

B.Sc., CHEMISTRY

SYLLABUS

Programme Code: 3USCHE



2025-2026

**SENGAMALA THAYAR EDUCATIONAL
TRUSTWOMEN'S COLLEGE (AUTONOMOUS)**

(Affiliated to Bharathidasan University, Tiruchirappalli)

Accredited by NAAC

SUNDARAKKOTTAI, MANNARGUDI-614016.



SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

(Affiliated to Bharathidasan University, Tiruchirappalli)

Accredited by NAAC

SUNDARAKKOTTAI, MANNARGUDI-614016.

TAMILNADU, INDIA.

B.Sc., CHEMISTRY

CHOICE BASED CREDIT SYSTEM– LEARNING OUTCOMES BASED CURRICULUM FRAME WORK (CBCS–LOCF)

(For the candidates admitted in the academic year 2025–2026)

CHOICE BASED CREDIT SYSTEM

The credit-based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice-based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning. Our college has moved to CBCS and implemented the grading system.

OUTCOME-BASED EDUCATION (OBE)

LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (LOCF)

The fundamental premise underlying the learning outcomes-based approach to curriculum planning and development is that higher education qualifications are awarded on the basis of demonstrated achievement of outcomes (expressed in terms of knowledge, understanding, skills, attitudes and values) and academic standards expected of graduates of a programme of study. Learning outcomes specify what graduates completing a particular programme of study are expected to know, understand and be able to do at the end of their programme of study. The expected learning outcomes are used as reference points that would help to formulate graduate attributes, qualification descriptors, programme learning outcomes and course learning outcomes which in turn will help in curriculum planning and development, and in the design, delivery and review of academic programmes. They provide general guidance for articulating the essential learnings associated with programmes of study and courses within a programme, maintain national standards and international comparability of learning outcomes and academic standards to ensure global competitiveness, and to facilitate student/graduate mobility and provide higher education institutions an important point of reference for designing teaching-learning strategies, assessing student learning levels, and periodic review of programmes and academic standards.

Some important aspects of the Outcome Based Education Course: is defined as a theory,

practical or theory cum practical subject studied in a semester.

Course Outcomes (COs): are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course. Generally, three or more course outcomes may be specified for each course based on its weightage.

Programme: is defined as the specialization or discipline of a degree.

Programme Outcomes (POs): Programme outcomes are narrower statements that describe what students are expected to be able to do by the time of graduation.

POs are expected to be aligned closely with Graduate Attributes.

Programme Specific Outcomes (PSOs): PSOs are what the students should be able to do at the time of graduation with reference to a specific discipline.

Some important terminologies repeatedly used in LOCF.

Core Courses (CC) A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. These are the courses which provide basic understanding of their main discipline. In order to maintain a requisite standard certain core courses must be included in an academic program. This helps in providing a universal recognition to the said academic program.

Discipline Specific Elective Courses (DSE) Elective course may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective (DSE). These courses offer the flexibility of selection of options from a pool of courses. These are considered specialized or advanced to that particular programme and provide extensive exposure in the area chosen; these are also more applied in nature.

Generic Elective Courses An elective course chosen generally from an **unrelated discipline/subject**, with an intention to seek exposure is called a Generic Elective. Generic Elective courses are designed for the students of **other disciplines**. Thus, as per the CBCS policy, the students pursuing particular disciplines would have to opted Generic Elective courses offered by other disciplines, as per the basket of courses offered by the college. The scope of the Generic Elective (GE) Courses is positively related to the diversity of disciplines in which programmes are being offered by the college.

Non-Major Elective (NME). A student shall choose at least two Non – major Elective Courses (NME) from outside his /her department. Non –Major Elective I – Those who choose Tamil in Part I can choose a non –major elective course offered by other departments. Those who do not choose Tamil in Part I must choose either a) Basic Tamil if Tamil language was not studies in school level or b) Special Tamil if Tamil language was studies up to 10th & 12th std. **Skill Enhancement Courses (SECs)** These courses focus on developing skills or proficiencies in the student, and aim at providing hands-on training. Skill enhancement courses can be opted by the students of any other discipline, but are highly suitable for students pursuing their academic programme. These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge. **Field Study/Industrial Visit/Case Study:** It has to be completed during the fifth semester of the degree programme. Credit for this course will be entered in the fifth semester's marks statement. **Internship:** Students must complete internship during summer holidays after the fourth semester. They have to submit a report of internship training with the necessary documents and have to appear

for a viva-voce examination during fifth semester. Credit for internship will be entered in the fifth semester's mark statement.

Extra Credit Courses: In order to facilitate the students, gaining knowledge/skills by attending online courses MOOC, credits are awarded as extra credits, the extra credit are at three semesters after verifying the course completion certificates. According to the guidelines of UGC, the students are encouraged to avail this option of enriching their knowledge by enrolling themselves in the Massive Open Online Courses (MOOC) provided by various portals such as SWAYAM, NPTEL etc.

Undergraduate Programme:

Programme Pattern: The Under Graduate degree programme consists of **FIVE** vital components. They are as follows:

Part -I: Languages (Tamil / Hindi / French / Sanskrit)

Part-II: General English

Part-III: Core Course (Theory, Practical's, Generic Elective courses, Discipline Specific Elective courses, Compulsory and Optional Allied courses, Project)

Part-IV: Non-Major Elective, Foundation Course, Value Education, Environmental studies, Skill Enhancement Courses/ Soft Skills, Internship / field visit / industrial visit/ Case Study), Professional Competency Course

Part –V

Extension activity, Gender studies

EXAMINATION

Continuous Internal Assessment (CIA):

UG - Distribution of CIA Marks Passing

Minimum: 50 %

Assignment-3	=	30%
Test-2	=	50%
Seminar	=	10%
Attendance	=	10%

Question Paper Pattern

Part A:

Part A 1 (10X1=10 marks)

One word question/ Fill in the blanks/ /True or False/ Multiple Choice Questions

Two Questions from Each unit

Part A 2 (5X2=10 marks)

Match the following Short

Answers

One question from Each unit

Total Marks – 20

Part B: (5X5=25 marks)

Paragraph Answers

Either/ or type, One Question from each unit

Part C: (10X3=30)

Essay Type Answers

Answer 3 out of 5 Questions

One Question from each unit

Part A: K1 Level

Part B: K2, K3 and K4 Level

Part C: K5 and K6 Level

Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

S. No.	Level	Parameter	Description
1	K1	Knowledge/Remembering	It is the ability to remember the previously learned
2	K2	Comprehension/ Understanding	The learner explains ideas or concepts
3	K3	Application/Applying	The learner uses information in a new way
4	K4	Analysis/Analyzing	The learner distinguishes among different parts
5	K5	Evaluation/Evaluating	The learner justifies a stand or decision
6	K6	Synthesis /Creating	The learner creates a new product or point of view

WEIGHTAGE of K – LEVELS IN QUESTION PAPER

(Cognitive Level) K- LEVELS →	Lower Order Thinking			Higher Order Thinking			Total
	K1	K2	K3	K4	K5	K6	
END SEMESTER EXAMINATIONS (ESE)	20	25			30		75
Continuous Internal Assessment (CIA)	20	25			30		75
QUESTION PATTERN FOR END SEMESTER EXAMINATION/Continuous Internal Assessment							
PART							MARKS
PART –A I. (No choice, One Mark) TWO questions from each unit					(10x1 =10)		20
II. (No choice, Two Mark) ONE question from each unit					(5x2 =10)		
PART -B (Either/ or type ,5-Marks) ONE questions from each unit					(5x5 =25)		25
PART -C (3 out of 5) (10 Marks) ONE question from each unit					(3x10 =30)		30
Total							75

BLUE PRINT OF QUESTION PAPER FOR END SEMESTER EXAMINATION							
DURATION: 3. 00 Hours.				Max Mark : 75			
K- LEVELS	K1	K2	K3	K4	K5	K6	Total Marks
PART							
PART –A (One Mark, No choice) (10x1 =10)	10						10
(2-Marks, No choice) (5x2=10)	10						10
PART –B (5- Marks) (Either/or type) (5x5=25)		5	10	10			25
PART -C (10 Marks) (3 out of 5) (3x10=30)					20	10	30
Courses having only K5, K6 levels, K5 level- 3 Questions, K6 level- 2 Questions (One K6 level question is compulsory)							
Total	20	05	10	10	20	10	75

EVALUATION

GRADING SYSTEM

Once the marks of the CIA and the end-semester examination for each of the courses are available, they will be added and converted as final mark. The marks thus obtained will then be graded as per the scheme provided in Table-1.

