

UNIVERSITY OF MADRAS
Chepauk, Chennai-600005

Undergraduate Programme in Chemistry

Curriculum and Syllabus

B.Sc. Chemistry

(With effect from the academic year 2023-2024)

1. INTRODUCTION

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

Chemistry is the study of composition and transformation of matter. A science that is central to energy production, health care, 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 helps learners in building a solid foundation for higher studies in Chemistry. The hands on experience the students gain in Practical enable them 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 programme will be able to present the concepts of Chemistry clearly and precisely. They can find solutions to pressing problems that mankind are facing today. They can interpret data and present their findings to both scientific community and laymen and have ability to work as a team and evolve to become an entrepreneur

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, Forensic Science etc... They have employability opportunities in public and private sector jobs in energy, pharmaceutical, Food, cosmetic industries etc...

PROGRAMME OUTCOMES (PO) OF B.SC DEGREE PROGRAMME IN CHEMISTRY

- Students will possess basic subject knowledge required for higher studies, professional and applied courses
- Students will acquire basic Practical skills & Technical knowledge along with domain knowledge of different subjects in the science & humanities stream.
- Students will develop scientific aptitude Integrate skills of analysis, critiquing, application and creativity.
- Students will employ appropriate digital tools and techniques necessary in analyzing data and creative design.

- Students will gain competence to pursue higher learning, research and careers or will be able to opt for entrepreneurship
- Students will interact meaningfully with others displaying leadership and coordination in executing projects.
- Students will demonstrate responsibility as citizens committed to national development through community outreach, wellness of self and a sustainable environment.

PROGRAMME SPECIFIC OUTCOMES

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

PSO2: Students can disseminate the basics of chemistry and advanced topics and analytical skills in organic, inorganic and physical chemistry.

PSO3: Students will be able develop creativity in academics and research.

PSO4: Students will be able apply digital tools to collect, analyze and interpret data and present scientific findings.

PSO5: gain competence to pursue higher education and career opportunities in chemistry and allied fields.

PSO6: exhibit leadership qualities to work individually and within a team in organizing curricular, co-curricular and extracurricular activities.

PSO7: apply the concepts of chemistry to solve problems in the community, entrepreneurial and research pursuits.

PSO8: exhibit competence in educational, industrial and research pursuits that contribute towards the holistic development of self and community.

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, 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, enable the students to provide solutions to industry / real life situations. The curriculum also facilitates peer learning and research aptitude in the final semester by providing an opportunity do a project.
- The General Studies and Chemistry based problem solving skills are included as mandatory components in the 'Training for Competitive Examinations' course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Industrial internship is newly introduced in the fourth semester, to expose the students to real life working environment and train the students to face challenges
- The Internship during the second year vacation will help the students gain valuable work
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting an experiment collecting and interpreting data and finally presenting the findings is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of 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 -Nanoscience

Value additions in the Revamped Curriculum:

Semester newly introduced Outcome / Benefits

Components

I	<p>Foundation Course To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning chemistry.</p>	<ul style="list-style-type: none"> • Instill confidence among students • Create interest for the subject
I, II, III, IV	<p>Skill Enhancement papers (Discipline centric / Generic / Entrepreneurial)</p>	<ul style="list-style-type: none"> • Industry ready graduates • Skilled human resource • Students are equipped with essential skills to make them employable <hr/> <ul style="list-style-type: none"> • Training on entrepreneurial skills enable the students to gain knowledge and make them ready for start-up. • Provides an opportunity for independent livelihood. • Generates self –employment. • Creates small scale entrepreneurs. • Training to girls leads to women empowerment. <hr/> <ul style="list-style-type: none"> • Skill enhancement courses help the students to gain internships, apprenticeships, field work involving data collection, compilation, analysis etc. • Enables the students to learn the operations of instruments. • Improves self-confidence. • Learns different analytical techniques. <hr/> <ul style="list-style-type: none"> • Discipline specific course helps to recognize, identify, examine and testify any and every kind of physical evidence mostly found in crime scenes. • It improves the technical knowhow of solving real life problems.
I, II, III, IV, V & VI	<p>Elective papers- An open choice of topics categorized under Generic and Discipline Centric</p>	<ul style="list-style-type: none"> • Strengthening the domain knowledge • Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature • Students are exposed to latest topics on Computer Science / IT, physics, and mathematics. • Emerging topics in higher education / industry/

