

Bachelor of Science in Chemical Sciences

in

School of Chemical Sciences (SCS)

1.1. Preamble of the Program

The discipline of Chemical Sciences as an integral part of Basic Sciences serves as the basis of critical developments for value-added chemicals, pharmaceuticals, novel materials, understanding biological processes, and establishing the theoretical basis of natural phenomena. The 4-Year BS program can be extended for one more year to complete BS-MS program, which is for 5 years. The 4-year BS with an optional 1-year MS program (BS-MS) in Chemical Sciences is designed to prepare graduates with a strong foundation in fundamental Chemistry along with Engineering for today's research and technology-driven world. The program creates a perfect harmony between Chemistry and Engineering branches by bridging the gap between chemical, physical, mathematical, computational, data, and engineering sciences. Particularly, owing to the "true" cross-disciplinary nature of the program, it can help advance the knowledge ranging from atomic-level understating of the chemical and biochemical phenomena to designing and developing new molecules, materials, and devices. As the barrier between Basic Sciences and Engineering is fast disappearing with modern innovations and their applications, the BS program in Chemical Sciences can perfectly inculcate the young minds in academia to develop and deploy chemistry-based technologies for the modern world.

1.2. Objective of the Program

The major objective of this program is to train the graduates with fundamental concepts of both Chemistry and Engineering, thereby, equipping them for taking up diverse roles in industry and academia. The program particularly aims at training young minds to creatively think about research and innovation at a very early stage through a diverse range of hands-on projects. The perfect fusion of chemistry and engineering along with specializations and minors in different branches is the goal that will prepare the students for industry and academia and motivate them toward research and innovation.

1.3. Uniqueness of the Program

The BS program offers specialization in chemistry branches, minors in engineering and humanities branches, and is highly research-oriented, which makes the program one of its kind. Particularly, it offers,

- Option for specialization in major chemistry branches, organic, inorganic, physical, and material chemistry through discipline elective courses in the 3rd and 4th year of BS.
- Option for minors in different branches including Computer Science Engineering, Communication Engineering, Electronics Engineering, Measurement and Instrumentation, Management, German Language, etc.

Due to the research-oriented nature of the program, the graduates get good exposure to research in the desired area as early as in their 4th year of the BS program. Thus, the program presents a unique opportunity for graduates to pursue a research career just after completing the BS.

1.4. Placement Prospects

The BS Chemical Sciences program graduates will have placement opportunities in various chemical, pharmaceutical, and technology industries. In addition, if one completes MS program (BS-MS, 5 year), they will have opportunity to pursue a research career in a specialized field.

1.5. Programme Structure:

Division	Sub-Division	BS Credit	BS-MS Credit
Institute Core Courses (IC)	IC Compulsory	As per the institute's 1 st -year B.Tech. curriculum with IC-I (Chemistry and Biotech. courses Compulsion) and IC-II (Physics Compulsion)	
	IC Basket		
	Humanities and Management		
	IKSMHA		
Discipline Courses	Discipline Core	59	59
	Discipline Electives (DE)	23	29
Free Electives and Research Projects	Free Electives (FE)	15	15
	Research Communication and Projects/DE	14	46
Total Credit		163	201

1.6. Semester-wise course distribution**

The semester-wise credit distribution is tabulated below

1 st and 2 nd Year (Total Credit: 84)			
Semester-I		Semester-II	
<ul style="list-style-type: none"> • Math-I Calculus (IC) • Math-II Complex and Vector Calculus (IC) • Graphics for Design (IC) • Computing and Data Science (IC) • IC-I Basket (Chemistry Compulsion) • HSS Course (HSS, Basket) • IKSMHA (IKS) 	<ul style="list-style-type: none"> 2 2 4 4 3 3 3 	<ul style="list-style-type: none"> • Math-III Linear Algebra (IC) • Math-IV ODE & Integral Transform (IC) • Applied Electronics (IC) • Applied Electronics Lab (IC) • Data Science II (IC) • IC-II Basket (Physics Compulsion) • Foundations of Design Practicum (IC) • Physics Practicum (IC) 	<ul style="list-style-type: none"> 2 2 3 2 4 3 4 2
	21		22
Semester-III		Semester-IV	
<ul style="list-style-type: none"> • Understanding Biotech. and Its Application (IC-I) • Physical Chemistry-I (CY) • Basic Organic Chemistry (CY) • Principles of Inorganic Chemistry (CY) • Discipline Elective I (DE) • Physical Chemistry Lab (CY, Lab-I) • HSS Course (HSS Basket) 	<ul style="list-style-type: none"> 3 3 3 3 3 2 3 	<ul style="list-style-type: none"> • Discipline Elective II (DE) • Physical Chemistry-II (Quantum & Spec.) (CY) • Analytical Chemistry (CY) • Discipline Elective III (DE) • Organic Chemistry Lab (CY, Lab-II) • Inorganic Chemistry Lab (CY, Lab-III) • HSS Course (HSS Basket) • Free Elective I (FE) 	<ul style="list-style-type: none"> 2 3 3 3 2 2 3 3
	20		21

