- **Summary**

BS Chemistry 4 years (8 semesters) program

Semester	Credit Hours		
	Theory	Lab	Total
1st	14	04	18
2nd	14	03	17
3rd	14	04	18
4th	14	04	18
5th	13	05	18
6th	17	01	18
7th	14	01	15
8th	13	02	15
Total	113	24	137

PROGRAM STRUCTURE:

Eligibility: At least 2nd Div. (45% marks) in intermediate or equivalent (12 years of education) with Chemistry (For admission in 5th semester as lateral entry in Fall 2025 & onwards only those candidates will be entertained who passed their ADS under new UEP 2023 with 2.00 out 4.00 CGPA in semester system and at least 2nd div. or 45% marks in annual/terminal system). For students who have not studied the subject of Chemistry or General Chemistry in prior qualification, must study 2 deficiency courses namely General Chemistry–I and General Chemistry–II having minimum learning standards. Passing these subjects is mandatory for student's further continuation in the program.

Program Duration: 04 Year; 8 semesters (minimum) and up to 12 semesters (06 years

maximum). The maximum limit is further extendable in accordance with HEC semester rules

Degree Requirements: 137 credit hours with the following breakup:

General Education (Gen Ed) Requirements:	32 Credit Hours (13 Courses)
	2 Credit Hours (2 courses)

[Understanding of Holy Quran-I (UHQ-501) & Understanding of Holy-II (UHQ-502) can be offered in any semester]

Disciplinary/Major Requirements:	81 Credit Hours (27 Courses)
Interdisciplinary:	18 Credit Hours (6 Courses)
Internship/Field Experience (I/FE):	03 Credit Hours
Capstone Project/Research (CP/R):	03 Credit Hours
	Total Credit Hours = 139

Semester Duration: 16-18 weeks for regular semesters (1-2 weeks for examination) 8-9 weeks for summer semesters (1 week for examination)

Course Load (per semester): 15-18 credit hours for regular semesters, up-to 8 credit hours for summer semesters (for remedial/deficiency/failure/repetition courses only)

3 Credit Hours (Theory): 3 classes (1 hour each) or 2 classes (1.5 hour each) or 1 class (3 hours) per week throughout the semester

1 Credit Hours (Lab / Field Work): 1 credit hour in laboratory or practical work / project requires lab contact of 3 hours per week throughout the semester.

Note: Department of Chemistry may offer summer sessions after 2nd, 4th and 6th semesters.

Semester-I			
Course Code	**Course Title**	**Credit Hours**	**Catagory**
CHEM-501	Fundamentals of Chemistry	3(2-1)	Major
CHEM-502	Principles of Biochemistry	3(2-1)	Interdisciplinary
QRE-501	Quantitative Reasoning –I	3(3-0)	General Education
ICT-501	Applications of Information and Communication Technology	3(2-1)	General Education
ENG-501	Functional English	3(3-0)	General Education
NS-501	Natural Science /[1] Pool of Natural Sciences	3(2-1)	General Education
Total Credit Hours: 18			

Semester-II			
Course Code	**Course Title**	**Credit Hours**	**Catagory**
CHEM-503	Principles of Organic Chemistry	3(2-1)	Major
CHEM-504	Principles of Inorganic Chemistry	3(2-1)	Major
CHEM-505	Principles of Physical Chemistry	3(2-1)	Major
QRE-502	Quantitative Reasoning –II	3(3-0)	General Education
PS-501	Pakistan Studies *	2(2-0)	General Education
ENG-502	Expository Writing *	3(3-0)	General Education
Total Credit Hours: 17			

Semester-III			
Course Code	**Course Title**	**Credit Hours**	**Catagory**
CHEM-506	Fuel Chemistry	3(2-1)	Major
CHEM-507	Principles of Analytical Chemistry	3(2-1)	Major
CHEM-508	Principles of Polymer Chemistry	3(2-1)	Major
CHEM-509	Introduction to Nano-chemistry	3(2-1)	Major
ICP-501	Ideology & Constitution of Pakistan	2(2-0)	General Education

