, Rutherford, Roentgen; nuclear stability - neutron-proton ratio; binding energy; packing fraction; mass defect. Simple calculations involving mass defect and B.E., decay constant and $t_{1/2}$ and radioactive series. Isotopes - uses - tracers - determination of age of rocks by radiocarbon dating. (Problems to be worked out) Nuclear energy; nuclear fission and fusion - major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures.
	UNIT-IV **Halogen derivatives** **Aliphatic halogen derivatives** Nomenclature and classes of alkyl halides - physical properties, Chemical reactions. Nucleophilic substitution reactions - S_N^1 , S_N^2 and S_N^i mechanisms. **Di and Tri Halogen derivatives:** Nomenclature, classification,preparation, properties and applications. **Aromatic halogen compounds** Nomenclature, preparation, properties and uses Mechanism of nucleophilic aromatic substitution - benzyne intermediate. **Aryl alkyl halides** Nomenclature, benzyl chloride - preparation - preparation properties and uses **Alcohols:** Nomenclature, classification, preparation, properties, use; test for hydroxyl groups. Oxidation of diols by per iodic acid and lead tetraacetate
	UNIT-V **Phenols** Nomenclature; classification, Preparation from diazonium salts, cumene, Dow's process, Raching process; properties - acidic character and effect of substitution on acidity. Reactions - Fries, Claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimenn, Kolbe, Schmidt, Gatermann synthesis, Libermann reaction. Resorcinol and picric acid – preparation, properties and uses. **Aromatic alcohols** Nomenclature, benzyl alcohol - methods of preparation - hydrolysis, reduction of benzaldehyde, Cannizzaro reaction, Grignard synthesis, physical properties - Reactions with sodium, phosphorus pentachloride, thionyl chloride, acetic anhydride and hydrogen iodide.

Extended Professional Component (is apart of internal component only,Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. B.R. Puri, L.R. Sharma, M.S. Pathania; *Principles of Physical Chemistry*, 46th edition, Vishal Publishing, 2020. 2. B.R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009. 3. 4. P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, Sultan Chand & amp; Sons, twentieth edition, 2006. 4. M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003. 5. S.M. Mukherji, and S.P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.
Reference Books	1. T. W. Graham Solomons, *Organic Chemistry*, John Wiley & Sons,fifth edition, 1992. 2. A. Carey Francis, *Organic Chemistry*, Tata McGraw-Hill Education Pvt., Ltd.,New Delhi, seventh edition, 2009. 3. I. L. Finar, *Organic Chemistry*, Wesley Longman Ltd, England, sixth edition, 1996. 4. P. L. Soni, and H. M.Chawla - *Text Book of Organic Chemistry*, New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007. 5. J.D. Lee, *Concise Inorganic Chemistry*, Blackwell Science, fifth edition, 2005.
Website and e-learning source	**MOOC components** https://nptel.ac.in/courses/104104101 Solid state chemistry https://nptel.ac.in/courses/103106071 Nuclear industries and safety https://nptel.ac.in/courses/104106119s Introduction to organic chemistry

Course Learning Outcomes (for Mapping with POs and PSOs)On completion of the course the students should be able to

CO1: explain the kinetic properties of gases by using mathematical concepts.

CO2: describe the physical properties of liquid and solids; identify various types of crystals with respect to its packing and apply the XRD method for crystal structure eterminations.

CO3: investigate the radioactivity, nuclear energy and it's production, also the nuclear waste management.

CO4: write the nomenclature, physical & chemical properties and basic mechanisms of haloorganic compounds and alcohols.

CO5: investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including thiol.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">QUALITATIVE INORGANIC ANALYSIS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td>Credits</td><td>3</td><td>Course Code</td><td>23UCHCC06</td></tr>
<tr><td>Semester</td><td>III</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">3</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">To develop the skill on systematic analysis of simple inorganic salts and mixture of salts.</td></tr>
<tr><td>Course Outline</td><td colspan="7">Semi - Micro Qualitative Analysis
1. Analysis of simple acid radicals: Carbonate, Sulphide, Sulphate, Thiosulphite, Chloride, Bromide, Iodide, Nitrate
2. Analysis of interfering acid radicals: Fluoride, Oxalate, Borate, Phosphate, Arsenate, Arsenite.
3. Elimination of interfering acid radicals and Identifying the group of basic radicals
4. Analysis of basic radicals (group wise): Lead, Copper, Bismuth, Cadmium, Tin, Antimony, Iron, Aluminium, Arsenic, Zinc, Manganese, Nickel, Cobalt, Calcium, Strontium, Barium, Magnesium, Ammonium
5. Analysis of a mixture - I to VI containing two cations and two anions (of which one is interfering type)</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="7">Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</td></tr>
<tr><td>Recommended Text</td><td colspan="7">Reference Books:
V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997.</td></tr>
<tr><td>Website and e-learning source</td><td colspan="7">https://www.vlab.co.in/broad-area-chemical-sciences</td></tr>
</table>

Course Learning Outcomes (for Mapping with POs and PSOs)

On successful completion of the course the students should be able to

CO 1: acquire knowledge on the systematic analysis of Mixture of salts.

CO 2: identify the cations and anions in the unknown substance.

CO 3: identify the cations and anions in the soil and water and to test the quality of water.

CO4: assess the role of common ion effect and solubility product

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M

CO-PO Mapping (Course Articulation Matrix)

CO /PO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">ENTREPRENEURIAL SKILLS IN CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC-4</td></tr>
<tr><td>Category</td><td>Skill Enhancement Course</td><td>Year
Semester</td><td>II
III</td><td>Credits</td><td>1</td><td>Course Code</td><td>23UCHSE04</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="2">1</td><td colspan="2">1</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at providing training to
• develop entrepreneur skills in students
• to provide hands on experience to prepare and develop products
• develop start ups</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNIT-I (Internal Examination Only)
Food Chemistry
Food adulteration - contamination of food items with clay stones, water and toxic chemicals - Common adulterants.
Food additives, Natural and synthetic anti-oxidants, glazing agents (hazardous effect), food colourants, Preservatives, leavening agents, Baking powder and baking soda, yeast, MSG, vinegar.
Dyes
Classification - Natural, synthetic dyes and their characteristics - basic methods and principles of dyeing</td></tr>
<tr><td colspan="7">UNIT-II (Internal Examination Only)
Hands on Experience (Students can choose any four)
Detection of adulterants in food items like coffee, tea, pepper, chillipowder, turmeric powder, butter, ghee, milk, honey etc., by simple techniques.
Preparation of Jam, squash and Jelly, Gulkand, cottage cheese.
Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, tooth paste/powder and disinfectants in small scale.
Extraction of oils from spices and flowers.Testing of water samples using testing kit.
Dyeing - cotton fabrics with natural and synthetic dyes
Printing - tie and dye, batik.</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="7">Entrepreneurial skills</td></tr>
<tr><td>RecommendedText</td><td colspan="7">1. George S &Muralidharan V, (2007) Fibre to Finished Fabric – A Simple Approach, Publication Division, University of Madras, Chennai.
2. Appaswamy G P, A Handbook on Printing and Dyeing of Textiles.</td></tr>
<tr><td>Reference Books</td><td colspan="7">Shyam Jha, Rapid detection of food adulterants and contaminants (Theory and Practice),Elsevier, e Book ISBN 9087128004289, 1st Edition,2015</td></tr>
</table>

Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to
CO 1: identify adulterated food items by doing simple chemical tests.
CO 2: prepare cleaning products and become entrepreneurs
CO 3: educate others about adulteration and motivate them to become entrepreneurs.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M

CO-PO Mapping (Course Articulation Matrix)

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
Weightage	6	6	6	6	6
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">PESTICIDE CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC-5</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Skill Enhancement Course (Discipline specific)</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23UCHSE05</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="2">-</td><td colspan="3">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Fundamentals in chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to providing the students
knowledge about the various types of pesticides and their toxicity.
to understand the accumulation of pesticides in in the form of residues and its analysis.
knowledge on choice of alternate and eco-friendly pesticides.</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNIT-I
Introduction: History of pesticides. Chemistry of Pesticides: Brief introduction to classes of pesticides (Chemical class, targets), structures, chemical names, physical and chemical properties.
Toxicity of pesticides: Acute and chronic toxicity in mammals, birds, aquatic species etc. Methods of analysis of pesticides.
UNIT-II
Insecticides: Classification and study of following insecticides with respect to structure, chemical name, physical properties, chemical properties, synthesis, degradation, metabolism, formulations, Mode of action, uses, toxicity.
Organophosphates and Phosphothionates: Acephate, Chlorpyriphos, Monocrotophos, and parathion-methyl. Organochlorine - Endosulfan, heptachlor; Carbamate: Cartap hydrochloride, Methomyl, Propoxur.</td></tr>
<tr><td colspan="7">UNIT-III
Pesticides residues: Introduction- application of agrochemicals, dissemination pathways of pesticides, causes of pesticide residues, remedies. Pesticides residues in atmosphere - entry into atmosphere, action of pesticides, effects on environments. Pesticides residues in water - entry into water systems, action and effect in aquatic environment. Pesticides residues in soil. entry into soil, absorption, retention and transport in soil, effects on microorganism, soil condition and fertility, decomposition and degradation by climatic factors and microorganism.
UNIT-IV
Pesticide Residues effect and analysis: Effects of pesticides residue on human life, birds and animals - routes for exposure to pesticides, action of pesticides on living system. Analysis of pesticides residues- sample preparation, extraction of pesticides residues (soil, water and vegetables/fruits) simple methods and schemes of analysis, multi-residue analysis.</td></tr>
</table>

	UNIT-V **Biopesticides:** Pheromones, attractants, repellents - Introduction, typesand application (8- Dodecen-1-ol, 10-cis-12-hexadecadienoic, Trimedlure, Cue-lure, methyl eugenol, N,N- Diethyl-m-toluamide, Dimethyl phthalate, Icaridin). Baits- Metaldehyde, Iron (II) phosphate, Indoxacarb, Zinc Phosphide, Bromadiolone.
Extended Professional Component (is a part of internal component only, Not to be includedin the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Handa SK. Principles of pesticide chemistry. Agrobios (India); 2012. 2. Matolcsy G, Nádasy M, Andriska V. Pesticide chemistry. Elsevier; 1989. 3. J. Miyamoto and P. C. Kearney Pesticide Chemistry Human Welfare and the Environment vol. IV Pesticide Residue and Formulation Chemistry, Pergamon press,1985. R. Cremlyn: Pesticides, John Wiley.
Reference Books	1. Roy N. K., Chemistry of Pesticides. CBS Publisher & Distributors PLtd; 1st Ed. (2010). 2. Nollet L.M., Rathore H.S., Handbook of pesticides: methods of pesticide residues analysis. CRC press; 2016. 3. Ellerbrock R.H., Pesticide Residues: Significance, Management and Analysis, 2005

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">GENERAL CHEMISTRY-IV</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core VII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Coure Code</td><td rowspan="2">23UCHCC07</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>3</td><td>1</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry-III</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide a comprehensive knowledge on
thermodynamic concepts on chemical processes and applied aspects.
thermo chemical calculations
transition elements with reference to periodic properties and group study of transition metals.
the organic chemistry of ethers, aldehydes and ketones
the organic chemistry of carboxylic acids</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNIT-I

Thermodynamics I
Terminology - Intensive, extensive properties, state, path functions; isolated, closed and open systems; isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible processes; First law of thermodynamics - Concept and significance of heat (q), work (w), internal energy (E), enthalpy (H); calculations of q, w, E and H for reversible expansion of ideal gases under isothermal conditions; relation between heat capacities (Cp & Cv); Joule Thomson effect- inversion temperature.

Thermochemistry - heats of reactions, standard states; effect of temperature (Kirchhoff’s equations) and pressure on enthalpy of reactions; Hess’s law and its applications; Measurement of heat of reaction - Zeroth law of thermodynamics-Absolute Temperature scale.</td></tr>
<tr><td colspan="7">UNIT-II

Thermodynamics II
Second Law of thermodynamics - Limitations of first law, spontaneity and randomness; Carnot’s cycle; Concept of entropy, entropy change for reversible and irreversible processes, entropy of mixing. Calculation of entropy changes of an ideal gas with changes in temperature, volume and pressure.

Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application.</td></tr>
</table>

	Third law of thermodynamics - Nernst heat theorem; Applications of third law - evaluation of absolute entropies from heat capacity measurements, exceptions to third law.
	UNIT-III **General Characteristics of d-block elements** **Transition Elements**- Electronic configuration - General periodic trend variable valency, oxidation states, stability of oxidation states, colour, magnetic properties, catalytic properties and tendency to form complexes. Comparative study of transition elements and non transition elements – comparison of II and III transition series with I transition series. Group study of Titanium, Vanadium, Chromium, Manganese, Iron, Cobalt, Nickeland Zinc groups
	UNIT-IV **Ethers and Epoxides** Nomenclature, isomerism, general methods of preparations, reactions involving cleavage of C-O linkages, alkyl group and ethereal oxygen. Zeisel's method of estimation of methoxy group. Reactions of epoxides with alcohols, ammonia derivatives and $LiAH_4$ **Aldehydes and Ketones** Nomenclatue, structure and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. Nucleophilic addition reactions, base catalysed reactions with mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes. Reduction: Clemmensen reduction, Wolf - Kishner reduction, Meerwein - Pondorf Verley reduction, reduction with $LiAlH_4$ and $NaBH_4$. Addition reactions of unsaturated carbonyl compounds: Michael addition.

	UNIT-V **Carboxylic Acids**: Nomenclature, structure, preparation and reactions of aliphatic and aromatic monocarboxylic acids. Physical properties, acidic nature, effect of substituent on acidic strength. HVZ reaction, Claisen ester condensation, Bouveault Blanc reduction, decarboxylation, Huns diecker reaction.Formic acid-reducing property. **Carboxylic acid Derivatives:** Preparations of aliphatic and aromatic acid chlorides, esters, amides and anhydrides. Nucleophilic substitution reaction at the acyl carbon of acyl halide and anhydride. Schottan - Baumann reaction, Claisen condensation, Dieckmann and Reformatsky reactions and Curtius rearrangement. **Active methylene compounds:** Keto - enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate **Halogen substituted acids** - nomenclature; preparation by direct halogenation, iodination from unsaturated acids, alkyl malonic acids **Hydroxy acids** - nomenclature; preparation from halo, aldehydicand ketonic acids, ethylene glycol - Action of heat on α, β and γ hydroxy acids.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination Question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. B.R. Puri and L.R. Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co., thirty three edition, 1992. 2. K. L. Kapoor, *A Textbook of Physical chemistry*, (volume-2 and 3), Macmillan, India Ltd, third edition, 2009. 3. P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, Sultan Chand & Sons, twentieth edition, 2006. 4. M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003. 5. S.M. Mukherji, and S.P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.

Reference Books	1. Maron, S. H. and Prutton C. P. *Principles of Physical Chemistry*,4th ed.; The Macmillan Company: Newyork,1972. 2. Lee, J. D. *Concise Inorganic Chemistry*, 4th ed.; ELBS William Heinemann: London,1991. 3. Gurudeep Raj, *Advanced Inorganic Chemistry*, 26th ed.; Goel Publishing House: Meerut, 2001. 4. Atkins, P.W. & Paula, J. *Physical Chemistry*, 10th ed.; Oxford University Press:New York, 2014. 5. Huheey, J. E. *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th ed; Addison Wesley Publishing Company: India,1993.
Website and e-learning source	**MOOC components** https://nptel.ac.in/courses/112102255 Thermodynamics https://nptel.ac.in/courses/104101136 Advanced transition metal chemistry

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="8">PHYSICAL CHEMISTRY PRACTICAL – I</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core VIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UCHCC08</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">3</td><td colspan="3">3</td></tr>
<tr><td>Prerequisites</td><td colspan="8">General Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at providing an understanding of
• the laboratory experiments in order to understand the concepts of physical changes in chemistry
• the rates of chemical reactions
• colligative properties and adsorption isotherm</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="8">UNIT-I
Chemical kinetics
1. Determination of rate constant of acid catalysed hydrolysis of an ester (methyl acetate (or) ethyl acetate).
2. Determination of order of reaction between iodide and persulphate (initial rate method).
3. Polarimetry: Determination of rate constant of acid catalysed inversion of cane sugar
Thermochemistry
4. Determination of heat of neutralisation of a strong acid by a strong base.
5. Determination of heat of hydration of copper sulphate.</td></tr>
<tr><td colspan="8">UNIT-II
Electrochemistry
Conductometry
6. Determination of cell constant
7. Determination of equivalent conductance of strong electrolyte
8. Determination of dissociation constant of acetic acid
Potentiometry
9. Potentiometric titration of HCl against NaOH</td></tr>
<tr><td colspan="8">UNIT-III
Colligative property
10. Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent
11. Determination of molar depression constant K_f of the given solvent.</td></tr>
</table>

Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Reference Books	1. Sindhu, P.S.*Practicals in Physical Chemistry*, Macmillan India : New Delhi, 2005. 2. Khosla, B. D.Garg,V. C.; Gulati, A.; *Senior Practical Physical Chemistry*, R.Chand : New Delhi, 2011. 3. Gupta, Renu, *Practical Physical Chemistry*, 1st Ed.; New Age International: New Delhi, 2017.

Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: describe the principles and methodology for the practical work

CO2: explain the procedure, data and methodology for the practical work.

CO3: apply the principles of electrochemistry, kinetics for carrying out the practical work.

CO4: demonstrate laboratory skills for safe handling of the equipment and chemicals

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M

CO-PO Mapping (Course Articulation Matrix)

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="8">INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS</td></tr>
<tr><td>Paper No.</td><td colspan="8">SEC-6</td></tr>
<tr><td>Category</td><td>Skill Enhancement Course (Discipline specific)</td><td>Year
Semester</td><td>II
IV</td><td>Credits</td><td>2</td><td>Course Code</td><td colspan="2">23UCHSE06</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="3">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">General Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at providing an overall view of the
• operation and troubleshooting of chemical instruments
• fundamentals of analytical techniques and its application in the characterization of compounds
• theory of chromatographic separation and
• theory of thermo / electro analytical techniques
• stoichiometry and the related concentration terms</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="8">UNIT-I
Qualitative and Quantitative Aspects of Analysis
S.I Units, Distinction between Mass and Weight. Moles, Milli moles, Milli equivalence, Molality, Molarity, Normality, Percentage by Weight and Volume, ppm, ppb. Density and Specific Gravity of Liquids.

Evaluation of analytical data - Errors - Types of Errors, Accuracy, Precision, Minimization of Errors. Significant Figures. Methods of Expressing Precision: Mean, Median, Average Deviation, Standard Deviation.</td></tr>
<tr><td colspan="8">UNIT-II
Atomic Absorption Spectroscopy: Basic principles - instrumentation (source, monochromator, detector, choice of flame and Burner designs) - Techniques of atomization and sample introduction - Techniques for the quantitative estimation of trace level of lead ions from water samples.</td></tr>
<tr><td colspan="8">UNIT-III
UV-Visible and IR Spectroscopy
Origin of spectra, interaction of radiation with matter, Beer-Lambert’s law and its validity.

UV-Visible Spectrometry: Basic principles, instrumentation for single and double beam instrument.

Infrared Spectroscopy: Basic principles, instrumentation for double beam instrument; sampling techniques.</td></tr>
</table>

	UNIT-IV **Thermal and Electro-analytical Methods of Analysis** TGA and DTA- Principle, Instrumentation, factors affecting TGA/DTA, Thermal analysis of calcium oxalates. Electroanalytical methods: Polarography - principle, instrumentation and applications.
	UNIT-V **Separation and purification techniques** Principle of Solvent Extraction and liquid - liquid extraction. Chromatography: Column, TLC and Paper - principle, choice of adsorbents, solvents, preparation of column and elution - development of chromatograms and R_f value.
Extended Professional Component (is a part of internal component only, Not to be includedin the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed., The English Language Book Society of Longman. 2. R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007 3. Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint (2017). 4. R. Speyer, Thermal Analysis of Materials, CRC Press, 1993. 5. R.A. Day and A.L. Underwood, Quantitative Analysis, 6thedn., Prentice Hall of India Private Ltd., New Delhi, 1993
Reference Books	1. D. A. Skoog, D. M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5thedn., Saunders college publishing, Philadelphia, 1998. 2. Dash U N, Analytical Chemistry; Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 2011. 3. Christian, Gary D; Analytical Chemistry, 6th Ed., John Wiley & Sons, New York, 2004. 4. Mikes, O. &Chalmes, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elles Harwood Ltd. London 5. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, sixth edition Pearson Education, 2000

Website ande-learning sources

1. http://www.epa.gov/rpdweb00/docs/marlap/402-b-04-001b-14- final.pdf
2. http://eric.ed.gov/?id=EJ386287
3. http://www.sjsu.edu/faculty/watkins/diamag.htm
4. http://www.britannica.com/EBchecked/topic/108875/separation-and-purification
5. http://www.chemistry.co.nz/stoichiometry.htm

Course Learning Outcomes (for Mapping with POs and PSOs)
On completion of the course the students should be able to

CO1: apply error analysis in the calibration and use of analytical instruments, explain theory, instrumentation and application of flame photometry and Atomic Absorption spectrometry

CO2: explain theory, instrumentation and application of UV visible and Infrared spectroscopy.

CO3: able to discuss instrumentation, theory and applications of thermal and electrochemical techniques

CO4: explain the use of chromatographic techniques in the separation and identification of mixtures

CO5: explain preparation of solutions, stoichiometric calculations

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">FORENSIC SCIENCE</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC-7</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Skill Enhancement Course Discipline Specific)</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23UCHSE07</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="2">-</td><td colspan="3">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at giving an overall view of
• crime detection through analytical instruments
• forgery and its detection
• medical aspects involved</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT-I

Poisons
Poisons - types and classification - diagnosis of poisons in the living and the dead - clinical symptoms - Heavy metal contamination (Hg, Pb, Cd) of sea foods - use of neutron activation analysisin detecting arsenic in human hair.</td></tr>
<tr><td colspan="7">UNIT-II

Crime Detection
Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human bombs - possible explosives (gelatin sticks and RDX) - metal detector devices and other security measures for VVIP-composition of bullets and detecting powder burns.</td></tr>
<tr><td colspan="7">UNIT-III

Forgery and Counterfeiting
Documents - different types of forged signatures - writing deliberately modified - uses of ultraviolet rays - comparison of type written letters - checking silver line water mark in currency notes - alloy analysis using AAS to detect counterfeit coins - detection of gold purity in 22 carat ornaments - detecting gold plated jewels - authenticity of diamond.</td></tr>
</table>

	UNIT-IV **Tracks and Traces** Tracks and traces - small tracks and police dogs - foot prints - costing of foot prints -residue prints, walking pattern or tyre marks - miscellaneous traces and tracks - glass fracture - tool marks - paints - fibres - Analysis of biological substances - blood, semen, saliva, urine and hair - detecting steroid consumption in athletes and racehorses.
	UNIT-V **Medical Aspects** Metabolite analysis using mass spectrum - Gas chromatography - Arson - natural fires and arson - burning characteristics and chemistry of combustible materials - nature of combustion. Ballistics - classification - internal and terminal ballistics - laboratory examination of barrel washing and detection of powder residue by chemical tests.
Recommended Text	1. SA Iqbal, M Liviu, Textbook of forensic chemistry, Discovery publishing house private limited, 2011. 2. Kelly M. Elkins, Introduction to Forensic Chemistry, CRC Press, Taylor & Francis Group, 2019. 3. Javed I. Khan, Thomas J. Kennedy, Donnell R. Christian, Jr., Basic principles of Forensic chemistry, Humana Press, first edition, 2012. 4. Bapuly AK, (2006) Forensic Science – Its application in crime investigation, Paras Medical Publisher, Hyderabad. 5. Sharma B.R., (2006) Scientific Criminal Investigation, Universal Law Publishing Co. Pvt. Ltd, New Delhi.
Reference Books	1. Richard Saferst in and Criminalistics-An Introduction to Forensic Science (College Version), Sopfestein, Printice hall, eighth edition,2003 2. Suzanne Bell, Forensic Chemistry, Pearson, second international edition, 2014. 3. Jay Siegel, Forensic chemistry: Fundamentals and applications, Wiley-Blackwell, first edition, 2015. 4. Max M. Houck & Jay A. Segal, (2006) Fundamentals of Forensic Science, Elsevier Academic press. 5. Henry C. Lee, Timothy Palmbach, Marilyn T. Miller, (2006) Henry Lee's Crime Scene Book Elsevier Academic press.
Website and e-learning source	1. http://www.library.ucsb.edu/ist/03-spring/internet.html 2. http://www.wonder howto.com/topic/forensic-science/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: learn about the Poisons - types and classification of poisons in the living and the dead organisms and also get information about Postmortem.