		<p>Communication network / health sector etc. are introduced with hands-on-training.</p> <ul style="list-style-type: none"> • Exposure to industry molds students into solution providers. • Generates Industry ready graduates. • Employment opportunities enhanced.
II-year Vacation activity	Internship / Industrial Training	<ul style="list-style-type: none"> • Practical training at the Industry/ Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.
V	Project with Viva – voce	<ul style="list-style-type: none"> • Self-learning is enhanced. • Application of the concept to real situation is conceived resulting in tangible outcome. • Helps to explore industries and to have first-hand experience in industrial background. (when students carry out projects in industries) • Instill confidence and problem solving approach.
VI	Introduction of Professional Competency component	<ul style="list-style-type: none"> • Curriculum design accommodates all category of learners; ‘Training for Competitive Examinations’ – caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, NDA, Banking Services, CAT, JAM, TNPSC group services, etc.
Extra Credits: For Advanced Learners / Honors degree		<ul style="list-style-type: none"> • 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.
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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	12/13	13/14	13	13	20	20	92
Part IV	4	4	3	6	4	2	23
Part V	-	-	-	-	-	1	1
Total	22/23	23/24	22	25	24	23	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 for obtaining the UG degree**

B.Sc Chemistry Curriculum Design

First Year - Semester-I

Part	List of Courses	Credit	Hours	Int.	Ext.	Total
I	Tamil and Other Languages Paper-I	3	6	25	75	100
II	100L1Z: English	3	6	25	75	100
III	124C1A: General Chemistry–I CC1	5	5	25	75	100
	124C11: Quantitative Inorganic estimation (titrimetric) and Inorganic Preparations CC2	5	4	40	60	100
	Elective Course-I (Mathematics/Botany/Zoology) (Any One)					
	124E1A: Mathematics-I	3	5	25	75	100
	124E1B: Botany-I	2	3	25	75	100
	Botany-I Practical	--	2	--	--	--
	124E1C: Zoology-I	2	3	25	75	100
	Zoology-I Practical	--	2	--	--	--
IV	124S1A: Skill Enhancement Course SEC-1: Food Chemistry*	2	2	25	75	100
	100S1A: Basic Tamil-I (Other Language Students) *					
	100S1B: Advanced Tamil-I (Other Language Students) *					
	124B1A: Foundation Course FC: Role of Chemistry in Daily Life	2	2	25	75	100
		22/23	30			

*** PART-IV: SEC-1 / Basic Tamil / Advanced Tamil (Any one)**

- Students who have studied Tamil upto XII STD and also have taken Tamil in Part I shall take SEC.
- Students who have **not** studied Tamil upto XII STD and have taken any Language other than Tamil in Part-I shall take **Basic Tamil** comprising of Two Courses (level will be at 6th Std.).
- Students who have studied Tamil upto XII STD and have taken any Language other than Tamil in Part-I shall take **Advanced Tamil** comprising of Two Courses.