ISL-501/ETH-501	Islamic Studies * (Ethics for non-Muslim students)	2(2-0)	General Education
AH-501	Arts & Humanities [2]	2(2-0)	General Education
Total Credit Hours: 18			

Semester-IV			
Course Code	**Course Title**	**Credit Hours**	**Catagory**
CHEM-510	Forensic Chemistry	3(2-1)	Major
CHEM-511	Industrial Chemistry	3(2-1)	Major
CHEM-512	Environmental Chemistry	3(2-1)	Major
CHEM-513	Pharmaceutical Chemistry	3(2-1)	Major
PSY-501	Introduction to Psychology/[3]Pool of Social Sciences	2(2-0)	General Education
CCE-501	Civics & Community Engagement	2(2-0)	General Education
EP-501	Entrepreneurship	2(2-0)	General Education
Total Credit Hours: 18			

List of Courses of Various Pools

[1]Pool of Natural Sciences

Course Code	**Title of Course**
PHY-509	General Physics
GSGC-XXX	The Science of Global Challenges
GES-XXX	Everyday Science
GESC-XXX	Environmental Science
GCHEM-XXX	Applied Chemistry
GZOO-XXX	Introduction to Zoology
GBIO-XXX	Introduction to Botany
GFNS-XXX	Fundamentals of Natural Sciences

[2]Pool of Arts & Humanities

Course Code	Title of Course
FWLE-XXX	Fables, Wisdom Literature, and Epic
SPE-XXX	Space, Place, and Experiences
PM-XXX	Project Management
GS-XXX	Gulsitan e Sadi
CLS-XXX	Cultural Studies
IH-XXX	Islamic History
AL-XXX	Arabic as an International Language
PP-XXX	Professional Practices

[3]Pool of Social Sciences

Course Code	Title of Course
IP-XXX	Introduction to Psychology
IE-XXX	Introduction to Economics
IAF-XXX	Introduction to Accounting and Finance
IM-XXX	Introduction to Management
IM-XXX	Introduction to Marketing
IS-XXX	Introduction to socialology
PS-XXX	Pakistan Studies

Semester-V			
Course Code	**Course Title**	**Credit Hours**	**Catagory**
CHEM-601	Advanced Organic Chemistry	3(2-1)	Major
CHEM-602	Advanced Inorganic Chemistry	3(2-1)	Major
CHEM-603	Advanced Physical Chemistry	3(3-0)	Major
CHEM-604	Advanced Analytical Chemistry	3(2-1)	Major
CHEM-605	Soil Chemistry	3(2-1)	Major
CHEM-606	Computational Chemistry	3(2-1)	Major

Total Credit Hours: 18

Semester-VI			
Course Code	**Course Title**	**Credit Hours**	**Catagory**
CHEM-607	Agricultural Chemistry	3(2-1)	Major
CHEM-6--	Elective – I **	3	Major
CHEM-6--	Elective – II **	3	Major
CHEM-608-	Scientific Writing & Research Methods	3(3-0)	Interdisciplinary
CHEM-609	Statistics for Chemists	3(3-0)	Interdisciplinary
CHEM-614	Internship***	3	Internship
Total Credit Hours: 18			

Semester-VII			
Course Code	**Course Title**	**Credit Hours**	**Category**
CHEM-610	Chemical Safety & Risk Management	3(3-0)	Major
CHEM-6--	Elective – III **	3	Major
CHEM-6--	Elective – IV **	3	Major
CHEM-6--	Elective – V **	3	Major
CHEM-611	Materials Science	3(2-1)	Interdisciplinary
Total Credit Hours: 15			

Semester-VIII			
Course Code	**Course Title**	**Credit Hours**	**Category**
CHEM-6--	Elective – VI **	3	Major
CHEM-6--	Elective – VII **	3	Major
CHEM-612	Artificial Intelligence in Chemistry	3(2-1)	Interdisciplinary
CHEM-613	Quality Control & Assurance	3(2-1)	Interdisciplinary
CHEM-615	Capstone	3	Capstone
Total Credit Hours: 15			

* For Muslim students only. Non-Muslim students may opt Ethics etc.