3 rd and 4 th Year (Total Credit: 79)			
Semester-V		Semester-VI	
<ul style="list-style-type: none"> • Organic Reactions & Mechanisms (CY) • Chemistry of Main Group Elements (CY) • Advanced Quantum Chemistry (CY) • Discipline Elective IV (DE) • Physical Chemistry Laboratory (CY) • Inorganic Chemistry Laboratory (CY) • Research Literature Presentation I (P) 	<ul style="list-style-type: none"> 3 3 3 3 3 3 P/F(1) 	<ul style="list-style-type: none"> • Photochemistry & Pericyclic Reactions (CY) • Chemistry of Transition Elements (CY) • Symmetry and Group Theory (CY) • Discipline Elective V (DE) • Discipline Elective VI (DE) • Organic Chemistry Laboratory (CY) • Research Literature Presentation II (P) 	<ul style="list-style-type: none"> 3 3 3 3 3 3 P/F(1)
	19		19
Semester-VII		Semester-VIII	
<ul style="list-style-type: none"> • Discipline Elective VII (DE) • Chemical & Statistical Thermodynamics (C) • Introduction Organometallic Chemistry (C) • Free Elective II (FE) • Free Elective III (FE) • Undergraduate Research Project I* (P) 	<ul style="list-style-type: none"> 3 3 3 3 3 6 	<ul style="list-style-type: none"> • Reaction Dynamics, Kinetics & Catalysis (C) • Heterocyclic Chemistry (C) • Discipline Elective VIII (DE) • Free Elective IV (FE) • Free Elective V (FE) • Undergraduate Research Project II* (P) 	<ul style="list-style-type: none"> 3 2 3 3 3 6
	21		20

*Research Lab I and II in the 7th and 8th semesters is optional, students can opt for discipline electives in place of the research lab if they wish to.

5 th Year (Total Credit: 38)			
Semester-IX		Semester-X	
• Discipline Elective IX (DE)	3	• Discipline Elective X (DE)	3
• Postgraduate Project - I (PGP-I)	16	• Postgraduate Project - II (PGP-II)	16
	19		19

*The two discipline elective courses at the MS level 9th and 10th semesters (6 credits) can be completed before without violating the maximum allowed credit in a semester to have more time for MS projects in the 5th year.

**Specific course names, content, and credit structure (L-T-P-C) for the 1st and 2nd year CY courses are being worked out.

5th Year (Total Credit: 38) is Optional for BS-MS only.

1.7. Required courses for chemistry specializations

For specialization in a specific chemistry branch, students need to complete at least *12 credits* from discipline electives with the following mandatory courses (to be updated) specific to a branch.

Organic	Organic Spectroscopy Natural Product Synthesis Asymmetric Organic Synthesis Reagents in Organic Synthesis
Inorganic	Advanced Inorganic Spectroscopy Bioinorganic Chemistry - -
Physical	Computational Chemistry Basic and Applied Electrochemistry Numerical Methods, Computer Programming, Data Analysis -
Material	Science and Technology of Nanomaterials Introduction to Polymer Science & Technology Hydrogen Generation and Storage Applied Polymer and Material Chemistry

1.8. List of Available Discipline Electives (DE) for BS

Senate Approved Courses

1. CY241: Nanoscale Science and Technology
2. CY342: Nanoscience: Understanding Small Systems
3. CY344: Food Chemistry Processing: Preservation and Storage
4. CY541: Fundamentals of Organic Chemistry
5. CY522: Computational Chemistry
6. CY556: Organic Spectroscopy
7. CY515: Advanced Inorganic Spectroscopy
8. CY547: Chemical Crystallography
9. CY540: Bioinspired Materials

10. CY552: Hydrogen Generation and Storage
11. CY554: Science and Technology of Nanomaterials
12. CY555: Introduction to Polymer Science & Technology
13. CY641: Polymer Synthesis
14. CY642: Molecular and Bio-electronics
15. CY643: Advanced Analytical Techniques
16. CY644: Bioinorganic Chemistry
17. CY645: Reagents in Organic Synthesis
18. CY670: Fluorescence Spectroscopy, Microscopy and Applications

To Be Proposed

19. CYXXX: Numerical Methods, Basic Computer Programming and Data Analysis in Chemistry
20. CYXXX: Applied Polymer and Materials Chemistry

1.9. Suggested courses for minors

As per the institute's B.Tech. curriculum requirements. Students can select the free electives as per the minor requirements to obtain minor in a specific branch.