CO 2: get awareness on Human bombs, possible explosives (gelatin sticks and RDX) and metal defector devices and other security measures for VVIP - composition of bullets and detecting powder burns

CO 3: detect the forgery documents, different types of forged signatures

CO4: have an idea about how to tracks and trace using police dogs, foot prints identification and gain the knowledge in analyzing biological substances - blood, semen, saliva, urine and hair - DNA Finger printing for tissue identification in dismembered bodies

CO 5: get the awareness on Aids - causes and prevention and also have an exposure on handling fire explodes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="8">ORGANIC CHEMISTRY - I</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core IX</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UCHCC09</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">General Chemistry I, II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims to provide an understanding of
stereoisomerism in chirals and geometric isomerism in olefins, conformations of ethane and butane
preparation and properties of aromatic and aliphatic nitro compounds and amines
preparation of different dyes, food colour and additives
preparation and properties of five membered heterocycles like pyrrole, furan and thiophene
preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline.</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT-I
Stereochemistry

Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions;
Geometrical isomerism:cis–trans, syn-anti isomerism, E/Z notations.

Optical Isomerism: Optical activity, specific rotation, asymmetry, enantiomers, distereoisomers, meso structures - molecules with one and two chiral centres, racemisation- methods of racemisation; resolution-methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereogenic) centres.

Molecules with no asymmetric carbon atoms - allenes and biphenyls.
Conformational analysis of ethane and butane.</td></tr>
</table>

	UNIT-II **Chemistry of Nitrogen Compounds-I** **Nitroalkanes** Nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes; physical properties; reactions - reduction, halogenations, Grignard reagent, Pseudo acid character. Nitro - aci nitro tautomerism. **Aromatic nitro compounds** Nomenclature, preparation - nitration, from diazonium salts, physical properties; reactions - reduction of nitrobenzene in different medium, Electrophilic substitution reactions, TNT. **Amines: Aliphatic amines** Nomenclature, isomerism, preparation - Hofmanns' degradationreaction, Gabriel's phthalimide synthesis, Curtius Schmidt rearrangement. Physical properties, reactions - alkylation, acylation, carbylamine reaction, Mannich reaction, oxidation, basicity of amines.
	UNIT-III **Chemistry of Nitrogen Compounds – II** **Aromatic amines** - Nomenclature, preparation - from nitro compounds, Hofmann's method; Schmidt reaction, properties - basic nature, ortho effect; reactions - alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid - zwitter ion formation. Distinction between primary, secondary and tertiary amines - aliphatic and aromatic Diazonium compounds Diazomethane, Benzene diazonium chloride - preparations and synthetic applications. **Dyes** Theory of colour and constitution; classification based on structure and application; preparation - Martius yellow, aniline yellow, methyl orange, alizarin, indigo, malachite green.

	UNIT-IV **Heterocyclic compounds** Nomenclature and classification. General characteristics - aromatic character and reactivity. Five - membered heterocyclic compounds Pyrrole - preparation - from succinimide, Paal Knorr synthesis; reactions - reduction, basic character, acidic character, electrophilic substitution reactions, ring opening. Furan - preparation from mucic acid and pentosan; reactions - hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction. Thiophene synthesis - from acetylene; reactions - reduction; oxidation; electrophilic substitution reactions.
	UNIT-V **Six-membered heterocyclic compounds** Pyridine - synthesis - from acetylene, Physical properties; reactions - basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution- uses Condensed ring systems Quinoline - preparation - Skraup synthesis and Friedlander's synthesis; reactions - basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions - Chichibabin reaction Isoquinoline - preparation by the Bischler - Napieralski reaction, reduction, oxidation; electrophilic substitution.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1.M.K. Jain, S.C.Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2009. 2.S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 2009. 3. ArunBahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand& CompanyPvt. Ltd., Multicolour edition, 2012. 4. P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007. 5.C.N.Pillai, Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009.

Reference Books	1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia, sixth edition, 2012. 2. T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons, eleventh edition, 2012.
	3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, seventh edition,2009. 4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, sixth edition, 2006. 5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, Fifth Edition, 2010.
Website and e-learning sources	1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http:/swayam.gov.in 4. Virtual Textbook of Organic Chemistry

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: assign RS notations to chirals and EZ notations to olefins and explain conformations of ethane and butane.

CO2: explain preparation and properties of aromatic and aliphatic nitro compounds and amines

CO3: explain colour and constitution of dyes and food additives

CO4: discuss preparation and properties of five membered heterocycles like pyrrole, furan and thiophene

CO5: discuss preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="8">INORGANIC CHEMISTRY - I</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core X</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UCHCC10</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="3">-</td><td colspan="3">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">General Chemistry I , II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims to provide knowledge on
nomenclature, isomerism and theory of coordination compounds, and chelate complexes
crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect
preparation and properties of metal carbonyls
Lanthanoids and actinoids
preparation and properties of inorganic polymers</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="8">UNIT-I
Co-ordination Chemistry - I
IUPAC Nomenclature of coordination compounds, Isomerism in coordination compounds.
Werner’s coordination theory - effective atomic number -interpretation of geometry and magnetic properties by Pauling’s theory - geometry of co-ordination compounds with co-ordination number 4 &6.
Chelates - types of ligands forming chelates - stability of chelates, applications of chelates in qualitative and quantitative analysis - application of DMG and oxine in gravimetric analysis - estimation of hardness of water using EDTA, metal ion indicators.
Role of metal chelates in living systems - haemoglobin and chlorophyll</td></tr>
<tr><td colspan="8">UNIT-II
Co-ordination Chemistry - II
Crystal field theory - Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy (CFSE), spectrochemical series - calculation of CFSE in octahedral and tetrahedral complexes - factors influencing the magnitude of crystal field splitting, crystal field effect on ionic radii, lattice energies, heats of ligation with water as a ligand (heat of hydration), interpretation of magnetic properties, spectra of $[Ti(H_2O)_6]^{3+}$ - Jahn - Teller effect. Stability of complexes in aqueous solution, stability constants- factors affecting the stability of a complex ion, thermodynamic and kinetic stability (elementary idea). Comparison of VBT and CFT.</td></tr>
</table>

	UNIT-III **Organometallic compounds** **Metal Carbonyls** Mono and polynuclear carbonyls, General methods of preparation of carbonyls - general properties of binary carbonyls - bonding in carbonyls - structure and bonding in carbonyls of Ni, Fe, Cr, Co, Mn, Ru and Os. EAN rule as applied to metal carbonyls. Ferrocene-Methods of preparation, physical and chemical properties **UNIT-IV** **Inner transition elements (Lanthanoids and Actinoids)** General characteristics of f-block elements - Comparative account of lanthanoids and actinoids - Occurrence, Oxidation states, Magnetic properties, Colour and spectra - Lanthanoids and Actinoids, Separation by ion-Exchange and Solvent extraction methods - Lanthanoids contraction- Chemistry of thorium and Uranium-Occurrence, Ores, Extraction, properties and uses - Preparation, Properties and uses of ceric ammonium sulphate, thorium dioxide and uranyl acetate.
	UNIT-V **Inorganic polymers** General properties - classification of inorganic polymers based on element in the backbone (Si, S, B and P) - preparation and properties of silicones (polydimethylsiloxane and polymethylhydrosiloxane) phosphorous based polymer (polyphosphazines and polyphophonitrilic chloride), sulphur based polymer (polysulfide and polymeric sulphur nitride), boron based polymers (borazine polymers) - industrial applications of inorganic polymers. Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Extended Professional Component (is a part of internal component only, Not to be includedin the external examination question paper)	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Skills acquired from this course	1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31thEdition, Milestone Publishers & Distributors, Delhi. 2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009),

RecommendedText	Advanced Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi 3. Lee J D, (1991), Concise Inorganic Chemistry, 4th Edition, ELBS William Heinemann, London. 4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, S. Chand and Company Ltd. 5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992.

Reference Books	1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed ., S.Chand and Company, New Delhi. 2. Gopalan R, (2009) Inorganic Chemistry for Undergraduates, Ist Edition, University Press (India) Private Limited,Hyderabad 3. Sivasankar B, (2013) Inorganic Chemistry.Ist Edition, Pearson, Chennai 4. Alan G. Sharp (1992), Inorganic Chemistry, 3rd Edition, Addition-Wesley, England 5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.
Website and e-learning source	1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http:/swayam.gov.in

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain isomerism, Werner's Theory and stability of chelate complexes

CO2: discuss crystal field theory, magnetic properties and spectral properties of complexes.

CO3: explain preparation and properties of metal carbonyls

CO4: give a comparative account of the characteristics of lanthanoids and actinoids

CO5:explain properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorous

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="8">PHYSICAL CHEMISTRY - I</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core XI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UCHCC11</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">General Chemistry I, II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at providing an overall view of
Gibbs free energy, Helmholtz free energy, Ellingham’s diagram and partial molar properties
chemical kinetics and different types of chemical reactions
adsorption, homogeneous and heterogeneous catalysis
colloids and macromolecules
photochemistry, fluorescence and phosphorescence</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="8">UNIT-I
Thermodynamics - III
Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation - derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases.

Partial molar properties - chemical potential, Gibbs-Duhem equation, variation of chemical potential with temperature and pressure, Duhem-Margules equation.</td></tr>
<tr><td colspan="8">UNIT-II
Chemical Kinetics
Rate of reaction - Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction - rate equation - order of reaction. order and molecularity of simple reactions, Rate laws - Rate constants - derivation of rate constants for zero, first order, second and third order (equal initial concentration) - Derivation of time for half change with examples. Methods of determination of order of Volumetry, manometry and polarimetry.
Effect of temperature on reaction rate - temperature coefficient - concept of activation energy - Arrhenius equation. Theories of reaction rates - Collision theory - derivation of rate constant of bimolecular gaseous reaction - Failure of collision theory. Lindemann’s theory of unimolecular reaction. Theory of absolute reaction rates - Derivation of rate constant for a bimolecular reaction - significance of entropy and free energy of activation. Comparison of collision theory and ARRT.
Complex reactions - reversible and parallel reactions (no derivation and only examples)</td></tr>
</table>

	UNIT-III Adsorption - Chemical and physical adsorption and their general characteristics- distinction between them Different types of isotherms - Freundlich and Langmuir. Adsorption isotherms and their limitations - BET theory (derivation not required), kinetics of enzyme catalysed reaction - Michaelis- Menten and Briggs- Haldene equation - Lineweaver-Burk plot - inhibition - reversible - competitive, noncompetitive and uncompetitive (no derivation of rate equations) Catalysis - general characteristics of catalytic reactions, auto catalysis, promoters, negative catalysis, poisoning of a catalyst - theories of homogenous and heterogeneous catalysis - Kinetics of Acid - base and enzyme catalysis.
	UNIT-IV **Colloids and Surface Chemistr**y **Colloids:** Types of Colloids, Characteristics Colloids (Lyophilic and Lyophobic sols), Preparation of Sols - Dispersion methods, aggregation methods, Properties of Sols - Optical properties, Electrical properties - Electrical double layer, Electro Kinetic properties- Electro-osmosis, Electrophoresis, Coagulation or precipitation, Stability of sols, Emulsions, Gels - preparation of Gels, Applications of colloids. Macromolecules: Molecular weight of Macromolecules - Number average molecular weight and weight average molecular weight.
	UNIT-V **Photochemistry** Laws of photo chemistry - Lambert - Beer, Grotthus - Draper and Stark - Einstein. Quantum efficiency. Photochemical reactions - rate law - Kinetics of H_2-Cl_2, H_2-Br_2 and decomposition of HI reactions, comparison between thermal and photochemical reactions. Fluorescence - applications including fluorimetry - sensitised fluorescence, phosphorescence - applications - chemiluminescence and photosensitisation - examples Chemistry of Vision - 11 cis retinal - colour perception of vision.
Extended Professional Component (is a part of internal componentonly, Not to be includedin the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., forty eighth edition, 2021. 2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018. 3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co. 4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996. 5. J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNagin Chand and CO., 1986.