** For electives, read in conjunction with guidance given on "**Standard Nomenclature**" in HEC Curriculum Booklet – Chemistry published in 2025 and circulated vide notification No. HEC/CD/NCRC/CHEM/2025/7163 dated 27-02-2025. The university / department may offer any 7 courses from either the general pool of electives or from within one of the specializations keeping in view availability of academic, human and infrastructural resources. Credit combination (reflecting balance of theory and lab / field work) may be arranged in accordance with the nature of the course.

*** Internship of 3 credit hours is a mandatory degree award requirement for Bachelor of Science in Chemistry. Internship of 6 to 8 weeks (preferably undertaken during semester or summer break) must be graded by a faculty member in collaboration with the supervisor in the field. This requirement cannot be substituted with additional course work, capstone or any project work.

Specialization 1: Inorganic Chemistry

Below is the recommended list of courses within the given specialization. The concerned department may offer any 7 courses from the following list or any other course as elective(s) relevant to the given specialization keeping in view its available academic, human and infrastructural resources.

Bioinorganic Chemistry (CHEM-617)
Catalysis in Inorganic Chemistry (CHEM-618)
Chemistry of Transition Metals (CHEM-619)
Coordination Chemistry (CHEM-620)
Crystallography (CHEM-621)
Group Theory (CHEM-622)
Inorganic Materials Chemistry (CHEM-623)
Inorganic Photochemistry (CHEM-624)
Inorganic Polymers (CHEM-625)
Inorganic Reaction Mechanisms (CHEM-626)
Lanthanide & Actinide Chemistry (CHEM-627)
Main Group Chemistry (CHEM-628)
Nuclear & Radiochemistry (CHEM-629)
Organometallics (CHEM-630)
Inorganic Spectroscopy (CHEM-631)

Specialization 2: Organic Chemistry

Below is the recommended list of courses within the given specialization. The concerned department may offer any 7 courses from the following list or any other course as elective(s) relevant to the given specialization keeping in view its available academic, human and infrastructural resources.

Green Organic Synthesis (CHEM-633)
Heterocyclic Chemistry (CHEM-634)
Medicinal Chemistry (CHEM-635)
Molecular Rearrangements (CHEM-636)
Named Organic Reactions (CHEM-637)
Natural Product Chemistry (CHEM-638)
Organic Electronics (CHEM-639)
Organic Photochemistry (CHEM-640)

Organic Reaction Mechanisms (CHEM-641)
Organic Spectroscopy (CHEM-642)
Organometallic Chemistry (CHEM-643)
Protective Groups in Organic Synthesis (CHEM-644)
Reactive Intermediates (CHEM-645)
Stereochemistry (CHEM-646)
Synthetic Organic Chemistry (CHEM-647)

Specialization 3: Physical Chemistry

Below is the recommended list of courses within the given specialization. The concerned department may offer any 7 courses from the following list or any other course as elective(s) relevant to the given specialization keeping in view its available academic, human and infrastructural resources.

Advanced Material Chemistry (CHEM-649)
Chemical Kinetics & Dynamics (CHEM-650)
Chemical Thermodynamics (CHEM-651)
Colloids & Surfactants (CHEM-652)
Computational Methods in Physical Chemistry (CHEM-653)
Electrochemistry (CHEM-654)
Molecular Spectroscopy (CHEM-655)
Nuclear & Radiation Chemistry (CHEM-656)
Photochemistry (CHEM-657)
Physical Chemistry of Polymers (CHEM-658)
Physical Chemistry of Solutions (CHEM-659)
Quantum Mechanics (CHEM-660)
Solid State Chemistry (CHEM-671)
Surface Chemistry (CHEM-662)
Symmetry & Group Theory (CHEM-663)

Specialization 4: Analytical Chemistry

Below is the recommended list of courses within the given specialization.The concerned department may offer any 7 courses from the following list or any other course as elective(s) relevant to the given specialization keeping in view its available academic, human and infrastructural resources.