Grade Point Average (GPA) will be calculated from the first semester onwards for all semester. From the second semester onwards, the total performance within a semester and the continuous performance starting from the first semester are indicated by semester Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA), respectively. These two are calculated by the following formulae:

$\text{GPA} = \frac{\sum_{i=1}^n C_i G_i}{\sum_{i=1}^n C_i}$	$\text{WAM (Weighted Average Marks)} = \frac{\sum_{i=1}^n C_i M_i}{\sum_{i=1}^n C_i}$
Where, C_i is the Credit earned for the Course i G_i is the Grade Point obtained by the student for the Course i M_i is the marks obtained for the course i and n is the number of Courses Passed in that semester.	

CGPA: Average GPA of all the Courses starting from the first semester to the current semester.

CLASSIFICATION OF FINAL RESULTS:

1. For each of the first three parts, there shall be separate classification on the basis of CGPA, as indicated in Table-2.
2. For the purpose of declaring a candidate to have qualified for the Degree of Bachelor of Arts/Science/Commerce/Management as Outstanding /Excellent /Very Good /Good/Above Average/Average, the marks and the corresponding CGPA earned by the candidate in Part-III alone will be the criterion, provided the candidate has secured the prescribed passing minimum in all the Five parts of the Programme.
3. Grade in Part –IV and Part-V shall be shown separately and it shall not be taken into account for classification.
 1. A Pass in PART- V will be mandatory although the marks will not count for the calculation of the CGPA.
 2. Absence from an examination shall not be taken as an attempt.

Table-1: Grading of the Courses - UG

Marks Range	Grade Point	Corresponding Grade
90 and above	10	O
80 and above and below 90	9	A+
70 and above and below 80	8	A
60 and above and below 70	7	B+
50 and above and below 60	6	B
40 and above and below 50	5	C
Below 40	NA	RA

The candidate's performance in every current semester is indicated by **Semester Grade Point Average (SGPA)** and from the second semester onwards, the continuous performance including previous semester /s is indicated by **Cumulative Grade Point Average (CGPA)**.

Table-3: Final Result

CGPA	Corresponding Grade	Classification of Final Result
9.00 and above	O	Outstanding
8.00 to 8.99	A+	Excellent
7.00 to 7.99	A	Very Good
6.00 to 6.99	B+	Good
5.00 to 5.99	B	Above Average
4.00 to 4.99	C	Average
Below 4.00	RA	Re-appearance

The candidates who have passed in the first appearance and within the prescribed duration of the UG programme are eligible. If the candidate's Grade is O/A+ with more than one attempt, the performance is fixed as —Very Good.

VISION

To empower the women students by providing excellent theoretical, practical and research skills in Chemistry to meet the global needs.

MISSION

- Providing quality education in the principles, theory and practice of Chemistry
- Making the students to cope up with the requirements of industry and service sectors
- Excelling in teaching, research, knowledge transfer and to serve the social, cultural and economic needs of the nation.

PROGRAMME OUTCOMES FOR B.Sc.,DEGREE PROGRAMME

PO No.	Programme Outcomes (Upon completion of the B.Sc. Degree Programme, the Undergraduate will be able to)
PO-1	Disciplinary knowledge: Demonstrate comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate program of study in Bachelor of science.
PO-2	Critical thinking, Problem Solving and Reflective thinking: think critically about the issues and identify, critically analyze and solve problems from the disciplines of concern using appropriate tools and techniques and the knowledge, skills and attitudes acquired and extrapolate the same to real life situations; show critical sensibility to life experiences, with self-awareness and reflexivity of both self and society.
PO-3	Analytical & Scientific Reasoning: 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; critically evaluate ideas, evidence, and experiences from an open minded and reasoned perspective.
PO-4	Research-related Skills: develop a sense of capability for relevant/appropriate inquiry and asking questions, synthesize, articulate and report results and to recognize and predict cause and effect relationships, define problems, formulate and establish hypothesis, analyze and interpret and draw conclusions from data, execute and report the results of an experiment or investigation.
PO-5	Digital literacy and Effective Communication: use ICT in a variety of learning situations and speak, read, write and listen clearly in person and through electronic media in English and in one or more Indian languages, and make meaning of the world by connecting people, ideas, books, media and technology; efficiently communicate thoughts and ideas in a clear and concise manner.
PO-6	Individual and Team Work: effectively accomplish tasks individually as well as work effectively and respectfully as member or leader 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 interest so for a common cause and work efficiently as a member of a team.
PO-7	Multicultural Competence and Social Interaction: understand the values and beliefs of multiple cultures, global perspectives, engage and interact respectfully with diverse groups and elicit views of others, mediate disagreements and help reach conclusions in group settings.
PO-8	Awareness of Ethical issues, Human values and Gender Issues: 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 and understand the value of relationship between self and the community and aware of the various issues concerning women and society.
PO-9	Awareness of Environment and Sustainability: understand the impacts of technology and business practices in societal and environmental contexts, and sustainable development.
PO-10	Self-directed and Lifelong learning: acquire knowledge and skills, including learning —how to learn—, that are necessary for participating in learning activities throughout life and to engage in independent and life-long learning in the broadest context of socio-technological changes.

PROGRAMME SPECIFIC OUTCOMES FOR B.Sc., CHEMISTRY

PSO No.	Programme Specific Outcomes <i>(Upon completion of the Course, the Student will be able to)</i>
PSO-1	Acquire in-depth knowledge of the fundamental concepts in all disciplines of Chemistry.
PSO-2	Disseminate the basics of Chemistry and advanced topics and analytical Skills in Organic, Inorganic and Physical Chemistry.
PSO-3	Develop creativity in academics and research.
PSO-4	Apply digital tools to collect, analyze and interpret data and present scientific findings.
PSO-5	Gain competence to pursue higher education and career opportunities in Chemistry and allied fields
PSO-6	Exhibit leadership qualities to work individually and within a team in organizing curricular, co-curricular and extracurricular activities
PSO-7	Apply the concepts of Chemistry to solve problems in the community, entrepreneurial and research pursuits
PSO-8	Exhibit competence in educational, industrial and research pursuits that contribute towards the holistic development of self and community

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**B. Sc., CHEMISTRY COURSE STRUCTURE UNDER CHOICE BASED CREDIT
SYSTEM-LEARNING OUTCOMES BASED CURRICULUM (CBCS-LOCF)**

(For the candidates admitted from the academic year 2025-2026)

ELIGIBILITY: A Pass in 10+2 with Chemistry and Maths /Biology or Botany/Zoology as two of the core subjects.

Sem	Part	Nature of the Course	Course Code	Title of the course	T. In. Hrs/ Week	Ins. Hours/ Week				Credit	Exam Hours	Marks		Total
						L	T	P	S			CIA	ESE	
I	I	Language Course– I	U25LC101	Pothu Tamil-I- Tamil Ilakkiya Varalaru-I	6	5	1	-	-	3	3	25	75	100
	II	English Language Course-I	U25ELC101	General English-I	6	5	1	-	-	3	3	25	75	100
		Core Course-I	U25CH101	General Chemistry–I	5	4	1	-	-	5	3	25	75	100
		Core Practical-I	U25CH102P	Quantitative Inorganic Estimations and Inorganic Preparations(P)	4	-	-	4	-	4	3	25	75	100
		Allied Course-I	U25AMM101/ U25ABO101	Mathematics – I (Calculus) / Allied Botany – I	3	2	1	-	-	2	3	25	75	100
	III	Allied Course-II/ Allied Practical-I/	U25AMM102/ U25ABO102P	Mathematics – II (Algebra and Analytical Geometry(3D))/Allied Botany Practical	-	-	-	2	-	-	-	-	-	-
					2	-	-	-	-	-	-	-	-	-
	IV	Non-Major Elective – I @ Those who choose Tamil In Part –I can choose a non-major elective course offered by other departments. Those who do not choose Tamil in Part-I Must choose either a) Basic Tamil if Tamil language was not studied in school level (or) b) Special Tamil if Tamil language was studied up to 10 th & 12 th std c) Those who choose NCC in Part V must choose NCC Course as Non – Major Elective			2	2	-	-	-	2	3	25	75	100
		Foundation Course-I	U25FCCH11	Fundamentals of Chemistry	2	2	-	-	-	2	3	25	75	100
				TOTAL	30	20	4	6	-	21	-	-	-	700