First Year - Semester-II

Part	List of Courses	Credit	Hours	Int.	Ext.	Total
I	Tamil and Other Languages Paper-II	3	6	25	75	100
II	100L2Z: English Paper-II	3	4	25	75	100
III	124C2A: General Chemistry–II CC3	5	5	25	75	100
	124C21: Qualitative Organic Analysis and preparation of Organic Compounds CC4	5	4	40	60	100
	Elective Paper (Mathematics/Botany/Zoology) (Any One)					
	124E2A: Mathematics-II	3	5	25	75	100
	124E2B: Botany-II	2	3	25	75	100
	124E21: Botany-I & II Practical	2	2	40	60	100
	124E2C: Zoology-II	2	3	25	75	100
	124E22: Zoology-I & II Practical	2	2	40	60	100
IV	124S2A: Skill Enhancement Course SEC-2 (NME) * Dairy Chemistry	2	2	25	75	100
	100S2A: Basic Tamil-II (Other Language Students) *					
	100S2B: Advanced Tamil-II (Other Language Students) *					
	124S2B: Skill Enhancement Course SEC-3 (Discipline Specific) Cosmetics and Personal care Products	2	2	25	75	100
		23/24	30			

Second Year - Semester-III

Part	List of Courses	Credit	Hours	Int.	Ext.	Total
I	Language	3	6	25	75	100
II	200L3Z: English	3	6	25	75	100
III	224C3A: General Chemistry–III CC5	5	5	25	75	100
	224C31: Qualitative Inorganic Analysis-CC6	5	5	40	60	100
	224E3A: Physics – I EC 3 (Theory and Practicals)	3	4	25	75	100
IV	224S3A: Skill Enhancement Course SEC-4 [Entrepreneurial Skills in Chemistry]	1	1	25	75	100
	224S3B: Skill Enhancement Course SEC-5 (Discipline Specific) [Pesticide Chemistry]	2	2	25	75	100
	Environmental Studies (EVS)	-	1			
		22	30			

Second Year - Semester-IV

Part	List of Courses	Credit	Hours	Int.	Ext.	Total
I	Language	3	6	25	75	100
II	200L4Z: English	3	6	25	75	100
III	224C4A: General Chemistry–IV CC7	5	5	25	75	100
	224C41: Physical Chemistry Practicals-CC8	5	5	40	60	100
	224E4A: Physics – II EC 4 (Theory and Practicals)	3	4	25	75	100
IV	224S4A: Skill Enhancement Course SEC-6 [Instrumental methods of Chemical Analysis]	2	2	25	75	100
	224S4B: Skill Enhancement Course SEC-7 (Discipline Specific) [Forensic Science]	2	1	25	75	100
	Environmental Studies (EVS)	2	1	25	75	100
		25	30			

Third Year - Semester-V

Part	List of Courses	Credit	Hours	Int.	Ext.	Total
III	324C5A: Organic Chemistry -I CC9	4	5	25	75	100
	324C5B: Inorganic Chemistry - I CC10	4	5	25	75	100
	324C5C: Physical Chemistry – I CC11	4	5	25	75	100
	324C51: Gravimetric analysis Practicals- CC12	4	5	40	60	100
	EC-5 (Compulsory Elective) 324E5A: Nanoscience	2	4	25	75	100
	EC-6 (Elective- choose any one) 324E5B: Industrial Chemistry / 324E5C: Pharmaceutical Chemistry	2	4	25	75	100
IV	Value Education	2	2	25	75	100
	Internship /Industrial training (Carried out in II Year Summer vacation) (30 hours)	2	-	--	--	--
		24	30			

Third Year - Semester-VI

Part	List of Courses	Credit	Hours	Int.	Ext.	Total
III	324C6A: Organic Chemistry -II CC13	4	5	25	75	100
	324C6B: Inorganic Chemistry - II CC14	4	5	25	75	100
	324C6C: Physical Chemistry -II CC15	4	5	25	75	100
	324C61: Project with viva-voce CC16	4	5	20	80	100
	EC-7 (Compulsory Elective) 324E6A: Fundamentals of Spectroscopy	2	4	25	75	100
	EC- 8 (Elective - Choose any one) 324E6B: Biochemistry / 324E6C: Polymer Science	2	4	25	75	100
IV	324S6A: Professional Competency Skill	2	2	25	75	100
V	Extension Activity	1	--	--	--	--
		23	30			