Advanced Chromatography (CHEM-664)
Advanced Forensic Chemistry (CHEM-665)
Atomic Spectroscopy (CHEM-666)
Chemometrics in Analytical Chemistry (CHEM-667)
Electroanalytical Chemistry (CHEM-668)
Environmental Analytical Chemistry (CHEM-669)
Hyphenated Analytical Techniques (CHEM-670)
Mass Spectrometry & Applications (CHEM-671)
Molecular Spectroscopy (CHEM-672)
Pharmaceutical Analysis (CHEM-673)
Quality Control & Quality Assurance Analysis (CHEM-674)
Sample Preparation Techniques (CHEM-675)

Sensor Technology & Applications (CHEM-676)
Separation Techniques in Analytical Chemistry (CHEM-677)
Surface Analysis Techniques (CHEM-678)

Specialization 5: Fuel Chemistry

Below is the recommended list of courses within the given specialization.The concerned department may offer any 7 courses from the following list or any other course as elective(s) relevant to the given specialization keeping in view its available academic, human and infrastructural resources.

Biofuels & Bioenergy Production (CHEM-69)
Catalysis in Sustainable Energy (CHEM-680)
Chemistry of Carbon Capture (CHEM-681)
Chemistry of Renewable Energy Sources (CHEM-682)
Electrochemistry in Energy Systems (CHEM-683)
Energy Policy & Environmental Impact (CHEM-684)
Energy Storage Devices (CHEM-685)
Fossil Fuel Chemistry (CHEM-686)
Fuel Cell Chemistry & Technology (CHEM-687)
Hydrogen Production & Storage (CHEM-688)
Nuclear Fuel Chemistry (CHEM-689)
Petrochemicals (CHEM-690)
Propellants (CHEM-691)
Sustainable Energy Systems (CHEM-692)
Thermochemical Conversion Processes (CHEM-693)

Specialization 6: Industrial Chemistry

Below is the recommended list of courses within the given specialization.The concerned department may offer any 7 courses from the following list or any other course as elective(s) relevant to the given specialization keeping in view its available academic, human and infrastructural resources.

Advanced Chemical Reactor Design (CHEM-694)
Bioprocess Engineering in Industry (CHEM-695)
Chemical Process Safety & Hazard Management (CHEM-696)
Chemistry of Fuels & Lubricants (CHEM-697)
Corrosion Science & Protection (CHEM-698)
Cosmetics Industry (CHEM-699)
Industrial Electrochemistry (CHEM-6xx)
Industrial Organic Synthesis (CHEM-6xx)
Industrial Polymer Chemistry (CHEM-6xx)
Industrial Waste Treatment & Pollution Control (CHEM-xx)
Industrial Water Treatment (CHEM-6xx)
Petroleum Chemistry (CHEM-6xx)
Process Chemistry & Industrial Catalysis (CHEM-6xx)
Quality Management in Industry (CHEM-6xx)
Scale-up & Process Development in Industry (CHEM-6xx)

Specialization 7: Polymer & Materials Chemistry

Below is the recommended list of courses within the given specialization.The concerned department may offer any 7 courses from the following list or any other course as elective(s) relevant to the given specialization keeping in view its available academic, human and infrastructural resources.

Biomaterials & Tissue Engineering (CHEM-585)
Characterization of Polymers & Materials (CHEM-586)
Chemistry of Coatings & Adhesives (CHEM-587)
Composite Materials & Applications (CHEM-588)
Conducting Polymers & Applications (CHEM-589)
Functional Polymers & Smart Materials (CHEM-590)
High-Performance Polymers (CHEM-591)
Nanostructured Materials (CHEM-592)
Polymer Blends & Alloys (CHEM-593)
Biodegradable & Biocompatible Polymers (CHEM-594)
Polymer Degradation & Stability (CHEM-595)
Polymer Nanocomposites (CHEM-696)
Polymer Rheology & Morphology (CHEM-597)
Polymerization Techniques (CHEM-598)
Synthesis & Processing of Ceramic Materials (CHEM-599)

Specialization 8: Agricultural Chemistry

Below is the recommended list of courses within the given specialization. The concerned department may offer any 7 courses from the following list or any other course as elective(s) relevant to the given specialization keeping in view its available academic, human and infrastructural resources.