Sem	Part	Nature of the Course	Course Code	Title of the course	T.In. Hrs Week	Ins. Hours/ Week				Credit	Exam Hours	Marks		Total
						L	T	P	S			CIA	ESE	
II	I	Language Course– II	U25LC202	Pothu Tamil-II- Tamil Ilakkiya Varalaru-II	6	5	1	-	-	3	3	25	75	100
	II	English Language Course – II	U25ELC202	General English-II	6	5	1	-	-	3	3	25	75	100
	III	Core Course-II	U25CH203	General Chemistry–II	5	4	1	-	-	5	3	25	75	100
		Core Practical-II	U25CH204P	Qualitative Organic Analysis and Preparation of Organic Compounds (P)	4	-	-	4	-	4	3	25	75	100
		Allied Course-II/ Allied Practical-I	U25AMM102 / U25ABO102P	Mathematics-II (Algebra and Analytical Geometry(3D))/Allied Botany Practical	2 2	2 -	- -	2 -	- -	2 2	3	25	75	100
		Allied Course – II/III	U25ABO203 / U25AMM203	Allied BotanyII/ Mathematics-III (Trigonometry and Fourier Series)	3	2	1	-	-	2	3	25	75	100
	IV	Non-Major Elective-II @ Those who choose Tamil In Part –I can choose a non-major elective course offered by other departments. Those who do not choose Tamil in Part-I Must choose either d) Basic Tamil if Tamil language was not studied in school level (or) e) Special Tamil if Tamil language was studied up to 10 th & 12 th std f) Those who choose NCC in Part V must choose NCC Course as Non – Major Elective			2	2	-	-	-	2	3	25	75	100
		Skill Enhancement Course-I	U25SECH21	Cosmetics and Personal Grooming	2	2	-	-	-	2	3	25	75	100
			TOTAL		30	20	4	6	-	23	-	-	-	800
	I	Language Course– III	U25LC303	Pothu Tamil-III-Tamilaga Varalarum Panpadum	6	5	1	-	-	3	3	25	75	100
	II	English Language Course – III	U25ELC303	General English-III	6	5	1	-	-	3	3	25	75	100
	III	Core Course-III	U25CH305	General Chemistry–III	4	3	1	-	-	4	3	25	75	100
		Core Practical -III	U25CH306P	Qualitative Inorganic Analysis(P)	4	-	-	4	-	4	3	25	75	100

III		Allied Course-III/ IV	U25APY301	Allied Physics- I	2	1	1	-	-	2	3	25	75	100
		Allied Practical -I/ II	U25APY302P	Allied Physics Practical	2	-	-	2	-	-	-	-	-	-
	IV	Skill Enhancement Course-II	U25SECH32	Entrepreneurial Skills in Chemistry	2	-	-	2	-	2	3	25	75	100
		Skill Enhancement Course—III	U25SECH33	Pesticide Chemistry	2	2	-	-	-	2	3	25	75	100
	V	Part-V- Special Course	25UGSC	Health and Wellness	2	-	-	2	-	1	-	-	-	-
			TOTAL		30	16	4	10	-	21	-	-		700
Sem	Part	Nature of the Course	Course Code	Title of the course	T.In. Hrs/ Week	Ins. Hours/ Week				Credit	Exam Hours	Marks		Total
						L	T	P	S			CIA	ESE	
IV	I	Language Course–IV	U25LC404	Pothu Tamil-IV- Tamilum Ariviyalum	6	5	1	-	-	3	3	25	75	100
	II	English Language Course–IV	U25ELC404	General English-IV	6	5	1	-	-	3	3	25	75	100
	III	Core Course -IV	U25CH407	General Chemistry–IV	5	4	1		-	5	3	25	75	100
		Core Practical- IV	U25CH408P	Gravimetric Analysis (P)	4	-	-	4	-	4	3	25	75	100
		Allied Practical-I/ II	U25APY302P	Allied Physics Practical	2	-	-	2	-	2	3	25	75	100
		Allied Course - IV/V	U25APY403	Allied Physics -II	3	2	1	-	-	2	3	25	75	100
	I V	Skill Enhancement Course -IV	U25SECH44	Instrumental Methods of Chemical Analysis	2	2	-	-	-	2	3	25	75	100
		Skill Enhancement Course -V	U25SECH45	Forensic Science	2	2	-	-	-	2	3	25	75	100
			TOTAL		30	20	4	6	-	23	-	-	-	800
V		Core Course –V		Organic Chemistry-I	5	4	1	-	-	5	3	25	75	100
		Core Course –VI		Inorganic Chemistry	5	4	1	-	-	4	3	25	75	100
		Core Course-VII		Physical Chemistry–I	6	5	1	-	-	5	3	25	75	100
		Core Practical- V		Physical Chemistry Practical	4	-	-	4	-	4	3	25	75	100
		Elective Course-I		Nanoscience and Nanotechnology /Biochemistry /Organometallic Chemistry	4	3	1	-	-	3	3	25	75	100
		Elective Course -II		Nuclear, Industrial Chemistry & Metallic State / Solid State Chemistry / Pharmaceutical Chemistry	4	3	1		-	3	3	25	75	100
		Environmental Studies		Environmental Studies	2	2	-		-	2	3	25	75	100
		Internship/ Industrial visit/ Field visit		Internship/ Industrial visit/ Field visit	-	-	-		-	2	-	-	-	-

				TOTAL	30	21	5	4	-	28	-	-	-	700
Sem	Part	Nature of the Course	Course Code	Title of the course	T.In. Hrs/ Week	Ins. Hours/ Week				Credit	Exam Hours	Marks		Total
						L	T	P	S			CIA	ESE	
VI	III	Core Course-VIII		Organic Chemistry – II	6	5	1	-	-	4	3	25	75	100
		Core Course—IX		Physical Chemistry -II	6	5	1	-	-	4	3	25	75	100
		Core Project- X		Group Project with viva voce /Research Topics	5	1	-	4	-	5	3	25	75	100
		Elective Course- III		Fundamentals of Spectroscopy/ Industrial Chemistry / Supramolecular Chemistry	4	3	1	-	-	3	3	25	75	100
		Elective Course- IV		Polymer Chemistry/ Green Chemistry/ Textile Chemistry	4	3	1	-	-	3	3	25	75	100
	IV	Value Education		Value Education	2	2	-	-	-	2	3	25	75	100
		Professional Competency Course		Chemistry for Competitive Examinations	2	2	-	-	-	2	3	25	75	100
	V	Gender Studies		Gender Studies	1	1	-	-	-	1	3	25	75	100
		Extension activity		Extension activity	-	-	-	-	-	1	-	-	-	-
			TOTAL			30	22	4	4	-	25	-	-	-
Extra Credit			Grand Total		180	121	25	34	-	141	-	-	-	4500
			Value added Courses (At least one per year)			-	-	-	-	2	-	-	-	-
		L-Lecture	T- Tutorial		P-Practical				S-Seminar					

Credit Distribution for UG PROGRAMME: CHEMISTRY

S. No	Part	Subject	No. of Courses	Total Credits
1	I	Language Course	4	12
2	II	English Language Course	4	12
3	III	Core Course	9	41
4		Core Practical	5	20
5		Core Project	1	05
6		Allied Course- Mathematics/ Botany	5/4	10/8
7		Allied Practical- Mathematics/ Botany	1/2	02/04
8		Elective Course	4	12
9	IV	Non-Major Elective	2	04
10		Foundation Course – FC	1	02
12		Skill Enhancement Course	5	10
13		Internship/ Industrial visit/ Field visit	1	02
14		Environmental Studies	1	02
15		Value Education	1	02
16		Professional Competency Course	1	02
17	V	Gender Studies	1	01
17		Extension Activity	1	01
18		Special course-Health and Wellness	1	01
Total			48	141

Note:

	CIA	ESE
1 Theory	25	75
2 Practical	25	75
3	Separate passing minimum is prescribed for Internal and External marks	

FOR THEORY

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

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

FOR PRACTICAL

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

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

NON -MAJOR ELECTIVE (NME) OFFERED BY THE DEPARTMENT

Semester	Part	Course	Course code	Title of the Course
I	IV	NME– I	U25NMECH11	Sustainability and Green Chemistry in EV sector
II	IV	NME– II	U25NMECH22	Fuel Chemistry

SEMESTER-III

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(For the Candidates admitted in the academic year 2025 – 2026)
DEPARTMENT OF CHEMISTRY
B.Sc., CHEMISTRY

Semester: III-CC-III: General Chemistry-III

Ins. Hrs. /Week: 4

Course Credit: 4

Course Code: U25CH305

UNIT I : GASEOUS STATE

(15 Hours)

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 and viscosity of gases. Real gases: Deviations from ideal gas behaviour, (Andrew's and Amagat's plots); compressibility factor, Z, and its variation with pressure for different gases. equations of states for real gases-van der Waal's equation; Virial equation; Boyle temperature; Numerical problems based on equations of states for real gases, isotherms of real gases – critical phenomena – isotherms of CO₂ - continuity of state–Van der waal's equation and the critical state; law of corresponding states-liquefaction of gases; numerical problems involving the core concepts.