Reference Books	1. J. Rajaram and J.C. Kuriacose, Chemical Thermodynamics, Pearson, 1st edition, 2013. 2. Keith J. Laidler, Chemical kinetics, third edition, Pearson, 2003. 3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002. 4. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition, 2009. 5. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001
Website and e-learning source	1. https://nptel.ac.in 2. https://swayam.gov.in 3. www.epgpathshala.nic.in

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain Gibbs and Helmholtz free energy functions, partial molar quantities and Ellinghams

CO2: apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction, demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation.

CO3: compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogenous and heterogeneous catalysis.

CO4: demonstrate the types and characteristics of colloids, preparation of sols and emulsions, and determine the molecular weights of macromolecules.

CO5: utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="8">BIOCHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="8">EC-5</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UCHEC05</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Organic Chemistry - I</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at providing knowledge on
relationship between biochemistry and medicine, composition of blood
structure and properties of amino acids, peptides, enzyme, vitamins and proteins
biological functions of proteins, enzymes, vitamins and hormones
biochemistry of nucleic acids and lipids
metabolism of lipids</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="8">UNIT-I
Logic of Living Organisms
Relationship of Biochemistry and Medicine
Blood - Composition of Blood, Blood Coagulation - Mechanism
Hemophilia and Sickle Cell Anaemia - Definition,
Maintenance of pH of Blood - Bicarbonate Buffer, Acidosis, Alkalosis.</td></tr>
<tr><td colspan="8">UNIT-II
Peptides and Proteins
Amino acids - nomenclature, classification - essential and Non-essential; Synthesis - Gabriel Phthalimide, Strecker; properties - Zwitter ion and isoelectric point, electrophoresis and reactions.

Peptides - peptide bond - nomenclature - synthesis of simple peptides - solution and solid phase. Determination of structure of peptides, N - terminal analysis - Sanger’s & Edmann method; C terminal analysis - Enzymic method.
Proteins - classification based on composition, functions and structure; properties and reactions - colloidal nature, coagulation, denaturation, renaturation; colour tests for proteins; definition of structure of proteins - primary, secondary, tertiary and quaternary.</td></tr>
</table>

	UNIT-III **Enzymes and Vitamins** Nomenclature and classification, characteristics, factors influencing enzyme activity - mechanism of enzyme action - Lock and key hypothesis, Koshland's induced fit model. Vitamins as coenzymes - functions of TPP, lipoic acid, NAD, NADP, FMN, FAD, folic acid, biotin, cyanocobalamin.
	UNIT-IV **Amino acids** Components of nucleic acids - nitrogenous bases - structure of nucleosides and nucleotides, DNA - structure & functions; RNA - structure - functions; biosynthesis of proteins **Hormones** Adrenalin and thyroxine - chemistry, structure and functions (No structure elucidation).
	UNIT-V **Lipids** Occurrence, biological significance of fats, classification of lipids. **Simple lipids** - Oils and fats, chemical composition, properties, reactions - hydrolysis, hydrogenation, trans - esterification, saponification, rancidity; analysis of oils and fats - saponification number, iodine number, acid value, R.M. value. Distinction between animal and vegetable fats. **Compound lipids** - Lipoproteins - VLDL, LDL, HDL, chylomicrons - biological significance. Cholesterol - occurrence, structure, test.
Extended Professional Component (is a part of internal component only, Not to be includedin the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Bahl, B. S.; Bhal, A. *Advanced Organic Chemistry*, 3rd ed.; S. Chand: New Delhi, 2003. 2. Jain, M.K.; Sharma, S.C. *Modern Organic Chemistry*, Vishal Publications: New Delhi, 2017. 3. Shanmugam, A. *Fundamentals of Biochemistry for Medical Students*, 6th ed.; Published by the author, 1999. 4. Veerakumari, L. *Biochemistry*, 1st ed.; MJP Publications: Chennai,2004. 5. Jain, J. L.; *Fundamentals of Biochemistry*, 2nd ed.; S.Chand: New Delhi, 1983.

Reference Books	1. Conn, E. E.; Stumpf, P. K. *Outline of Biochemistry*, 5th ed.; Wiley Eastern: New Delhi, 2002. 2. West, E. S.; Todd, W. R.; Mason, H. S.; Van Bruggen, J. T. *Text Book of Biochemistry*, 4th ed.; Macmillan: New York, 1970. 3. Lehninger, A. L. *Principles of Biochemistry*, 2nd ed.; CBS Publisher: Delhi, 1993. 4. Rastogi, S. C. *Biochemistry*, 2nd ed.; Tata McGraw-Hill: New Delhi, 2003 5. Chatterjea, M. N.; Shinde, R. *Textbook of Medical Biochemistry*, 5th ed.; Jaypee Brothers: New Delhi, 2002.
Website and e-learning source	1) http://library.med.utah.edu/NetBiochem/nucacids.html 2)http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/EnzymeKinetics.html 3) https://swayam.gov.in/courses/4384-biochemistry Biochemistry 4) https://onlinecourses.nptel.ac.in/noc19_cy07/preview Experimental Biochemistry

Course Learning Outcomes (for Mapping with POs and PSOs)
On completion of the course the students should be able to
CO1: explain molecular logic of living organisms, composition of blood and blood coagulation
CO2: explain synthesis and properties of amino acids, determination of structure of peptides and proteins
CO3: explain factors influencing enzyme activity and vitamins as coenzymes
CO4: explain RNA and DNA structure and functions
CO5: explain biological significance of simple and compound lipids

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO and CO

<table>
<tr><td>Title of theCourse</td><td colspan="7">INDUSTRIAL CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">EC-6</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>23UCHEC06</td></tr>
<tr><td>Semester</td><td>V</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry I, II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course is designed to provide knowledge on
classifications and characteristics of fuels
preparation of cosmetics
manufacture of sugar, paper, cement and leather and food processing
applications of abrasives, lubricants and other industrial products
intellectual property rights</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT-I
Survey of Indian Industries and mineral resources in India

Fuels: Classification, characteristics of fuels. Solid fuels: coal - classification; analysis of coal- proximate analysis and ultimate analysis; calorific value-determination.
Liquid fuels: Petroleum - characteristics; Gasoline aviation petrol-knocking in internal combustion engines, antiknock agents; unleaded petrol-octane number, cetane number.
Gaseous fuel: advantages over solid and liquid fuels; water gas, producer gas, carburetted water gas - preparations - uses.

Natural gas: LPG-composition, advantages, application; gobar gas-production, composition, advantages, application. Propellants – rocket fuels (basic idea)</td></tr>
<tr><td></td><td colspan="7">UNIT-II
Cosmetics

Skin care: powders, ingredients; creams and lotion-cleansing, moisturising, all purpose shaving cream, sunscreen.

Dental care: tooth pastes - ingredients.

Hair care: shampoos-types, ingredients; conditioners-types, ingredients.
Perfumes: natural-plant origin-parts of the plant used, chief constituents; animal origin- ambergries and musk; synthetic-classification - esters-amylsalicylate alcohols - terpeneols and nerol; ketones-muskone, coumarin; aldehydes-vanilin.
Soaps and Detergents
Soaps-properties, manufacture of soap-batch process; types-transparent soap, toilet soap and liquid soap - ingredients.
Detergents-definition, properties-cleansing action; soapless detergents-anionic, cationic and non-ionic (general idea only); uses of detergents as surfactants. Biodegradability of soaps and detergents.</td></tr>
</table>

	UNIT-II **Sugar Industry** Manufacture from sugar cane; recovery of sugar from molasses; testing and estimation of sugar. **Food Preservation and processing** Food spoilage - causes; Food preservation - methods - high temperature, low temperature, drying, radiation; Food additives - preservatives, flavours, colours, anti-oxidants, sweetening agents; hazards of using food additives; Food standards - Agmark and Codex alimentarius.
	UNIT-IV **Abrasives** Definition, characteristics, types-natural and synthetic; natural abrasives - diamond, emery and quartz – composition, uses; synthetic abrasives - carborundum, aluminium carbide, boron carbide, boronnitride, synthetic graphite - composition and uses. **Leather Industry** Structure and composition of skin, hide; Manufacture of leather – pre-tanning process - curing, liming, beating, pickling; methods of tanning-vegetable, chrome - one bath, two bath process; finishing. **Paper Industry** Manufacture of pulp - mechanical, chemical processes; sulphate pulp, rag pulp; manufacture of paper - beating, refining, filling, sizing, colouring, calendaring; cardboard.
	UNIT-V **Lubricants** Definition, classification - liquid, semi-solid, solid and synthetic; properties-viscosity index, flash point, cloud point, pour point, aniline point drop point; greases-properties, types; cutting fluids. **Cement Industry** Cement – types, raw materials; manufacture-wet process, constituent of cement, setting of cement; properties of cement-quality, setting time, soundness, strength; mortar, concrete, RCC; curing and decay of concrete. **Intellectual Property Rights** Introduction to Intellectual Property Rights - Patents - Factors for patentability - Novelty, Non obviousness, Industrial applications - Patent offices in India: Trademark - Types of trademarks- Certification marks, logos, brand names, signatures, symbols and service marks.
Extended Professional Component (is a part of internal component only, Not to be includedin the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Sharma, B.K. *Industrial Chemistry*, 9th ed.; Goel Publishing House: Meerut, 1998. 2. Wilkinson, J.B.E. Moore, R.J. *Harry's Cosmeticology*, 7th ed.; Chemical Publishers : New York, 1982. 3. Alex V. Ramani, *Food Chemistry*, MJP publishers: Chennai, 2009. 4. Jayashree Ghosh, *Applied Chemsitry*, S. Chand : New Delhi, 2006. 5. Srilakshmi, B. *Food Science*, 4th ed.; New Age International Publication, 2005.

Reference Books	1. Jain, P.C.; Jain, M. *Engineering Chemistry*, 16th ed.; Dhanapet Rai: Delhi, 1992 2. George Howard, *Principles and Practice of Perfumes and Cosmetics*, Stanley Therones, Cheltenham: UK, 1987. 3. Thankamma Jacob, *Foods, Drugs and Cosmetics - A Consumer Guide*, Macmillan : London, 1997. 4. ShankuntalaManay, N.; Shadaksharaswamy, M. *Food Facts and Principles*, 3rd ed.; New Age Publication, 2008. 5. Neeraj Pandey, KhushdeepDharni, *Intellectual Property Rights*, PHI Learning, 2014.
Website and e-learning source	1. http://www.sciencecases.org/irradiation/irradiation_notes.asp 2. http://discovery.kcpc.usyd.edu.au//9.5.5/ 3. https://www.wipo.int/about-ip/en/ 4. www.nptel.ac.in 5. http:/swayam.gov.in

Course Learning Outcomes (for Mapping with POs and PSOs)
On completion of the course the students should be able to

CO1: summarize the properties of fuels which include petroleum, water gas, natural gas and propellents

CO2: evaluate cosmetic products, soaps, detergents.

CO3: explain manufacture of sugar, food spoilages and food additives

CO4: explain properties of abrasives, manufacture of leather and paper

CO5: explain properties and manufacture of lubricants and cement, and intellectual property rights

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="8">PHYSICAL CHEMISTRY PRACTICAL – II</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core XIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UCHCC12</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">3</td><td colspan="3">3</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Theoretical knowledge on Physical Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims at providing
basic principles of physical chemistry experiments
hands on experience in carrying out the experiments</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="8">UNIT-I
Phase diagrams
1. Simple eutectic - determination of eutectic temperature and composition of naphthalene - diphenyl amine or naphthalene - diphenyl system
2. Determination of transition temperature of a salt hydrate.
3. Determination of upper critical solution temperature of phenol - water system
4. Effect of an electrolyte on miscibility temperature of phenol - water system
5. Determination of concentration of sodium chloride using phenol-sodium chloride system</td></tr>
<tr><td colspan="8">UNIT-II
Distribution law
6. Determination of the distribution coefficient of iodine between carbon tetrachloride (or) benzene and water.
7. Determination of equilibrium constant of the reaction
$I_2 + I^- \rightleftharpoons I_3^-$
8. Determination of concentration of the given potassium iodide solution using the above equilibrium constant.</td></tr>
<tr><td colspan="8">UNIT-III
Electro chemistry
9. Conductometric titration of hydrochloric acid against sodium hydroxide
10. Conductometric titration of mixture of acids against sodium hydroxide
11. Potentiometric titration of ferrous ion against potassium dichromate</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved
(To be discussed during the Tutorial hours)</td></tr>
</table>

Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Reference Books	1. Sindhu, P.S. *Practicals in Physical Chemistry*, Macmillan India : New Delhi, 2005. 2. Khosla, B. D. Garg,V. C.; Gulati, A. *Senior Practical Physical Chemistry*, R. Chand : New Delhi, 2011. 3. Gupta, Renu, *Practical Physical Chemistry*, 1st Ed.; New Age International : New Delhi, 2017.
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences

Course Learning Outcomes (for Mapping with POs and PSOs)
On completion of the course the students should be able to
CO1: Describe the principles and methodology for the practical work.
CO2: Explain the procedure, data and methodology for the practical work
CO3: Apply the principles of phase rule and electrochemistry for carrying out the practical work
CO4: Demonstrate laboratory skills for safe handling of the equipment and chemicals

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution toPSOs	3.0	3.0	3.0	3.0	3.0

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">ORGANIC CHEMISTRY - II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core XIV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>23UCHCC14</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Organic Chemistry-I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on
classification, isolation and discussing the properties of alkaloids and terpenes
preparation and properties of saccharides
biomolecules
different molecular rearrangement
preparation and properties of organometallic compounds</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNIT-I
Alkaloids
Classification, isolation, general properties - Hofmann Exhaustive Methylation; Structure elucidation - Coniine, piperine, nicotine.