Agricultural Chemical & Toxicology (CHEM-521)
Agricultural Waste Management (CHEM-522)
Agrochemicals & Plant Nutrition (CHEM-523)
Analytical Techniques in Agricultural Chemistry (CHEM-524)
Chemistry of Fertilizers (CHEM-525)
Chemistry of Food Preservatives (CHEM-525)
Chemistry of Herbicides (CHEM-527)
Chemistry of Pesticides (CHEM-528)
Chemistry of Plant Protection Agents (CHEM-529)
Environmental Impacts of Agricultural Chemicals (CHEM-530)
Nanotechnology in Agriculture (CHEM-531)
Pesticide Residue Analysis (CHEM-532)
Plant Growth Regulators & Hormones (CHEM-533)
Post-Harvest Chemistry (CHEM-534)
Soil Remediation (CHEM-535)

Specialization 9: Computational Chemistry

Below is the recommended list of courses within the given specialization. The concerned department may offer any 7 courses from the following list or any other course as elective(s) relevant

to the given specialization keeping in view its available academic, human and infrastructural resources.
Artificial Intelligence in Chemistry (CHEM-537)
Bioinformatics & Computational Biology (CHEM-538)
Cheminformatics (CHEM-539)
Computational Approaches in Nanotechnology (CHEM-540)
Computational Biochemistry (CHEM-541)
Computational Materials Science (CHEM-542)
Computer Aided Drug Design (CHEM-543)
Density Functional Theory (CHEM-544)
Molecular Dynamics Simulations (CHEM-545)
Molecular Modeling (CHEM-546)
Next Generation Data Analysis (CHEM-547)
Quantum Chemistry Algorithms (CHEM-548)
Quantum Mechanics & Spectroscopy (CHEM-549)
Simulation of Chemical Reactions (CHEM-550)
Visualization Techniques in Computational Chemistry (CHEM-551)

Specialization 10: Environmental Chemistry
Below is the recommended list of courses within the given specialization. The concerned department may offer any 7 courses from the following list or any other course as elective(s) relevant to the given specialization keeping in view its available academic, human and infrastructural resources.
Atmospheric Chemistry & Air Pollution (CHEM-552)
Bioindicators in Environmental Monitoring (CHEM-553)
Climate Change Chemistry (CHEM-554)
Ecotoxicology (CHEM-555)
Environmental Data Analysis & Modeling (CHEM-556)
Environmental Impact of Industrial Chemicals (CHEM-557)
Environmental Nanotechnology (CHEM-558)
Environmental Toxicology & Risk Assessment (CHEM-559)
Greenhouse Gases (CHEM-560)
Hazardous Waste Management (CHEM-561)
Marine & Aquatic Chemistry (CHEM-562)
Renewable Energy & Environmental Sustainability (CHEM-563)
Soil and Groundwater Contamination (CHEM-564)
Waste Management & Recycling (CHEM-565)
Water Treatment & Purification Technologies (CHEM-566)

Specialization 11: Forensic Chemistry
Below is the recommended list of courses within the given specialization. The concerned department may offer any 7 courses from the following list or any other course as elective(s) relevant to the given specialization keeping in view its available academic, human and infrastructural resources.
Arson & Fire Debris Analysis (CHEM-568)
Chemical Analysis of Explosives (CHEM-569)
Crime Scene Chemistry & Evidence Collection (CHEM-570)

Digital Forensics & Cyber Chemistry (CHEM-571)
DNA Analysis in Forensic Science (CHEM-572)
Fingerprint Chemistry (CHEM-573)
Forensic Analysis of Controlled Substances (CHEM-574)
Forensic Anthropology (CHEM-575)
Forensic Document Examination (CHEM-576)
Forensic Microscopy (CHEM-577)
Forensic Odontology (CHEM-578)
Forensic Serology (CHEM-579)
Forensic Toxicology & Drug Analysis (CHEM-580)
Toxicology in Forensic Science (CHEM-581)
Trace Evidence & Fiber Analysis (CHEM-582)

Specialization 12: Pharmaceutical Chemistry

Below is the recommended list of courses within the given specialization. The concerned department may offer any 7 courses from the following list or any other course as elective(s) relevant to the given specialization keeping in view its available academic, human and infrastructural resources.