UNIT-II: LIQUID AND SOLID STATE

(15 Hours)

Properties of Liquids- Surface tension, viscosity and their applications. Crystalline and amorphous – differences - geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism.

Crystals –size and shape; laws of crystallography; 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, TiO₂; comparison of structure and properties of diamond and graphite. Defects in solids - stoichiometric and nonstoichiometric defects. Liquid crystals – classification and applications.

UNIT-III: NUCLEAR CHEMISTRY

(15 Hours)

Natural radioactivity - α , β and γ rays; half-life period; Fajans–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 AND ALIPHATIC ALCOHOLS (15 Hours)

Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions.

Nucleophilic substitution reactions – SN_1 , SN_2 and SN_i mechanisms with stereochemical aspects and effect of solvent.

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; conversions – ascent and descent of series; test for hydroxyl groups. Oxidation of diols by periodic acid and lead tetraacetate.

UNIT-V: PHENOLS AND AROMATIC ALCOHOLS (15 Hours)

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 - Teimen, Kolbe, Schmidt, Gattermann synthesis, Libermann, nitro reaction, phthalein reaction. Resorcinol, quinol, picric acid– preparation, properties and uses.

Nomenclature, benzyl alcohol – methods of preparation – hydrolysis, reduction of benzaldehyde, Cannizzaro reaction, Grignard synthesis, physical properties, reactions – reaction with sodium, phosphorus pentachloride, thionyl chloride, acetic anhydride, hydrogen iodide, oxidation – substitution on the benzene nucleus, uses. Thiols: Nomenclature, structure, preparation and properties.

Total Lecture Hours: 75

COURSE OUTCOME

The students are able to

1. Explain the kinetic properties of gases by using mathematical concepts.
2. 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 determinations.
3. Investigate the radioactivity, nuclear energy and its production, also the nuclear waste management.
4. Write the nomenclature, physical & chemical properties and basic mechanisms of halo organic compounds and alcohols.
5. Investigate the named organic reactions related to phenol; explain the preparation and roperties of aromatic alcohol including thiol.

TEXT BOOKS

1. Anil J Elias, (2019), The Chemistry of p block elements, Synthesis, Reactions and Applications, First Edition, The orient Black swan.
2. Arun Bahl and BS Bahl, (2018), A Text book of Organic Chemistry, 5th edition, New Delhi, Sultan Chand & Co.
3. Buri BR, Sharma LR and Pathania MS, (2020). Principles of Physical Chemistry, 47th edition, Vishal publishing Co, Punjab.
4. Kalsi PS, (2017), Stereochemistry conformation and mechanism, 9th edition, New Age International publishers.
5. Satake M, (2003), The Chemistry of p block elements, First Edition, Discovery publishing Pvt, Ltd.
6. Puri B.R, Sharma L.R, Pathania M.S, (2020), Principles of Physical Chemistry, 46th edition, Vishal Publishing.
7. Mukherji S.M. and Singh S.P, (2024), Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition.

REFERENCES

1. Graham Solomons T. W, Organic Chemistry, John Wiley & Sons, fifth edition, (1992).
2. Carey Francis A, Organic Chemistry, Tata McGraw-Hill Education Pvt., Ltd., New Delhi, seventh edition, (2009).
3. Finar I. L, Organic Chemistry, Wesley Longman Ltd, England, sixth edition, (1996).
4. Soni P. L, and Chawla H. M, - Text Book of Organic Chemistry, New Delhi, Sultan Chand & Sons, twenty ninth edition, (2007).
5. Lee J.D, Concise Inorganic Chemistry, Blackwell Science, fifth edition, (2025).
6. Bahl, A., & Bahl, B. S. (2026). A textbook of organic chemistry (22nd ed.). S. Chand Publishing.
7. Housecroft, C. E., & Sharpe, A. G. (2026). Inorganic chemistry (6th ed.). Pearson Education.

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1. <http://jpsw.shikshamandal.org> chemistry of p block elements
2. <https://www.britannica.com>. Organohalogen compounds
3. <https://wiki.ubc.ca>. chemistry of p block elements
4. <https://www.khanacademy.org>. stereochemistry
5. <https://www.topper.com> chemistry The gaseous state

MAPPING WITH PROGRAMME OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3		2		2		2	2		3	3	2	
CO2	2	3	3	2		2	2		2	2	3	3	2	3
CO3	3	3		2		3			3	2	3	3	2	
CO4	3	3	3	2		3	3	2	2	2	3	3	2	3
CO5	3	2	3	2		2		2	2		3	3	2	3

3- Strong

2-Medium

1-Low



**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
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(For the Candidates admitted in the academic year 2025 – 2026)

DEPARTMENT OF CHEMISTRY

B.Sc., CHEMISTRY

Semester: III-CP-III: Qualitative Inorganic Analysis (P)

Ins. Hrs. /Week: 4

Course Credit: 4

Course Code: U25CH306P

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, aluminum, arsenic, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium.
5. Analysis of a mixture - I to VIII containing two cations and two anions (of which one is interfering type)

COURSE OUTCOME

The students are able to,

1. Acquire knowledge on the systematic analysis of Mixture of salts.
2. Identify the cations and anions in the unknown substance.
3. Identify the cations and anions in the soil and water and to test the quality of water.
4. Assess the role of common ion effect
5. Learn about the solubility product.

TEXT BOOKS

1. Amarnath Mishra. (2018), Qualitative Inorganic Analysis, Bharati Bhawan (P& D).
2. Rakesh Sharma L, (2021), Practical Inorganic Chemistry. Evince Publishing.
3. Svehla G, Sivasankar B. (2012), Qualitative Inorganic Analysis. 7th Ed, Pearson Education, India.
4. Vogel, (2000), Text Book of Quantitative Inorganic Analysis. 6th Ed, Longman, New Delhi.
5. V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, (2025). Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition.

REFERENCES

1. George Marr BW, Rachetl, (1972), Practical Inorganic Chemistry. Van Nostr and Reinhold Company.
2. Gurdeep Raj, (2013), Advanced Practical Inorganic Chemistry. Krishna Prakashan Media (P) Ltd.
3. Ramanujam VV, (1988), Inorganic Semimicro Qualitative Analysis. 3rd Ed, National Pubs, London.
4. Sonia Ratnani, Swati Agarwal, Sujeet Mishra, (2020), Practical Chemistry, 1st Ed, McGrawHill Education Private Ltd.
5. Svehla G, (2024), Text Book of Macro and Semimicro Qualitative Inorganic Analysis. 5th Ed, Longman group Ltd, London.
6. Karad, S. C., Makasana, J. S., & Mamtora, M. J. (2026). Chemistry practical inorganic qualitative analysis. LAP Lambert Academic Publishing.

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1. https://www.researchgate.net/publication/283476036_inorganic_qualitative_analysis_a_greener_approach
2. <https://www.readallbooks.org/book/vogels-qualitative-inorganic-analysis-7th-edition/>
3. https://www.academia.edu/14685017/vogels_textbook_of_qualitative_inorganic_analysis
4. <https://kresnadipayana.files.wordpress.com/2018/10/macro-and-semimicro-qualitative-inorganic-analysis-5ed-vogel.pdf>
5. <https://bookflow.in/books/vogels-qualitative-inorganic-analysis/>
6. <https://www.vlab.co.in/broad-area-chemical-sciences>

MAPPING WITH PROGRAMME OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	3			3			2	3	3	3	2	2
CO2	2	3	3			3	2		2	3	3	3		3
CO3	3	3	3	3		3	3	2	3	2	3	3	3	3
CO4	3	3	3	3		3	3			3	3			
CO5	3	2	3	3		2		2	2		3	3		2

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SEC-II&III



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DEPARTMENT OF CHEMISTRY

B.Sc., CHEMISTRY

Semester: III-: SEC-II Entrepreneurial Skills in Chemistry

Ins. Hrs. /Week: 2

Course Credit: 2

Course Code: U25SECH32

UNIT –I FOOD CHEMISTRY

(6 Hours)

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 colorants, Preservatives, leavening agents, baking powder and baking soda, yeast, MSG, vinegar.

UNIT II: HANDS ON EXPERIENCE (Students can choose any four)

(6 Hours)

Detection of adulterants in food items like coffee, tea, pepper, chilly powder, turmeric powder, butter, ghee, milk, honey etc., by simple techniques. Preparation of Jam, squash and Jelly, Gulk and, cottage cheese. Preparation of products like candles.

UNIT III: CHEMISTRY IN HOUSEKEEPING

(6 Hours)

Deodorants, acid cleaners, laundry aids, alkaline cleaners, metal polishes, Preparation of products like candles, pain balm, tooth paste/powder and disinfectants in small scale. Extraction of oils from spices and flowers. Testing of water samples using testing kit.