Terpenes: Classification, Isoprene rule, isolation and structural elucidation of Citral, alpha terpineol, Menthol, Geraniol and Camphor.</td></tr>
<tr><td colspan="7">UNIT-II
Carbohydrates
Definition and Classification of Carbohydrates with examples. Relative configuration of sugars. Determination of configuration (Fischer’s Proof). Definition of enantiomers, diastereomers, epimers and anomers with suitable examples.

Monosaccharides - configuration - D and L hexoses - aldohexoses and ketohexoses.
Glucose, Fructose - Occurrence, preparation, properties, reactions, structural elucidation, uses.
Interconversions of sugar series - ascending, descending, aldose to ketose and ketose to aldose.

Disaccharides - sucrose, lactose, maltose - preparation, properties and uses (no structural elucidation).

Polysaccharides - Source, constituents and biological importance of homo polysaccharides - starch and cellulose, hetero polysaccharides - hyaluronic acid, heparin.</td></tr>
</table>

	UNIT-III **Molecular rearrangements:** Molecular Rearrangement: Type of rearrangements, Mechanism for Benzidine, Favorskii, Clasien, Fries, Hofmann, Curtius, Schmidt and Beckmann, Pinacol-pinacolone rearrangement
	UNIT-IV **Special reagents in organic synthesis** AIBN, 9BBN, BINAP/BINOL, BOC, DABCO, DCC, DIBAL, DMAP, NBS/NCS, NMP, PCC, TBHP, TEMPO **Organometallic compounds in Organic Synthesis** Preparation, Properties and applications: Grignard Reagents, Organo Lithium Compounds, Ziegler -Natta, Wilkinson, Metal Carbonyl, Zeiss's Salt
	UNIT-V **Green Chemistry:** Principles, chemistry behind each principle and applications in chemical synthesis. Green reaction media - green solvents, green reagents and catalysts; tools used like microwave and ultra-sound in chemical synthesis.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. M.K.Jain, S. C.Sharma, Modern Organic Chemistry, Vishal Publishing, 4th reprint,2009. 2. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan IndiaLtd., 3rd edition,2009 3. Arun Bahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand& Company Pvt. Ltd., Multicolour edition,2012. 4. P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, 29th edition, 2007. 5. C Bandyopadhya; An Insight into Green Chemistry; Published on 2020

Reference Books	1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia,6th edition, 2012. 2. T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons,11th edition, 2012. 3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi,7th edition,2009. 4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, 6th edition, 2006. 5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, 5th Edition, 2010.
Website and e-learning source	1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3.http:/swayam.gov.in 4. Virtual Textbook of Organic Chemistry 5. https://vlab.amrita.edu/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain isolation and properties of alkaloids and terpenes
CO2: explain preparation and reactions of mono and disachharides
CO3: classify biomolecules and natural products based on their structure, properties, reactions and uses.
CO4: explain molecular rearrangements like benzidine, Hoffmann etc.,
CO5: preparation and properties of organolithium compounds

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">INORGANIC CHEMISTRY – II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core XV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UCHCC15</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="2">-</td><td colspan="3">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Inorganic Chemistry-I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims to provide knowledge on
• tracer elements and their role in the biological system.
• iron transport and storage
• metallo enzymes, oxygen transport.
• silicates and their applications
• industrial applications of refractories, alloys, paints and pigments</td></tr>
<tr><td rowspan="4">Course Outline</td><td colspan="7">UNIT-I
Bioinorganic Chemistry
Essential and trace elements: Role of Na^{+}, K^{+}, Mg^{2+}, $Ca^{2+,}$ $Fe^{3+,}$ Cu^{2+} and Zn^{2+} in biological systems. Effect of excess intake (Toxicity) of Metal ions – trace elements - As, Cd, Pb, Hg.</td></tr>
<tr><td colspan="7">UNIT-II
Metal ion transport and storage
Iron - storage, transport - Transferrin and Ferretin; Iron-porphyrins - myoglobin, haemoglobin - oxygen transport - Bohr effect; Sodium/potassium pump, calcium pump; transport and storage - copper and zinc.</td></tr>
<tr><td colspan="7">UNIT-III
Metallo enzymes
Isomerase and synthetases, structure of cyanocobalamin (Vitamin B12), nature of Co-C bond; Metalloenzymes - functions of carboxy peptidase A, zinc metalloenzyme - mechanism and uses, Zn-Cu enzyme - structure and function, carbonic anhydrase, Vitamin B-12 as transferase and isomerase - Iron-sulphur proteins - 2Fe-2S - rubredoxin, 4Fe-2S - ferridoxin, Iron sulphur cluster enzymes.
Invivo and Invitro nitrogen fixation - biological functions of nitrogenase and molybdo enzymes.</td></tr>
<tr><td colspan="7">UNIT-IV
Silicates
Introduction - general properties of silicates, structure – types of silicates - ortho silicates(zircon), pyrosilicates (thortveitite), chain silicates(pyroxenes), ring silicates(beryl), sheet silicates(talc, mica, asbestos), silicates having three dimensional structure (feldspars, zeolites, ultramarines)</td></tr>
</table>

	UNIT-V **Industrial Applications of Inorganic Compounds** Refractories, pyrochemical, explosives. Alloys, Paints and pigments - requirements of a good paint; classification, constituents of paints - pigments, vehicles, thinners, driers, extenders, anti-knocking agents, anti-skinning agents, plasticizers, binders-application; varnishes- oils, spirit; enamels. Nanocomposite Hydrogels: synthesis, characterization and uses. Industrial visits and internship mandatory.
Extended Professional Component (is a part of internal component only, Not to be includedin the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31th ed., Milestone Publishers & Distributors, Delhi.
	2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advancd Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi 3. Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., ELBS William Heinemann, London. 4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, Schand and Company Ltd. 5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992
Reference Books	1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nded., S.Chand and Company, New Delhi. 2. Gopalan R, (2009) Inorganic Chemistry for Undergraduates, Ist Edition, University Press (India) Private Limited, Hyderabad 3. Sivasankar B, (2013) Inorganic Chemistry. Ist Edition, Pearson, Chennai 4. Alan G. Sharp (1992), Inorganic Chemistry, 3rd Edition, Addition-Wesley, England 5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.

Website and e-learning source	1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http:/swayam.gov.in

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: ability to explain the importance of tracer elements on biological system.

CO2: explain the metal ion transport, Bohr effect, Na, K, Ca pump.

CO3: explain the function of Vitamin B_{12}, Zn-Cu enzyme, ferredoxin, cluster enzymes.

CO4: classification and structure of silicates.

CO5: explain the manufacture of refractories, explosives, paints and pigments

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">PHYSICAL CHEMISTRY- II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core - XVI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>23UCHCC16</td></tr>
<tr><td>Semester</td><td>VI</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Physical Chemistry-I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at providing an overall view of the
phase diagram of one and two component systems
chemical equilibrium,
separation techniques for binary liquid mixtures.
electrical conductance and transport number.
galvanic cells, EMF and significance of electrochemical series.</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT-I
Phase rule
Definition of terms; derivation of phase rule ; application to one component systems - water and sulphur - super cooling, sublimation ; two component systems - solid liquid equilibria- simple eutectic (lead - silver), freezing mixtures (potassium iodide- water), compound formation with - congruent melting points (magnesium - zinc and ferric chloride - water system), peritectic change (sodium - potassium), copper sulphate - water system.</td></tr>
<tr><td colspan="7">UNIT-II
Chemical equilibrium
Law of mass action - thermodynamic derivation - relationship between K_p and K_c - application to the homogeneous equilibria - dissociation of PCl_5 gas – equilibrium constant and degree of dissociation - formation of HI and NH_3 - heterogeneous equilibrium - decomposition of solid calcium carbonate - Lechatelier principle - van’t Hoff reaction isotherm - temperature dependence of equilibrium constant - van’t Hoff reaction isochore - Clayperon equation - Clausius Clayperon equation and its applications.</td></tr>
<tr><td colspan="7">UNIT-III
Binary liquid mixtures
Ideal liquid mixtures - non ideal solutions - azeotropic mixtures - fractional distillation - partially miscible mixtures - phenol-water, triethylamine-water, nicotine-water - effect of impurities on critical solution temperature; immiscible liquids - steam distillation; Nernst distribution law - applications.</td></tr>
</table>

	UNIT-IV **Electrical Conductance and Transference** Arrhenius theory of electrolytic dissociation - Ostwald's dilution law, limitations of Arrhenius theory; behavior of strong electrolytes - Debye Huckel theory - Onsager equation (noderivation), significance of Onsager equation, Debye Falkenhageneffect, Wien effect. Transport number - determination - Hittorf's method, moving boundary method - factors affecting transport number. Kohlrausch's law- applications; molar ionic conductance and viscosity (Walden's rule); applications of conductance measurements - determination of - degreeof dissociation of weak electrolyte, dissociation constant of weak acidand weak base, ionic product of water, solubility and solubility productof sparingly soluble salts - conductometric titrations - acid base titrations.
	UNIT-V **Galvanic Cells and Applications** Galvanic cell, representation, reversible and irreversible cells, EMF and its measurement - standard cell; sign of EMF and spontaneity of a reaction, thermodynamics and EMF - calculation of ΔG, ΔH and ΔS from EMF data. Electrode potential, standard electrode potential, primary and secondary reference electrodes, Nernst equation for electrode potential and cell EMF; types of electrodes - metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode, redox electrode; electrochemical series - applications of electrochemical series. **Applications of EMF measurements** applications of EMF measurements - determination of activity coefficient of electrolytes, transport number, valency of ions, solubility product, pH using hydrogen gas electrode and glass electrode, potentiometric titrations - acid base titrations, redox titrations, precipitation titrations, ionic product of water and degree of hydrolysis. **Industrial component** Galvanic cells- lead storage and Nickel-Cadmium batteries Fuel cells - H_2-O_2 cell - efficiency of fuel cells.
Extended Professional Component (is a part of internal component only, Not to be includedin the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

Recommended Text	1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, ShobanLalNagin Chand and Co., forty eighth edition, 2021. 2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018. 3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co. 4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996. 5. J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNagin Chand and CO., 1986.
Reference Books	1. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition,2009. 2. Gilbert. W. Castellen, Physical Chemistry, Narosa Publishing House, third edition, 1985. 3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002. 4. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001 5. D.N.Bajpai, Advanced Physical Chemistry, S.Chand&Co., 2001
Website and e-learning source	https://nptel.ac.in https://swayam.gov.in https://archive.nptel.ac.in/content/storage2/courses/112108150/pdf/PPTs/MTS_07_m.pdf Thermodynamics - NPTEL https://www.youtube.com/watch?v=f0udxGcoztE Introduction to chemical equilibrium – MIT open course ware

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: construct the phase diagram for one component and two component systems, explain the properties of freezing mixture, component with congruent melting points and solid solutions.

CO2: apply the concepts of chemical equilibrium in dissociation of PCl_5, N_2O_4 and formation of HI, NH_3, SO_3 and decomposition of calcium carbonate. Demonstrate important principles such as Le chatelier principle, van't Hoff reaction isotherm and Clausius-Clayperon equation.