Biopharmaceuticals & Biotechnology (CHEM-xxx)
Chemistry of Antibiotics & Antivirals (CHEM-xxx)
Clinical Pharmacology & Toxicology (CHEM-xxx)
Drug Delivery Systems (CHEM-xxx)
Drug Design & Molecular Modeling (CHEM-xxx)
Drug Discovery & Development (CHEM-xxx)
Drug Stability & Degradation (CHEM-xxx)
Immuno-pharmaceuticals (CHEM-xxx)
Medicinal Chemistry of Natural Products (CHEM-xxx)
Pharmaceutical Analysis & Quality Control (CHEM-xxx)
Pharmaceutical Formulation & Technology (CHEM-xxx)
Pharmacognosy (CHEM-xxx)
Pharmacokinetics & Pharmacodynamics (CHEM-xxx)
Radiopharmaceutical Chemistry (CHEM-xxx)
Regulatory Affairs in Pharmaceuticals (CHEM-xxx)

Specialization 13: Soil Chemistry

Below is the recommended list of courses within the given specialization. The concerned department may offer any 7 courses from the following list or any other course as elective(s) relevant to the given specialization keeping in view its available academic, human and infrastructural resources.

Advanced Soil & Analytical Techniques (CHEM-xxx)
Chemistry of Soil Erosion & Sedimentation (CHEM-xxx)
Soil Acidity & Alkalinity (CHEM-xxx)
Soil Carbon Sequestration & Climate Change (CHEM-xxx)
Soil Chemistry for Heavy Metals (CHEM-xxx)
Soil Chemistry for Sustainable Land Use (CHEM-xxx)
Soil Contaminants & Remediation Techniques (CHEM-xxx)
Soil Mineralogy & Chemistry (CHEM-xxx)

Soil Nutrient Bioavailability & Management (CHEM-xxx)
Soil Organic Matter Chemistry (CHEM-xxx)
Soil Redox Reactions & Biogeochemistry (CHEM-xxx)
Soil Salinity & Sodality Management (CHEM-xxx)
Soil Water Interactions & Chemistry (CHEM-xxx)
Soil-Fertilizers Chemistry (CHEM-xxx)
Soil-Plant Nutrient Dynamics (CHEM-xxx)

Specialization 14: Biochemistry

Below is the recommended list of courses within the given specialization. The concerned department may offer any 7 courses from the following list or any other course as elective(s) relevant to the given specialization keeping in view its available academic, human and infrastructural resources.

Advanced Molecular Biological Techniques (CHEM-xxx)
Cellular Signaling (CHEM-xxx)
Clinical Biochemistry (CHEM-xxx)
Endocrinology (CHEM-xxx)
Enzymology & Catalysis (CHEM-xxx)
Glycobiology (CHEM-xxx)
Lipid Biochemistry (CHEM-xxx)
Metabolic Disorders (CHEM-xxx)
Metabolic Pathways & Regulation (CHEM-xxx)
Molecular Immunology (CHEM-xxx)
Neurochemistry (CHEM-xxx)
Nucleic Acid Chemistry (CHEM-xxx)
Plant Biochemistry (CHEM-xxx)
Protein Structure & Functions (CHEM-xxx)
Structural Biology(CHEM-xxx)

Deficiency Courses:

Higher Secondary School Certificate (involving 12 years of schooling) or an IBCC equivalent qualification in any **science group** is the basic eligibility requirement for admission in the Bachelor of Science in Chemistry. For students, **who have not studied the subject of Chemistry or General Chemistry in prior qualification** (like DAE etc.), must study two deficiency courses namely "General Chemistry – I" and "General Chemistry – II". Passing these subjects is mandatory for student's further continuation in the BS program.

Semester Zero			
Course Code	**Course Title**	**Credit Hours**	**Category**
CHEM-401	General Chemistry – I	3 (2-1)	Deficiency
CHEM-402	General Chemistry – II	3 (2-1)	Deficiency
Total Credit Hours: 06			