UNIT IV: SHAMPOOS AND DYES

(6 Hours)

Shampoos- Requisites, formulation and ingredients. Dandruff curing shampoos- preparation.

Dyes Classification – Natural, synthetic dyes and their characteristics – basic methods and principles of dyeing.

UNIT V: SOAPS AND DETERGENTS

(6 Hours)

Soaps - Definition, different raw materials in soap manufacture-hot and cold process. Varieties of soap and their uses (brief study- manufacture not necessary).

Detergents- Introduction. Cleansing action of soap. Distinction between soaps and detergents.

Total Lecture Hours-30

COURSE OUTCOME

The students are able to

1. Understand the requirements and ingredients of cosmetics.
2. Learn the basic requirements and classifications of flavorings agent.
3. Describe the preparation of shampoos and Hair dyes.
4. Know how to prepare the powder tooth paste.
5. Understand the manufacturing process of soaps and detergents.

TEXTBOOKS

1. Thangamma Jacob, Macmillan, (1987)home science and allied science Edition.
2. Belitz H.D, Grosch .W, Schieberie.P (2009) Food Chemistry, Springer 4 th Edition.
3. Harry's Cosmeticology, (2009), Cosmetic Chemistry, Chemical Publishing Company, 9 th Edition.
4. Anthony.J, (2005), Handbook of Soap and Detergents, Chemical Publishing Company 1 st Edition.
5. Shyam Jha, (2025), Rapid detection of food adulterants and contaminants (Theory and Practice).

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1. Dr. Kashmiri, M. khamkar, vaishali, M. Gokhale,(2018) Applied science Technical Publications.
2. Dr. AIJAZ shellah, Dr.subnash, Deshmane.V, Do.Kallash, Biyani.R,Dr. Rageeb. Md, Usman. Md, (2019)Cosmetic Science S.Vikas and Company (PV).
3. George S &Muralidharan V, (2007) Fibre to Finished Fabric – A Simple Approach,Publication Division, University of Madras, Chennai.
4. Larry Branen .A, Michael Davidson, SeppoSalminen, John . H, (2023), Food Chemistry, CRC Press, 2nd Edition.
5. Johanna . y. Rondon, (2022), Household Chemistry, Nova Science Publishers.
6. Rothenberg, G. (2026). Innovation management in sustainable chemistry (1st ed.). Wiley-VCH. ISBN 978-3-527-35451-1.
7. Sakhare, P. R., Saha, B., Garelick, H., & Li, B. (2026). Fostering chemistry entrepreneurship. Chemistry International, 48(1), 26–28.

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- 1.<https://doi.org/10.3108/beej.14.1>
- 2.<https://doi.org/10.1152/advan.00007.2017>
- 3.<https://www.jstor.org/stable/40555946>
- 4.<https://www.vlab.co.in/broad-area-chemical-sciences>.
- 5.<https://Faculty.Kfupm.Edu.Sa/Chem/Belali/Chem%20456/Chapter%205/Chapter%205%20and%20detergents.Pdf>
6. <https://doi.org/10.1515/ci-2026-0112>

MAPPING WITH PROGRAMME OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	2	2		2					3	3	3	
CO2	3	3	3	3		1		3	3		3	3	3	3
CO3	3	3	3	3		1		3	3	3	2	2	2	3
CO4	3	2	2	2		2					3	3	3	
CO5	3	1	2	3		3		3	2		3	3	3	

3- Strong

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DEPARTMENT OF CHEMISTRY

B.Sc., CHEMISTRY

Semester: III-: SEC-III Pesticide Chemistry

Ins. Hrs. /Week: 2

Course Credit: 2

Course Code: U25SECH33

UNIT I: INTRODUCTION AND TOXICITY OF PESTICIDES

(6 Hours)

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

(6 Hours)

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, Chlorpyrifos, Monocrotophos.

UNIT III: PESTICIDES RESIDUES

(6 Hours)

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.

UNIT IV: PESTICIDE RESIDUES EFFECT AND ANALYSIS

(6 Hours)

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.

UNIT V: BIO PESTICIDES

(6 Hours)

Pheromones, attractants, repellents – Introduction, types and application (8- Dodecen-1-ol, 10-cis-12-hexadecadienoic, Trimedlure, Cue-lure, methyl eugenol, N,N- Diethyl-m-toluamide, Dimethyl phthalate, Icaridin), Zinc Phosphide, Bromadiolone.

Total Lecture Hours-30

COURSE OUTCOME

The students are able to

1. Teach about the pesticides and their toxicity with respect to structure and category.
2. Explain the preparation and property of pesticides

- Investigate the pesticide residues, prevention and care
- Demonstrate the extraction and analytical methods of pesticide residues.
- Make awareness to the public on bio-pesticides

TEXTBOOKS

- Handa SK, (2012.), Principles of pesticide Chemistry. Agrobios (India).
- Matolcsy G, Nádas M, Andriská V. (1989) Pesticide Chemistry. Elsevier.
- Miyamoto. J and Kearney. P. C, (2012) Pesticide Chemistry Human Welfare and the Environment vol.
- Cremlyn. R. Pesticides, John Wiley, (1985), Pesticide Residue and Formulation Chemistry, Pergamon press.
- Dileep.K.Singh, (2025), Pesticide Chemistry and Toxicology, Scientific Publishers.

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- Roy N. K., (2010), Chemistry of Pesticides. CBS Publisher & Distributors P Ltd; 1st Ed.
- Nollet L.M., Rathore H.S., (2016), Handbook of pesticides: methods of pesticide residues analysis. CRC press.
- Ellerbrock R.H, 2005 Pesticide Residues: Significance, Management and Analysis.
- Franklin . R, Hall, Julius . J.Menn, 1999, Biopesticides, Humana Press.
- Robert Krieger, (2024), Handbook of Pesticide toxicology (vols 1-3), Academic Press 2 nd Edition.
- Jeschke, P., Lamberth, C., & Lorschach, B. (Eds.). (2026). Modern crop protection compounds, Volume 1: Herbicides (4th ed.).

E-RESOURCES

- <https://youtube.com/playlist?list=PLqFaTIg4myuFiYr04HfRk2z4CFaB2ppDc>
- <https://epgp.inflibnet.ac.in>
- <https://www.fao.org/pesticide-registration/toolkit>
- <https://ncert.nic.in/ebooks.html>
- <https://openwho.org>

MAPPING WITH PROGRAMME OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	3	2		3	2	2	2	2	3	3	3	1
CO2	3	3	3	3		3	2	2	2	2	3	3	3	3
CO3	3	3	3	2		3	3	2	3	2	3	3	3	1
CO4	3	3	3	2		3	3	2	2	2	3	3	3	1
CO5	3	2	3	2		3	2	2	2	2	3	2	3	1

3- Strong

2-Medium

1-Low



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DEPARTMENT OF CHEMISTRY

B.Sc., CHEMISTRY

Semester: III:- Part V – Special Course – Health and Wellness

Ins. Hrs. /Week: 2

Course Credit: 1

Course Code: 25UGSC

UNIT I Introduction to Holistic Well – being:

1. Introduce the core components of Health & Well – being namely Physical, mental and emotional well – being.
2. Provide worksheets on all the four components individually and explain the interconnectedness to give an overall understanding.

UNIT II Wellness Wheel Exercise (Overall Analysis)

Guide students to assess their well – being in various life dimensions through exercises on various aspects of well – being and explain the benefits of applying wellness wheel.

Introduce Tech Tools.

Explore the use of technology to support well – being.

Introduce students to apps for meditation, sleep, tracking or health recipe inspiration.

UNIT III Breaking Bad Habits (Overall Analysis)

- Open a discussion on bad habits and their harmful effects.
- Provide a worksheet to the students to identify their personal bad habits.
- Discuss the trigger, cause, consequence and solution with examples.
- Guide them to replace the bad habits with good ones through worksheets.

UNIT IV Physical Well – being

1. Fitness

Introduce the different types of fitness activities such as basic exercises, cardiovascular exercises, Strength training exercises, flexibility exercise, so on and so forth. (Include theoretical explanations and outdoor activity)

2. Nutrition

Facilitate students to reflect on their eating habits, their body type, and to test their knowledge on nutrition, its sources and the benefits.

3. Yoga & Meditation

Discuss the benefits of yoga and Meditation for one's overall health.

Demonstrate different yoga postures and their benefits on the body through visual(Picture or videos)

4. Brain Health

Discuss the importance of brain health for daily life.

Habits that help for brain health(irregular sleep, eating, screen time).