CO3: Identify an appropriate distillation method for the separation of binary liquid mixtures such as azeotropic mixtures, partially miscible mixtures and immiscible liquids.

CO4: Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equation and Kohlrausch's law in conductance.

CO5: Construct electrochemical cell with the help of electrochemical series and calculate cell EMF. Demonstrate the applications of EMF and significance of potentiometric titrations.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="8">GRAVIMETRIC ESTIMATION PRACTICAL</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core XVII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UCHCC17</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>1</td><td>-</td><td colspan="3">4</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Theoretical knowledge on Analytical Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims at providing
basic principles of an analytical chemistry experiments
hands on experience in carrying out the experiments</td></tr>
<tr><td>Course Outline</td><td colspan="8">1. Estimation of Barium as Barium sulphate
2. Estimation of Barium as Barium chromate
3. Estimation of Lead as Lead chromate
4. Estimation of Calcium as Calcium oxalate monohydrate
5. Estimation of Sulphate as Barium sulphate
6. Estimation of Chloride as Silver chloride
7. Estimation of Nickel as Nickel dimethyl glyoxime</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="8">Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved
(To be discussed during the Tutorial hours)</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="8">Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</td></tr>
<tr><td>Reference Book</td><td colspan="8">Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. Basic Principles of Practical Chemistry,2nd ed.; Sultan Chand &Sons: New Delhi, 1997.</td></tr>
<tr><td>Website and e-learning source</td><td colspan="8">https://www.vlab.co.in/broad-area-chemical-sciences</td></tr>
</table>

Course Learning Outcomes (for Mapping with POs and PSOs)
On completion of the course the students should be able to
CO1: Describe the principles and methodology for the practical work.
CO2: Explain the procedure, data and methodology for the practical work
CO3: Apply the principles for carrying out the practicalwork
CO4: Demonstrate laboratory skills for safe handling of the equipment and chemicals

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">FUNDAMENTALS OF SPECTROSCOPY</td></tr>
<tr><td>Paper No.</td><td colspan="7">EC-7</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective Course</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UCHEC07</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="2">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry I, II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course is designed to provide knowledge on
electrical and magnetic properties of organic and inorganic compounds
basic principles of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry
instrumentation of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry
applications of various spectral techniques in structural elucidation
solving combined spectral problems</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNIT-I
Electrical and Magnetic properties of molecules
Dipole moment - polar and nonpolar molecules - polarisability of molecules.Magnetic permeability, volume susceptibility, mass susceptibility and molar susceptibility; diamagnetism, paramagnetism - determination of magnetic susceptibility using Guoy balance, ferromagnetism, anti ferromagnetism
Microwave spectroscopy
Rotation spectra - diatomic molecules (rigid rotator approximation) selection rules - determination of bond length, effect of isotopic substitution - instrumentation and applications.</td></tr>
<tr><td colspan="7">UNIT-II
Ultraviolet and Visible spectroscopy
Electronic spectra of diatomic molecules (Born Oppenheimer approximation) - vibrational coarse structure - rotational fine structure of electronic vibration transitions - Frank Condon principle - dissociation in electronic transitions - Pre-dissociation energy - Types of electronic transistions: σ -σ *, π-π*, n-σ* and n-π* transitions - chromophore, auxochrome, bathochromic shift and hypsochromic shifts, applications</td></tr>
</table>

	UNIT-III **Infrared spectroscopy** Vibrational spectra - principles - modes of vibrations - diatomic, triatomic linear (CO_2) and non- linear triatomic (H_2O) molecules - selection rules - stretching and bending vibrations - applications - determination of force constant, moment of inertia and inter nuclear distance - application of IR spectra to simple organic and inorganic molecules - (group frequencies). **Raman Spectroscopy** Rayleigh scattering and Raman scattering of light - Raman shift - Stokes and Antistokes lines - selection rules - mutual exclusion principle - instrumentation (block diagram) - applications - differences between IR and Raman spectroscopy.
	UNIT-IV **Nuclear magnetic resonance spectroscopy:** PMR - theory of PMR - instrumentation - number of signals - chemical shift - peak areas and proton counting - spin-spin coupling - coupling constant - shielding and deshielding of protons, chemical shifts of protons in hydrocarbons and in simple monofunctional organic compounds; spin-spin splitting of neighbouring protons in vinyl and allyl systems.
	UNIT-V **Mass spectrometry** Principle - different kinds of ionisation - instrumentation - the mass spectrum - types of ions - molecular ion peak, base peak, meta stable peak, isotopic peak - fragmentation and their types - McLafferty rearrangement; Retro Diels Alder reaction - illustrations with simple organic molecules. Solving structure elucidation problems using multiple spectroscopic data (NMR, MS, IR and UV-Vis).
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)

Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Gopalan, R.; Subramaniam, P. S.; Rengarajan, K. *Elements of Analytical Chemistry*; S Chand: New Delhi, 2003. 2. Usharani, S. *Analytical Chemistry*, 1st ed.; Macmillan: India, 2002. 3. Banwell, C.N.; Mc Cash, E. M. *Fundamentals of Molecular Spectroscopy*, 4th ed.; Tata McGraw Hill, New Delhi, 2017. 4. U.N.Dash, Analytical Chemistry Theory and Practice, Sultan Chand &Sons,2nd Ed., 2005 5. B.K.Sharma, Spectroscopy,22nd ed., Goel Publishing House, 2011.
Reference Books	1. Srivastava, A. K.; Jain, P. C. *Chemical Analysis an Instrumental Approach*, 3rd ed.; S.Chand, New Delhi, 1997. 2. Robert D Braun. *Introduction to Instrumental Analysis*; Mc.Graw Hill: New York, 1987. 3. Skoog, D. A.; Crouch, S. R.; Holler, F.J.; West, D. M. *Fundamentals of Analytical Chemistry*, 9th ed.; Harcourt college Publishers: USA, 2013. 4. Madan, R. L.; Tuli, G. D. *Physical Chemistry*, 2nd ed.; S.Chand: New Delhi, 2005. 5. Puri, B. R.; Sharma, L. R.; Pathania, M.S. *Principles of Physical Chemistry*, 43rd ed.; Vishal Publishing: Delhi, 2008.
Website and e-learning source	1. http://vallance.chem.ox.ac.uk/pdfs/SymmetryLectureNotes2004.pdf 2. http://chemistry.rutgers.edu/undergrad/chem207/SymmetryGroupTheory.html 3. www.epgpathshala.nic.in 4. www.nptel.ac.in 5.. http:/swayam.gov.in

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain electrical and magnetic properties of materials and microwave spectroscopy

CO2: explain theory, instrumentation and applications of Infrared and Raman spectroscopy

CO3: apply selection rules to understand spectral transitions, explain Woodward – Fieser's rule for the calculation of wavelength maximum of conjugated dienes

CO4: explain theory, instrumentation and applications of NMR spectroscopy

CO5: explain theory, instrumentation and applications of Mass spectrometry

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping (Course Articulation Matrix)

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">NANO SCIENCE</td></tr>
<tr><td>Paper No.</td><td colspan="7">EC-8</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UCHEC08A</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td></td><td colspan="2">-</td><td colspan="3">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basics knowledge in Physics and Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on
introduction to nanoparticles/clusters and nanocomposites
properties of nanomaterials
characterization of nanomaterials by different methods
synthesis of carbon nanotubes, graphene, quantum dots, self-assembled nanomaterials
applications of nanomaterials as sensors</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT-I
Introduction to nanoscience
Definition of terms - nanoscience, nanoparticles, clusters, quantum dots, nanostructures and nanocomposites. Electron behaviour in free space, bulk material and nanomaterials.
Synthesis and stabilization of nanomaterials Top down approach (physical methods), mechanical dispersion - ball milling, methods based on evaporation of a precursor-inert gas condensation. Bottom–up approach (chemical methods) - solvothermal synthesis, sol-gel method. Nanomaterials via chemical routes- solvents reducing agents, capping agents - stabilization of nanoparticles - electrostatic and steric stabilization, common stabilizers.</td></tr>
<tr><td colspan="7">UNIT-II
Properties of materials on a nanoscale
Optical properties of metal and semiconductor nanomaterials- surface Plasmon resonance (SPR), surface enhanced Raman spectra (SERS), quantum confinement effect, tuning of optical spectrum. Magnetic properties - Fe_3O_4 particle, supra magnetic properties, electronic properties, Chemical properties- chemical process on the surface of nanoparticles, catalysis, mechanical properties.</td></tr>
<tr><td colspan="7">UNIT-III
Techniques employed for characterisation of nanomaterials
Spectrocopy - UV-visible, Photoelectron spectroscopy - Electron microscopy - Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning probe microscopy (SPM) - Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Optical microscopy - confocal microscopy, X-ray diffraction (XRD) [Principle and Block diagram only].</td></tr>
</table>

	UNIT-IV **Special nanomaterials** Carbon Nano Structures Carbon nanotubes: Introduction - types - zigzag, armchair, helical, synthesis by CVD, Functionalization of Carbon Nanotubes, Reactivity of Carbon Nanotubes. Other Important Carbon based materials: Preparation, properties and applications of Fullerene and Graphene. Semiconductor nanoparticles: Quantum dots, synthesis - chemical synthesis using clusters, properties, porous silicon - electrochemical etching, aerogel - types - silica aerogel, resorcinol formaldehyde (RF) aerogels - applications. Self Assembled Nanomaterials: Self Assembled Monolayers (SAMS) - inorganic, organic molecules.
	UNIT-V **Application of nanomaterials** Biomedical Applications- drug, drug delivery, biolabelling, artificial implants, cancer treatment. Sensors - Natural nanoscale sensors, chemical sensors, biosensors, electronic noses. Optics & Electronics - Nanomaterials in the next generation computer technology, high definition TV, flat panel displays, quantum dot laser, single electron transistors [SET]. Nanotechnology in agriculture - Fertilizer and pesticides nanomaterials for water purification, nanomaterials in food and packaging materials, fabric industry. Impacts of Nanotechnology - human & environmental safety risks.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Sulabha K. Kulkarni, *Nanotechnology: Principles and Practices*, Capital Publishing Co., New Delhi. 2. Pradeep. T, *Nano: The Essentials, Understanding Nanoscience and Nanotechnology*; Tata McGraw-Hill Publishing Company Limited, NewDelhi, 2007. 3. Shah. M.A.; Tokeer Ahmad, *Principles of Nanoscince and Nanotechnology*; Narosa Publishing House, New Delhi, 2010. 4. Murthy. B.S; Shankar. P, Baldev Raj.; Rath. B.B. JamesMurday, *Textbook of Nanoscience and Nanotechnology*;Universities press, India Ltd ,Hyderabad. 2012.