Benefits of breathing exercises and meditation for healthy Lungs.

5. Healthy Lungs

Discuss the importance of lung health for daily life.

Habits that help for lung health(Smoking, lack of exercises)

Benefits of breathing exercises for healthy Lungs.

6. Hygiene and Grooming

Discuss the importance of hygienic habits for good oral, vision, hearing and skin health.

Discuss the positive effects of grooming on one's confidence level and professional growth.

Suggested Activities (sample):

Nutrition

Invite a nutritionist to talk among the students on the importance of nutrition to the body or

Show similar videos shared by experts on social media. Organize a 'Stove less/ fireless cooking competition' for students where they are expected to prepare a nutritious dish and explain the nutritive values in parallel.

5. Emotional Well -being

1. Stress Management

Trigger a conversation or provide self-reflective worksheets to identify the stress factors in daily life and their impact on students' performance.

Introduce different relaxation techniques like deep breathing, progressive muscle relaxation or guided Imagery. (use audio recordings visuals to guide them through these techniques).

After practicing the techniques, have them reflect on how these methods can help manage stress in daily life.

2. Importance of saying 'NO'

Explain the students that saying 'NO' is important for their physical and mental well-being, Academic Performance, Growth and Future, Confidence, Self – respect, Strong and Healthy Relationships, building Reputation for self and their family(avoid earning a bad name).

Factors that prevent them from saying 'NO'

3. Body Positivity and self – acceptance

Discuss the following with the students.

- What is body positivity and self – acceptance?
- What is it important?
- Be kind to yourself.
- Understand that everyone's unique.

Suggested Activities(Sample)

(Importance of saying 'NO').

Provide worksheets to self – reflect on....

How they feel when they should say 'no' to them

The situations where they should say 'no'

Challenge students to write a song or rap about the importance of saying no and how to do it effectively.

Students can perform their creations for the class.

UNIT VI

Social Well – Being

1. Practicing Gratitude

Discuss the importance of practicing gratitude for building relationships with family, friends, relatives, mentors and colleagues. Discuss how one can show gratitude through words and deeds.

Explain how practicing gratitude can create 'ripple effect'.

2. Cultivating kindness and compassion.

Define and differentiate between kindness and compassion. Explore practices that cultivate these positive emotions. Self – Compassion as the Foundation. The power of small gestures.

Understanding another's perspective. The fruits of Compassion.

3. Practising Forgiveness

Discuss the concept of forgiveness and its benefits. Forgiveness: What is it? And What it isn't? Benefits of forgiveness. Finding forgiven practices.

4. Celebrating Differences

Appreciate the value of individual differences and foster inclusivity. The world: A Tapestry of Differences (Cultures, backgrounds, beliefs, abilities and appearances). Finding strength in differences (diverse perspectives and experiences lead to better problem solving and innovation). Celebrating differences, not ignoring them (respecting and appreciating the unique qualities). Activities for celebrating differences (share culture, learn about others, embrace new experiences).

5.Digital Detox

Introduce the students to:

The concept of a digital detox and its benefits for social well-being. How to disconnect from devices more often to strengthen real – world connections.

Suggested Activities (Sample)

Practicing Gratitude)

Provide worksheets to choose the right ways to express gratitude. Celebrate 'gratitude day' in the college and encourage the students to honour the house keeping staff in some way to express gratitude for their

UNIT VII Intellectual Well – being

1. Being a lifelong Learner

Give students an understanding on:

The relevance of intellectual well – being in this 21st century to meet the expectations in personal and professional well – being. The importance of enhancing problem solving skills. Cultivating habits to enhance the intellectual well-being (using the library extensively, participating in extra – curricular activities, reading newspaper etc.)

2. Digital Literacy

Discuss:

The key aspects of digital literacy and its importance in today's world. It is more than just liking and sharing on social media. The four major components of digital literacy (critical thinking, communication, problem – solving, digital citizenship). Why is digital literacy important? Boosting one's digital skills.

3. Transfer of Learning

Connections between different subjects – How knowledge gained in one area can be applied to others.

Suggested Activities (Sample)

Intellectual well – being. Provide worksheet to students for teaching them how to boost intellectual well – being. Ask the students to identify long – standing problem in their locality and come up with a solution and present it in the classroom. Also organize an event like idea Expo' to display the designs, ideas and suggestions, to motivate the students to improve their intellectual well – being.

UNIT VIII Environmental Well - being

1. The importance of initiating a change in the environment.

The Session could be around:

Defining Environmental well – being (physical, chemical, biological, social and psychosocial factors) – people's behavior, crime, pollution, political activities, infrastructure, family situation etc.

Suggesting different ways of initiating changes in the environment (taking responsibility, creating awareness, volunteering, approaching administration).

Suggested Activities (sample):

Providing worksheets to self – reflect on how the environment affects their life and the ways to initiate a change. Dedicate a bulletin board or wall space (or chart work) in the classroom for students to share their ideas for improving environmental well – being. Creating a volunteers club in the college and carrying out monthly activities like campus cleaning, awareness campaigns against noise pollution, (loud speakers in public places), addressing antisocial behavior on the campus or in their locality.

UNIT IX Mental Well – being

1. Importance of self – reflection

Discuss

Steps involved in achieving mental well – being (self – reflection, self – awareness, applying actions, achieving mental well – being). Different ways to achieve mental well – being (finding purpose, coping with stress, moral compass, connecting for a common cause). The role of journaling in mental well-being.

2. Mindfulness and Meditation Practices

Benefits of practicing mindful habits and meditation for overall well – being.

1. Connection with nature

Practicing to be in the present moment – Nature walk, feeling the sun, listening to the natural sounds.

Exploring with intention – Hiking, gardening to observe the nature. Reflecting on the emotions and feeling kindled by nature.

2. Serving people

Identifying the needs of others. Helping others. Volunteering your time, skills and listening ear.

Finding joy in giving.

3. Creative Expressions

Indulging in writing poems, stories, music making / listening, creating visual arts to connect with inner selves.

Suggested Activities (Sample) :

(Mindfulness and Meditation) – Conducting guided meditation every day for 10 minutes and directing the students to record the changes they observe.

UNIT X Situational Awareness (Developing Life Skills)

1. Being Street smart

Discuss:

Who are street smart?

Why is it important to be street smart?

Characteristics of a street smart person: Importance of acquiring life skills to become street smart – (General First – aid procedure, CPR procedure, Handling emergency situations like fire, flood etc).

2. Digital Awareness

Discuss:

Cyber Security. Information Literacy. Digital Privacy, Fraud Detection.

Suggested Activities (Sample)

(Street Smart) Inviting professionals to demonstrate the CPR procedure. Conducting a quiz on Emergency Numbers.

UNIT XI Understanding Addiction

Plan this session around:

Identifying the environmental cues, triggers that lead to picking up this habit. Knowing the impact of substance abuse – Adverse health conditions, social isolation, ruined future, hidden financial loss and damaging the family reputation. Seeking help to get out of this addiction.

Suggested Activities:

Provide Worksheets to check the student's level of understanding about substance addiction and their impacts. Share case studies with students from real – life. Play / share awareness videos on addiction / de – addiction, experts talk.

Conduct awareness programmes on Drugs and its ill effects. (Arrange Experts from the concerned government departments and NGOs working in drug addiction issues) and maintain the documents of the program.

Assessments:

- Use Self – reflective worksheets to assess their understanding.
- Submit the worksheets to internal audit / external audit.
- Every student's activities report should be documented and the same have to be assessed by the physical Director with the mentor. The evaluation should be for 100 marks. No examination is required.

References / Resource Materials :

The Course acknowledge that individual needs for references and resources may vary. However, here are some general reference materials and resources that may be helpful.

1.The Well – Being Wheel:



2. Facilities & Spaces :

Some activities may require access to specific facilities, resources or space. Students may need

to coordinate with the college administration to reserve these are required.

3. Online Resources :

1. United Nations Sustainable Development Goals – Goal 3 – Good Health & Well – Being :
<https://www.un.org/sustainabledevelopment/health/>
2. Mindfulness and Meditation : Stanford Health Library offers mindfulness and meditation resources : <https://healthlibrary.stanford.edu/books-resources/mindfulness-meditation.html>
3. Breaking Bad Habits: James Clear provides a guide on how to build good habits and break bad ones: <https://jamesclear.com/habits>
4. 6 ways to keep Your Brain Sharp
<https://www.lorman.com/blog/post/hou-to-keep-your-brain-sharp>
5. What is Social Wellbeing? 12+ Activities for Social Wellness
<https://positivepsychology.com/social-wellbeing/>
6. How does Your Environment Affect Your Mental Health?
<https://www.Verywellmind.com/how-your-environment-affects-your-mental-health-5093687>
7. How to say no to others (and why you shouldn't feel guilty)
<https://www.betterup.com/blog/how-to-say-no>

SEMESTER-IV



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DEPARTMENT OF CHEMISTRY

B.Sc., CHEMISTRY

Semester: IV-: CC IV General Chemistry–IV

Ins. Hrs. /Week: 5

Course Credit: 5

Course Code: U25CH407

UNIT I: THERMODYNAMICS I

(15 Hours)

Terminology – Intensive, extensive variables, 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, irreversible expansion of ideal and real gases under isothermal and adiabatic conditions; relation between heat capacities (C_p & C_v); Joule Thomson effect- inversion temperature.