Reference Books	1. Sharma. P.K., *Understanding Nanotechnology*; Vista International Publishing House, Delhi. 2008. 2. Charles P. Poole Jr.; Frank J. Owens. *Introduction to Nanotechnology;* A John Wiley & Sons, INC., Publication, 2003. 3. Viswanathan B., *Nano Materials;*Narosa Publishing House, New Delhi, 2009. 4. Edited by C.N.R. Rao; Mu¨ller.A; Cheetham. A.K.*Nanomaterials Chemistry Recent Developments and New Directions*, WILEY-VCH Verlag GMBH & Co.,KGaA, Darmstad. 5. Jing Zhong Zhang, *Optical properties and spectroscopy of Nanomaterials*; World Scientific Publishing Pvt. Ltd., Singapore.
Website and e-learning source	1) http://www.nanotechnology.com/docs/wtd015798.pdf 2) http://nccr.iitm.ac.in/Nanomaterials.pdf

Course Learning Outcomes (for Mapping with POs and PSOs)
On completion of the course the students should be able to
CO1: explain the general concepts and physical phenomena of relevance within the field of nanoscience.
CO2: describe the properties, synthesis, characteristics of nanomaterials, special nanomaterials and applications.
CO3: examine the structure, properties, applicability and characterization of nanomaterials.
CO4:analyze various synthesis procedures, characterizations and uses of carbon nanotubes, fullerene and graphene
CO5: discuss applications of nanomaterials of sensors and in optics and electronics

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

CO-PO Mapping (Course Articulation Matrix)

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO and CO

<table>
<tr><td>Title of the Course</td><td colspan="8">POLYMER SCIENCE</td></tr>
<tr><td>Paper No.</td><td colspan="8">EC-8</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UCHEC08B</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="3">-</td><td colspan="3">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Knowledge on functional groups and reaction mechanisms</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at providing an overall view of
classification of polymers, preparation of polymers
kinetics of polymerization and characterization of polymers
analytical techniques used to characterize polymers
reactions of polymers
speciality polymers like PVC, PMMA</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="8">UNIT-I
Introduction
Difference between polymer and macromolecule - classification - synthetic and natural, organic and inorganic, thermoplastic and thermosetting. Plastics, elastomers, fibres and liquid resins.
Techniques of polymerization
Bulk, solution, emulsion and suspension polymerization</td></tr>
<tr><td colspan="8">UNIT-II
Kinetics of polymerization
Kinetics of condensation and addition polymerisation; ionic, free radical, copolymerisation and coordination polymerisation - reactivity ratios - block and graft copolymers.
Characterisation of polymers
Appearance, feel and hardness, density, effect of heat, solubility, combustion, tensile strength, shear, stress, impact strength, mechanical, thermomechanical and rheological properties of polymers in viscoelastic state.</td></tr>
<tr><td colspan="8">UNIT-III
Molecular Weight and Properties of Polymers
Molecular Weight of Polymers-Number Average and Weight Average, Molecular Weight Distribution, Determination of Molecular Weight polydispersity index - membrane and vapour phase osmometry, light scattering - Zimm plot, ultracentrifuge - sedimentation velocity and sedimentation equilibrium - viscometry - gel permeation chromatography Thermal properties of polymers - Glass Transition Temperature-State of Aggregation and State of Phase Transitions, Factors Influencing Glass Transition Temperature and its importance.</td></tr>
</table>

	UNIT-IV Reactions of Polymers-Hydrolysis, Acidolysis, Aminolysis, Addition and Substitution Reactions (One Example Each) Cyclisation, Cross-Linking and Reactions of Specific Functional Groups in the Polymer. **Polymer technology** Processing of polymers - casting, thermoforming, moulding - extrusion, compression, blow moulding - foaming, lamination, reinforcing - processing of fibres - melt, wet and dry spinning.
	UNIT-V **Speciality polymers** Polyelectrolytes, conducting polymers, polymeric supports for solid phase synthesis, biomedical polymers, liquid crystalline polymers, electroluminescent polymers - two examples of each of these polymers. Polyethylene, PVC, PMMA, polyester; rubber - synthetic and natural, vulcanisation of rubber. **Polymer Degradation** Types of Degradation - Thermal, Mechanical, Ultra Sound, Photo Radiation and Chemical Degradation Methods. Rubber-Natural and Synthetic-Structure, Mechanism of Vulcanisation Biodegradable and Non-Biodegradable Polymers.
Extended Professional Component (is a part of internal component only, Not to be includedin the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Gowariker V.R, N.V. Viswanthan and Jayadev Sreedhar. Polymer Science. 2. New Delhi: New Age International, 2015 3. Misra G.S. Introductory Polymer Chemistry. New Delhi: Wiley Eastern, 2010. 4. Bahadur P and Sastry N V. Principles of Polymer Science. New Delhi: Narosa Publishing House, 2005 5. Ahluwalia, V.K. Anuradha Mishra, *Polymer Science A Text Book*, Ane Books India: New Delhi, 2008. 6. Morrison, R. R.; Boyd, R. N.; Bhattacharjee, S. K. *Organic Chemistry*, 7th ed.; Pearson: New Delhi, 2011.

Reference Books	1. Billmeyer, F.W. Polymer Science. India: Wiley-Interscience, 2007. 2. Seymour, R. B.; CarraherJr.C.E. *Polymer Chemistry: An Introduction*, Marcel Dckker Inc : New York, 1981. 3. Sinha, R. *Outlines of Polymer Technology*, Prentice Hall of India: New Delhi, 2000. 4. Joel R. Fried, *Polymer Science and Technology*, 3rd ed.; Prentice Hall of India: New Delhi, 2014.
Website and e-learning source	1. https://polymerdatabase.com 2. http://amrita.vlab.co.in/?sub=2&brch=190&sim=603&cnt=1 3. http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/polymers htm 4. http://nsdl.niscair.res.in/bitstream/123456789/406/2/Molecular+weigh ts+of+polymers.pdf
Course Learning Outcomes (for Mapping with POs and PSOs) **On completion of the course the students should be able to** **CO1:** explain classification of polymers, elastomers, fibres and liquid resins **CO2:** explain addition and condensation polymerization, mechanical properties of polymers **CO3:** determine the molecular weight of polymers, and explain the thermal properties of polymers **CO4:**explain reactions of polymers and polymer processing **CO5:**discuss speciality polymers like PVC, PMMA, rubbers, biodegradable polymers	

CO /PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

CO /PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">PHARMACEUTICAL CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">EC-8</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UCHEC08C</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Knowledge on active chemical compounds and Biochemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at providing an overall view of
drugs design and drug metabolism
important Indian medicinal plants, common diseases and antibiotics
drugs for major diseases like cancer, diabetes and AIDS
analgesics and antipyretic agents
significance of clinical tests</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNIT-I
Introduction
Important terminologies - drug, pharmacognosy, pharmacy, pharmacology, pharmacodynamics, pharmacokinetics, clinical pharmacology, pharmacotherapeutics, chemotherapy, toxicology, pharmacophore, antimetabolites, mutation, bacteria, virus, fungi, actinomycetes, vaccines, pharmacopeia, posology and therapeutic index.
Sources of drugs - dosage forms - bio availability - routes of administration - absorption, distribution and elimination of drugs - drug metabolism - prescription terms.
Structure and pharmacological activity
Effect of - unsaturation, chain length, isomerism; groups - halogens amino, nitro, nitrite, cyano, acidic, aldehydic, keto, hydroxyl and alkyl groups.</td></tr>
<tr><td colspan="7">UNIT-II
Indian medicinal plants
Some important Indian medicinal plants - tulsi, neem, kizhanelli, mango, semparuthi, adadodai, turmeric and thoothuvalai - uses.

Common diseases and their treatment
Causes, prevention and treatment of the following diseases:
Insect borne diseases - malaria, filariasis, plague; Water borne diseases - cholera, typhoid, dysentery. Digestive system - jaundice; Respiratory system – asthma; Nervous system - epilepsy.

Antibiotics
Definition - classification - structure and therapeutic uses of chloramphenicol, penicillins , structure activity relationship of chloramphenicol ; therapeutic uses of ampicillin, streptomycin, Erythromycin.</td></tr>
</table>

	UNIT-III **Drugs for major diseases** Cancer - common causes - chemotherapy - anti neoplastic agents - classification - adverse effects of cytotoxic agents ; alkylating agents - chlorambucil ; anti metabolites - methotrexate, fluouracil ; Vinca alkaloids - vincristine, vinblastine. Diabetes - types - management of diabetes - insulin; oral hypoglycemic agents - sulphonyl ureas - chlorpropamide; biguanides - metformin - thiazolidinediones. Cardiovascular drugs - cardio glycosides; anti-hypertensive drugs - Aldomet, pentolinium tartarate; AIDS - causes, symptoms and prevention - anti HIV drugs - AZT, DDC.
	UNIT-IV **Analgesics and antipyretic agents** Classification - action of analgesics - narcotic analgesics - morphine; synthetic analgesics - pethidine, methadone; antipyretic analgesics - salicylic acid derivatives, indolyl derivatives. **Anaesthetics** Definition, characteristics, classification - general anaesthetics - volatile anaesthetics - nitrous oxide, ethers, cyclopropane, chloroform, halothane, trichloro ethylene - storage, advantages and disadvantage ; non volatileanaesthetics - thiopental sodium ; local anaesthetics - requisites - advantages- esters - cocaine, benzocaine; amides. **Blood and haemotological agents** Blood - composition, grouping - physiological functions of plasma proteins - mechanism of clotting; Coagulants - vitamin K, protamine sulphate, dry thrombin; Anti coagulants - coumarins, citric acid and heparin; antifibrinolytic agents, Anaemia - causes, types and control - anti anaemic drugs.
	UNIT-V **Clinical Chemistry** Blood tests - blood count - complete haemotogram - Hb, RBC, GTT, TC, DC, platelets, PCV, ESR; bleeding and clotting time - glucose tolerance test. **Significance of Clinical Tests** Serum electrolytes - blood Glucose - orthotoluidine method**;** Renal functions tests - blood urea, creatinine; liver function tests - serum proteins, albumin globulin ratio, serum bilirubin, enzymes SGOT, SGPT; lipid profile - cholesterol, triglycerides, HDL, LDL, coronaryrisk index. Urine examination - pH, tests for glucose, albumin and bile pigment.

Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Jayashree Ghosh, (1999), A text book of pharmaceutical chemistry, 2nd ed., S.Chand& company, New Delhi. 2. Lakshmi S, (2004), Pharmaceutical chemistry, 3rd ed., Sultan chand& sons, Delhi. 3. Tripathi K D, (2018), Essentials of medical pharmacology, 8th ed., Jaypee brothers medical publishers (P) Limited, New Delhi. 4. Ashutosh Kar, (2018), Medicinal chemistry, 7th ed., New age international (P) Limited, Publishers, New Delhi.
Reference Books	**Reference Books:** 1. Chatwal G R, (2013), Pharmaceutical chemistry, inorganic (vol-I) 6thed ., Himalaya publishing house, Bombay. 2. Chatwal G R, (1991), Pharmaceutical chemistry, organic (vol-II)., Himalaya publishing house, Bombay. 3. Patrick G, (2002), Instant Notes Medicinal Chemistry, Viva Books Private Limited, New Delhi. 4. Intellectual Property Rights, NeerajPandey, Khushdeep Dharni. Publisher: PHI Learning Pvt. Ltd., 2014 ISBN: 812034989X, 9788120349896.
Website and e-learning source	1. http://www.pharmacy.umaryland.edu/faculty/amackere/courses/phar531_delete/lectures/qsar_1.pdf 2. http://www.indianmedicinalplants.info/ 3. https://www.wipo.int/about-ip/en/

Course Learning Outcomes (for Mapping with POs and PSOs)
On completion of the course the students should be able to

CO1: Define the pharmaceutical terminologies; describe the principles in pharmacological activity, drug development, clinical chemistry, hematology, therapeutic drugs and treatment of diseases; list the types of IPR and trademarks.

CO2: Discuss the development of drugs, structural activity, disease types, physio-chemical properties of therapeutic agents, significance of medicinal plants,clinical tests and factors for patentability.

CO3: Apply the principles involved in structural activity and drug designing, functions ofhaematological agents; estimation of clinical parameters and therapeutic application of drugs for major diseases.