Thermochemistry - heats of reactions, standard states; types of heats of reactions and their applications; effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions; Hess's law and its applications; determination of bond energy; Measurement of heat of reaction – determination of calorific value of food and fuels . Zeroth law of thermodynamics-Absolute Temperature scale.

UNIT II: THERMODYNAMICS II

(15 Hours)

Limitations of first law -Second Law of thermodynamics, 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 and a van der Waals gas with changes in temperature, volume and pressure, entropy and disorder.

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

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 (15 Hours)

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, Nickel and Zinc groups.

UNIT IV : ETHERS, EPOXIDES, ALDEHYDES AND KETONES (15 Hours)

Ethers -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 LiAlH_4 .

Aldehydes and Ketones

Nomenclature, 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. Baeyer - Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf - Kishner reduction, Meerwein – Ponnendorf Verley reduction, reduction with LiAlH_4 and NaBH_4 . Addition reactions of unsaturated carbonyl compounds: Michael addition.

UNIT V : CARBOXYLIC ACIDS AND ACTIVE METHYLENE COMPOUNDS(15 Hours)

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, Hunsdiecker reaction. Formic acid-reducing property. Reactions of dicarboxylic acids, hydroxy acids and unsaturated acids.

Carboxylic acid Derivatives: Preparations of aliphatic and aromatic acid chlorides, esters, amides and anhydrides. Nucleophilic substitution reaction at the acyl carbon of acyl halide, anhydride, ester, amide. Schotten- Baumann reaction. Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann bromamide degradation and Curtius rearrangement.

Active methylene compounds: Keto – enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate.

Hydroxy acids – nomenclature; preparation from halo, amino, aldehydic and ketonic acids, ethylene glycol, aldol acetaldehyde; reactions – action of heat on α , β and γ hydroxy acids.

Total Lecture Hours- 75

COURSE OUTCOME

1. Explain the terms and processes in thermodynamics; discuss the various laws of thermodynamics and thermo chemical calculations.
2. Discuss the second law of thermodynamics and its application to heat engine; discuss third law and its application on heat capacity measurement.
3. Investigate the chemistry of transition elements with respect to various periodic properties and group wise discussions.
4. Discuss the fundamental organic chemistry of ethers, epoxides and carbonyl compounds including named organic reactions.
5. Discuss the chemistry and named reactions related to carboxylic acids and their derivatives; discuss chemistry of active methylene compounds, halogen substituted acids and hydroxyl acid.

TEXT BOOKS

1. Puri . B.R and Sharma., (1992), Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., thirty three edition.
2. Kapoor K. L, A, (2009), Textbook of Physical chemistry, (volume-2 and 3), Macmillan, India Ltd, third edition.
3. Soni. P.L and Mohan Katyal, (2006), Textbook of Inorganic Chemistry, Sultan Chand & Sons, twentieth edition.
4. Jain. M. K, Sharma S. C, (2003), Modern Organic Chemistry, Vishal Publishing, fourth reprint.
5. Mukherji. S.M and Singh. S.P, (2024), Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition.

REFERENCES

1. Maron, S. H. and Prutton C. P, (1972), Principles of Physical Chemistry, 4th ed.; The Macmillan Company: New York.
2. Lee, J. D. Concise, (1991), Inorganic Chemistry, 4th ed.; ELBS William Heinemann: London.
3. Gurudeep Raj, (2001), Advanced Inorganic Chemistry, 26th ed.; Goel Publishing House: Meerut.
4. Atkins, P.W. & Paula, J, (2014), Physical Chemistry, 10th ed.; Oxford University Press: New York.
5. Huheey, J. E, (2025), Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed; Addison Wesley Publishing Company: India.
6. Atkins, P., de Paula, J., & Keeler, J. (2026). Atkins' physical chemistry (12th ed.). Oxford University Press.
7. Engel, T., & Reid, P. (2026). Physical chemistry: Thermodynamics, statistical thermodynamics, and kinetics (4th ed.). Pearson Education.

E-RESOURCES

1. <https://www.coursehero.com/file/92206671/ch11-alcohols-phenols-etherspptx/>
2. <https://pubs.acs.org/doi/10.1021/ja02254a006solidstate>
3. <https://learn.careers360.com/chemistry/chemical-kinetics-chapter/>
4. <https://nptel.ac.in/courses/112102255> Thermodynamics
5. <https://nptel.ac.in/courses/104101136> Advanced transition metal chemistry.
6. <https://pchem.digital.uic.edu/>

MAPPING WITH PROGRAMME OUTCOMES

	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	3	2		1	2	2	2	2	3	3	3	1
CO2	3	3	3	3		3	2	2	2	2	3	3	3	3
CO3	3	3	2	2		3	3	2	3	2	3	3	3	1
CO4	3	3	3	2		3	3	2	2	2	3	3	3	1
CO5	3	2	3	2		3	2	2	2	2	3	2	3	1

3- Strong

2-Medium

1-Low



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DEPARTMENT OF CHEMISTRY

B.Sc., CHEMISTRY

Semester: IV CP-IV Gravimetric Analysis (P)

Ins. Hrs. /Week: 4

Course Credit: 4

Course Code: U25CH408P

GRAVIMETRIC ANALYSIS:

1. Estimation of Lead as lead chromate.
2. Estimation of Barium as barium chromate.
3. Estimation of Nickel as Nickel - DMG complex.
4. Estimation Calcium as calcium oxalate monohydrate
5. Estimation of Barium as barium sulphate.

ONLY FOR DEMONSTRATION:

1. Estimation of Copper as copper (I) thiocyanate.
2. Estimation of Magnesium as magnesium oxalate.
3. Estimation of Iron as Iron (III) oxide.

Scheme of Valuation:

Max.Marks

Internal	25 Marks
External	75 Marks
Record	10 Marks
Procedure Writing	10 Marks

Results

< 2%	-	55 Marks
2-3%	-	45 Marks
3-4%	-	35 Marks
>4%	-	25 Marks

COURSE OUTCOME

The students are able to,

1. Recognize the principles of gravimetric analysis.
2. Understand the basics of gravimetric analysis of selected cations involving methods, selection of precipitants, nucleation, aggregation of precipitate, removal of contamination and weighing a precipitate.
3. Conduct experiments to determine physical constant of Unknown compounds.
4. Use proper apparatus to minimize the errors.

TEXT BOOKS

1. John Charles Olsen, (2015), Text Book of Quantitative Chemical Analysis. Arkose Press, New Delhi.
2. Nicholas Knight, (2016), A Course in Quantitative Chemical Analysis Gravimetric and Volumetric. Leopold Classic Library. Australia.
3. Pandey OP, Bajpai DN, Giri S Dr (2010), Practical Chemistry. Revised Edition, S.Chand, New Delhi.
4. Venkateswaran. V, Veeraswamy.R, Kulanthaivelu.A.R, (2015), Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi.
5. Vogel, A. I, (2024), Text Book of Quantitative Inorganic Analysis; 6th Ed., Longman.

REFERENCES

1. John Charles Olsen, (2010), Text Book of Quantitative Chemical Analysis. Nabu Press.
2. Shikha Gulati, Sharma . JL. Shagun Manocha, (2017), Practical Inorganic Chemistry. CBS Publisher, Chennai.
3. Henry Morton, Alfert . R, (2015), The Students Practical Chemistry. Palala Press.
4. Erdey. L, (2013), Gravimetric Analysis Part 2. Vol 7. Pergamon, Oxford.
5. John G Watson, Richard J Tropp, Steven D Kohl, Xiaoliang Wang, Judith C Chow, (2024). Filter Processing and Gravimetric Analysis for Suspended Particulate Matter samples. Aerosol Science and Engineering, 1 (2), 93-105.
6. Ahluwalia, V. K., & Dhingra, S. (2025). Advanced experimental inorganic chemistry. Taylor & Francis.

E-RESOURCES

1. <https://www.elsevier.com/books/gravimetric-analysis/erdey/978-1-4831-9756-2>
2. <https://www.sciencedirect.com/book/9781483197647/gravimetric-analysis>
3. https://books.google.com/books/about/Gravimetric_Analysis.html?id=MxkSBQAAQBAJ
4. https://books.google.com/books/about/Gravimetric_Analysis.html?id=7RoSBQAAQBB
5. <https://www.amazon.in/Gravimetric-Analysis-International-Monographs-Analytical-ebook/dp/B01DT29BUU>
6. <https://doi.org/10.1007/s41810-017-0010-4>.

MAPPING WITH PROGRAMME OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	3			3			2	3	3	3	2	2
CO2	2	3	3			3	2		2	3	3	3		3
CO3	3	3	3	3		3	3	2	3	2	3	3	3	3
CO4	3	3	3	3		3	3			3	3			
CO5	3	2	3	3		2		2	2		3	3		2

3- Strong

2-Medium

1-Low

SEC-IV & V



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DEPARTMENT OF CHEMISTRY

B.Sc., CHEMISTRY

Semester: IV SEC-IV Instrumental Methods of Chemical Analysis

Ins. Hrs. /Week: 2

Course Credit: 2

Course Code: U25SECH44

UNIT-I : QUALITATIVE AND QUANTITATIVE ASPECTS OF ANALYSIS (6 hours)

S.I Units, Moles, Millimoles, Milli equivalence, Molality, Molarity, Normality, Percentage by Weight and Volume, ppm, ppb. Density and Specific Gravity of Liquids. Stoichiometry Calculations Sampling, 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. Coefficient of Variation, Confidence Limits, Q- test, F-test, T-test.

UNIT II : ATOMIC ABSORPTION SPECTROSCOPY (6 hours)

Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

UNIT III: UV-VISIBLE AND IR SPECTROSCOPY (6 hours)

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. **UV-Visible Spectrometry:** Basic principles, instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. **Infrared Spectroscopy:** Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques.

UNIT IV: THERMAL AND ELECTRO-ANALYTICAL METHODS OF ANALYSIS (6 hours)

TGA and DTA- Principle, Instrumentation, methods of obtaining Thermo grams, factors affecting TGA/DTA, Thermal analysis of silver nitrate, calcium oxalate and calcium acetate DSC- Principle, Instrumentation and applications. Electro analytical methods: polarography - principle, instrumentation and applications. Derivative polarography- Cyclic Voltammetry – principle.

UNIT V: SEPARATION AND PURIFICATION TECHNIQUES . (6 hours)

Classification, principle, Factors affecting - Solvent Extraction – Liquid - Liquid Extraction, Chromatography: Column, TLC, Paper, Gas, HPLC and Electrophoresis, Principle, Classification, Choice of Adsorbents, Solvents, Preparation of Column, Elution Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms and Rf value.

Total Lecture Hours-30

COURSE OUTCOME

The students are able to,

1. Apply error analysis in the calibration and use of analytical instruments, explain theory, instrumentation and application of flame photometry and Atomic Absorption spectrometry
2. Explain theory, instrumentation and application of UV visible and Infrared spectroscopy.
3. Able to discuss instrumentation, theory and applications of thermal and electrochemical techniques
4. Explain the use of chromatographic techniques in the separation and identification of mixtures
5. Explain the preparation of solutions, stoichiometric calculations

TEXT BOOKS

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. Gopalan. R, Subramanian. P. S and Rengarajan. K, (2007), Elements of Analytical Chemistry, Sultan Chand, New Delhi.
3. Skoog, Holler and Crouch, (2017), Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint.
4. Speyer. R, (1993), Thermal Analysis of Materials, CRC Press.
5. Day. R.A and Underwood. A.L, (2023), Quantitative Analysis, 6th edn., Prentice Hall of India Private Ltd., New Delhi.

REFERENCES

1. Skoog. D. A, West. D. M and Holler. F. J, (1998), Analytical Chemistry: An Introduction, 5th edn., Saunders college publishing, Philadelphia..
2. Dash U N, (2011), Analytical Chemistry; Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi.
3. Christian, Gary D, 2004, Analytical Chemistry, 6th Ed., John Wiley & Sons, New York.
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, (2025), Textbook of Quantitative Chemical Analysis, sixth edition Pearson Education.
6. Chaurasia, B. (2026). Textbook of instrumental methods of analysis: Theory and practical (1st ed.). CBS Publishers & Distributors.

E-RESOURCES

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.sjsu.edu>

MAPPING WITH PROGRAMME OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	3			3			2	3	3	3	2	2
CO2	2	3	3			3	2		2	3	3	3		3
CO3	3	3	3	3		3	3	2	3	2	3	3	3	3
CO4	3	3	3	3		3	3			3	3			
CO5	3	2	3	3		2		2	2		3	3		2

3- Strong 2-Medium 1-Low



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DEPARTMENT OF CHEMISTRY

B.Sc., CHEMISTRY

Semester: IV SEC-V Forensic Science

Ins. Hrs. /Week: 2

Course Credit: 2

Course Code: U25SECH45

UNIT I: POISONS

(6 hours)

Poisons - types and classification - diagnosis of poisons in the living and the dead -clinical symptoms - postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of sea foods - use of neutron activation analysis in detecting arsenic in human hair. Treatment in cases of poisoning– use of antidotes for common poisons.

UNIT-II: CRIME DETECTION

(6 hours)

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.

UNIT-III: FORGERY AND COUNTERFEITING

(6 hours)

Documents - different types of forged signatures - simulated and traced forgeries -inherent signs of forgery methods - 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.

UNIT-IV: TRACKS AND TRACES

(6 hours)

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 - Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and racehorses.

UNIT-V: MEDICAL ASPECTS

(6 hours)

Aids - causes and prevention - misuse of scheduled drugs - burns and their treatment by plastic surgery. 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 - small arms -laboratory examination of barrel washing and detection of powder residue by chemical tests.

Total Lecture Hours-30

COURSE OUTCOME

The students are able to,

1. Learn about the Poisons - types and classification of poisons in the living and the dead organisms and also get information about Postmortem.
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
3. Detect the forgery documents, different types of forged signatures
4. 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
5. Get the awareness on Aids - causes and prevention and also have an exposure on handling fire explodes.

TEXT BOOKS

1. Iqbal. SA, Liviu. M, (2011), Textbook of forensic chemistry, Discovery publishing house private limited.
2. Kelly M. Elkins, (2019), Introduction to Forensic Chemistry, CRC Press, Taylor & Francis Group.
3. Javed I. Khan, Thomas J. Kennedy, Donnell R. Christian, Jr.,(2012), Basic principles of Forensic chemistry, Humana Press, first edition.
4. Bapuly AK, (2006) Forensic Science – Its application in crime investigation, Paras Medical Publisher, Hyderabad.
5. Sharma B.R., (2025) Scientific Criminal Investigation, Universal Law Publishing Co. Pvt. Ltd, New Delhi.
6. Reddy, K. S. N. (2026). The essentials of forensic medicine and toxicology (36th ed.). Jaypee Brothers Medical Publishers.

REFERENCES

1. Richard Saferst in and Criminalistics, (2003),An Introduction to Forensic Science (College Version),Sopfestein, Printice hall, eighth edition.
2. Suzanne Bell, (2014), Forensic Chemistry, Pearson, second international edition.
3. Jay Siegel, (2015),Forensic chemistry: Fundamentals and applications, Wiley-Blackwell, first edition.
4. Max M. Houck & Jay A. Segal, (2006) Fundamentals of Forensic Science, Elsevier Academic press.
5. Henry C. Lee, Timothy Palmbach, Marilyn T. Miller, (2024) Henry Lee's Crime Scene

Book Elsevier Academic press.

6. Houck, M. M., & Siegel, J. A. (2026). Fundamentals of forensic science (2nd ed.). Elsevier.

E-RESOURCES

1. <http://www.library.ucsb.edu/ist/03-spring/internet.html>
2. <http://www.wonderhowto.com/topic/forensic-science>
3. https://www.routledge.com/rsc/downloads/ATQ50_K22324_Sample.pdf
4. https://virtuallearningacademy.net/vla/lessondisplay/lesson9011/SCIFSU01Forensic_Introduction.pdf
5. <https://catalogimages.wiley.com/images/db/pdf/9781119608967.excerpt.pdf>

MAPPING WITH PROGRAMME OUTCOMES

	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	3	2		3	2	2	2	2	3	3	3	1
CO2	3	3	3	3		3	2	2	2	2	3	3	3	3
CO3	3	2	3	2		3	1	2	3	2	3	3	3	1
CO4	3	3	3	2		3	3	2	2	2	3	3	3	1
CO5	3	2	3	2		3	2	2	2	2	3	2	3	1

3- Strong

2-Medium

1-Low