CO4: explain classification of analgesics and anasthetics, and physiological functions of plasma protiens

CO5: explain the significance of clinical tests like blood urea, serum proteins and coronary risk index

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO and CO

GENERIC ELECTIVE (ALLIED)

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY FOR PHYSICAL SCIENCES - I
(FOR MATHEMATICS, PHYSICS & GEOLOGY STUDENTS)</td></tr>
<tr><td>Paper No.</td><td colspan="7">GE-1A</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UCHGE01A</td></tr>
<tr><td>Semester</td><td>I/III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="3"></td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on the
basics of atomic orbitals, chemical bonds, hybridization
concepts of thermodynamics and its applications.
concepts of nuclear chemistry
importance of chemical industries
Qualitative and analytical methods.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT-I
Chemical Bonding and Nuclear Chemistry
Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences - Stellar energy. Applications of radioisotopes - carbon dating, rock dating and medicinal applications.</td></tr>
<tr><td></td><td colspan="7">UNIT-II
Industrial Chemistry
Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones.
Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.</td></tr>
</table>

	UNIT-III **Fundamental Concepts in Organic Chemistry** Hybridization: Orbital overlap, hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Electronic effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric- examples. Reaction mechanisms: Types of reactions–aromaticity (Huckel's rule) - aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.
	UNIT-IV **Thermodynamics and Phase Equilibria** Thermodynamics: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Carnot's cycle and efficiency of heat engine. Entropy and its significance. Free energy change and its importance (no derivation). Conditions for spontaneity in terms of entropy and Gibbs free energy. Relationship between Gibbs free energy and entropy. Phase Equilibria**:** Phase rule - definition of terms in it. Applications of phase rule to water system. Two component system - Reduced phase rule and its application to a simple eutectic system (Pb-Ag).
	UNIT-V **Analytical Chemistry** Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques - extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

Recommended Text	1. V.Veeraiyan, Text book of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006. 3. S.ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, NewDelhi, twenty third edition, 2012. 4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninthedition, 2007.
Reference Books	5. P.L.Soni,MohanKatyal,TextbookofInorganicchemistry;SultanChandandCompany,New Delhi, twentieth edition, 2007. 6. B.R.Puri,L.R.Sharma,M.S.Pathania,TextbookPhysicalChemistry;VishalPublishingCo., New Delhi, fortyfortyseventh edition, 2018. 7. B.K,Sharma,IndustrialChemistry;GOELpublishinghouse,Meerut,sixteenthedition, 2014.
Course Learning Outcomes (for Mapping with POs and PSOs) **On completion of the course the students should be able to**	

CO 1: gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications.
CO 2: evaluate the efficiencies and uses of various fuels and fertilizers
CO 3: explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.
CO 4: apply various thermodynamic principles, systems and phase rule.
CO 5: explain various methods to identify an appropriate method for the separation of chemical components

CO /PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

CO /PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY FOR PHYSICAL SCIENCES - II
(FOR MATHEMATICS, PHYSICS & GEOLOGY STUDENTS)</td></tr>
<tr><td>Paper No.</td><td colspan="7">GE-2A</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23UCHGE02A</td></tr>
<tr><td>Semester</td><td>II/IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="2">-</td><td colspan="3">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Chemistry for Physical Sciences-I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on the
• Co-ordination Chemistry and Water Technology
• Carbohydrates and Amino acids
• basics and applications of electrochemistry
• basics and applications of kinetics and catalysis
• Various photochemical phenomenon</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNIT-I
Co-ordination Chemistry and Water Technology
Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature - Werner'stheory - EAN rule - Pauling's theory – Postulates - Applications to [Ni(CO)4], $[Ni(CN)4]^{2-}$,$[Co(CN)6]^{3-}$ Chelation - Biological role of Haemoglobin and Chlorophyll (elementary idea) - Applications in qualitative and quantitative analysis.
Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques-
BOD, COD.</td></tr>
<tr><td colspan="7">UNIT-II
Carbohydrates and Amino acids
Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose - fructose interconversion. Properties of starch and cellulose.
Amino acids: Classification - preparation and properties of
alanine, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).</td></tr>
</table>

	UNIT-III **Electrochemistry** Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome plating – Types of cells -fuel cells-corrosion and its prevention.
	UNIT-IV **Kinetics and Catalysis** Order and molecularity. Integrated rate expression for I and II (2A □ Products) order reactions. Pseudo first order reaction, methods of determining order of a reaction - Half-life period - Catalysis - homogeneous and heterogeneous, catalyst used in Contact and Haber's processes. Concept of energy of activation and Arrhenius equation.
	UNIT-V **Photochemistry** Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and Photosensitization and photosynthesis (definition with examples).
Extended Professional Component (is a part of internal component only, Not to be includedin the external examination question paper)	Questions related to the above topics, from various competitiveexaminations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006. 3. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012. 4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
Reference Books	1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. 2. R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018. 3. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

Course Learning Outcomes (for Mapping with POs and PSOs)On completion of the course the students should be able to

CO 1: write the IUPAC name for complex, different theories to explain the bonding incoordination compounds and water technology

CO 2: explain the preparation and property of carbohydrate, amino acids and nucleic acids.

CO 3: apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuelcells.

CO 4: identify the reaction rate, order for chemical reaction and explain the purpose of acatalyst.

CO 5: outline the various type of photochemical process.

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO and CO

<table>
<tr><td>Title of the Course</td><td colspan="8">CHEMISTRY FOR BIOLOGICAL SCIENCES -I
(FOR BOTANY, BIOCHEMISTRY AND ZOOLOGY STUDENTS)</td></tr>
<tr><td>Paper No.</td><td colspan="8">GE-1B</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23UCHGE01B</td></tr>
<tr><td>Semester</td><td>I/III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="4">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="2">-</td><td colspan="4">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims at providing knowledge on
• basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry
• nuclear chemistry and industrial chemistry
• importance of speciality drugs and
• separation and purification techniques.</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="8">UNIT-I
Chemical Bonding and Nuclear Chemistry
Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M. O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.
Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences - Stellar energy. Applications of radioisotopes - carbon dating, rock dating and medicinal applications.</td></tr>
<tr><td colspan="8">UNIT-II
Industrial Chemistry
Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required).
Silicones: Synthesis, properties and uses of silicones.
Fertilizers: Urea, ammonium sulphate, potassium nitrate NPK fertilizer, superphosphate, triple superphosphate.</td></tr>
<tr><td colspan="8">UNIT-III
Fundamental Concepts in Organic Chemistry
Hybridization: Orbital overlap hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Polar effects: Inductive effect and consequences on Ka and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation.
Reaction mechanisms: Types of reactions- aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation.
Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.</td></tr>
</table>

	UNIT-IV **Drugs and Speciality Chemicals** Definition,structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon.
	UNIT-V **Analytical Chemistry** Introduction qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006. 3. ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition,2012. 4. P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
Reference Books	1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. 2. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014. 3. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.

Course Learning Outcomes (for Mapping with POs and PSOs)
On completion of the course the students should be able to

CO1: state the theories of chemical bonding, nuclear reactions and its applications.

CO 2: evaluate the efficiencies and uses of various fuels and fertilizers.

CO 3: explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.

CO 4: demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.

CO 5: analyse various methods to identify an appropriate method for the separation of chemical components.

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution toPSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY FOR BIOLOGICAL SCIENCES -II
(FOR BOTANY, BIOCHEMISTRY AND ZOOLOGY STUDENTS)</td></tr>
<tr><td>Paper No.</td><td colspan="7">GE-2B</td></tr>
<tr><td>Category</td><td>Generic Elective</td><td>Year
Semester</td><td>I/II
II/IV</td><td>Credits</td><td>3</td><td>Course Code</td><td>23UCHGE02B</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Chemistry for Biological Sciences-I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on
• nomenclature of coordination compounds and carbohydrates.
• Amino Acids and Essential elements of biosystem
• understand the concepts of kinetics and catalysis
• provide fundamentals of electrochemistry and photochemistry</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT-I
Co-ordination Chemistry and Water Technology
Co-ordination Chemistry: Definition of terms - IUPAC Nomenclature - Werner’stheory - EAN rule - Pauling’s theory – Postulates - Applications to [Ni(CO)4], $[Ni(CN)4]^{2-}$,$[Co(CN)6]^{3-}$ Chelation - Biological role of Hemoglobin and Chlorophyll (elementary idea) - Applications in qualitative and quantitative analysis.
Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques - BOD and COD.</td></tr>
<tr><td colspan="7">UNIT-II
Carbohydrates
Classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose. Glucose-fructose interconversion. Preparation and properties of sucrose, starch and cellulose.</td></tr>
<tr><td colspan="7">UNIT-III
Amino Acids and Essential elements of biosystem
Classification - preparation and properties of alanine,preparation of dipeptides using Bergmann method - Proteins- classification - structure - Colour reactions - Biological functions - nucleosides -nucleotides - RNA and DNA - structure. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.</td></tr>
</table>

	UNIT-IV **Electrochemistry** Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water - pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method - buffer solutions and its biological applications - electroplating - Nickel and chrome plating - Types of cells -fuel cells-corrosion and its prevention.
	UNIT-V **Photochemistry** Grothus - Drapper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen - chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).
Extended Professional Component (is a part of internal component only, Not to be includedin the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. 3. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chandand Company, New Delhi, twenty third edition, 2012. 4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
Reference Books	1. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012. 2. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007. 3. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007 4. B.R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018. 5. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

Course Learning Outcomes (for Mapping with POs and PSOs)On completion of the course the students should be able to

CO 1: write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology.

CO 2: explain the preparation and property of carbohydrate.

CO 3: enlighten the biological role of transition metals, amino acids and nucleic acids.

CO 4: apply/demonstrate the electrochemistry principles in corrosion, electroplating andfuel cells.

CO 5: outline the various type of photochemical process.

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO and CO

O /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY PRACTICAL FOR PHYSICAL AND BIOLOGICAL SCIENCES - I
(For Mathematics, Physics, Geology, Botany, Biochemistry and Zoology)
(I Year / I Semester (or) II Year / III Semester)</td></tr>
<tr><td>Paper No.</td><td colspan="7">GE-3</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective</td><td>Year</td><td>I/ II</td><td>Credits</td><td>1</td><td>Course Code</td><td>23UCHGE03</td></tr>
<tr><td>Semester</td><td>I/III</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">2</td><td colspan="2">2</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on the
• basics of preparation of solutions.
• principles and practical experience of volumetric analysis</td></tr>
<tr><td>Course Outline</td><td colspan="7">VOLUMETRIC ANALYSIS
1. Estimation of sodium hydroxide using standard sodium carbonate.
2. Estimation of hydrochloric acid using standard oxalic acid.
3. Estimation of ferrous sulphate using standard Mohr's salt.
4. Estimation of oxalic acid using standard ferrous sulphate.
5. Estimation of potassium permanganate using standard potassium dichromate.
6. Estimation of hardness of water.
7. Estimation of ferrous ion using diphenyl amine as indicator.</td></tr>
<tr><td>Reference Books</td><td colspan="7">V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principlesof Practical Chemistry; Sultan Chand & sons, Second edition, 1997.</td></tr>
<tr><td colspan="8">Course Learning Outcomes (for Mapping with POs and PSOs)
On completion of the course the students should be able to
CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette.
CO 2: design, carry out, record and interpret the results of volumetric titration.
CO 3: apply their skill in the analysis of water/hardness.
CO4: analyze the chemical constituents in allied chemical products.</td></tr>
</table>

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution toPSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO and CO

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY PRACTICAL FOR PHYSICAL AND BIOLOGICAL SCIENCES - II
(For Mathematics, Physics, Geology, Botany, Biochemistry and Zoology)
(I Year / II Semester (or) II Year / IV Semester)</td></tr>
<tr><td>Paper No.</td><td colspan="7">GE-4</td></tr>
<tr><td>Category</td><td>Generic Elective</td><td>Year
Semester</td><td>I/ II
II/IV</td><td>Credits</td><td>1</td><td>Course Code</td><td>23UCHGE04</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">2</td><td>2</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on
• identification of organic functional groups
• different types of organic compounds with respect to their properties.
• determination of elements in organic compounds..</td></tr>
<tr><td></td><td colspan="7">SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS

The analysis must be carried out as follows:
(a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose].
(b) Detection of elements (N, S, Halogens).
(c) To distinguish between aliphatic and aromatic compounds.
(d) To distinguish - Saturated and unsaturated compounds.</td></tr>
<tr><td>Reference Books</td><td colspan="7">V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principlesof Practical Chemistry; Sultan Chand & sons, Second edition, 1997.</td></tr>
</table>

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette.

CO 2: design, carry out, record and interpret the results of volumetric titration.

CO 3: apply their skill in the analysis of water/hardness.

CO4: analyze the chemical constituents in allied chemical products

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO and CO

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO and CO

DEPARTMENT OF CHEMISTRY

PROGRAMME SPECIFIC OUTCOMES

On successful completion of the programme the students will be able to

PSO1: Acquire in-depth knowledge of the fundamental concepts in all disciplines of chemistry.

PSO2: Disseminate the basics of chemistry and advanced topics and analytical skillsin organic, inorganic and physical chemistry.

PSO3: Uphold ethical values in personal life, research and career.

PSO4: Demonstrate laboratory skills, analytical acumen, creatively in academics and research.

PSO5: Apply digital tools to collect, analyze and interpret data and presents cientific findings.

PSO6: Gain competence to pursue higher education and career opportunities in chemistry and allied fields.

PSO7: Exhibit leadership qualities to work individually and within a team in organizing curricular, co-curricular and extracurricular activities.

PSO8: Apply the concepts of chemistry to solve problems in the community, entrepreneurial and research pursuits.

PSO9: Exhibit competence in educational, industrial and research pursuits that contribute towards the holistic development of self and community.

PSO10: Display proactive approach towards sustainable environment through green laboratory practices.

PO-PSO MAPPING MATRIX:

PSOs POs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
PO1	X									
PO2		X								
PO3			X							
PO4				X						
PO5					X					
PO6						X				
PO7							X			
PO8								X		
PO9									X	
PO10										X