

Draft Proposal
NEW Undergraduate Programs in Chemistry

Department of Chemistry
College of Science
Illinois Institute of Technology

Approved by the Chemistry Faculty on Oct 21, 2016
Supported by Chair of Chemistry Department
Supported by the Dean of the College

New Bachelor of Science Degree Programs

BS in Bioanalytical Chemistry
BS in Environmental Chemistry
BS in Forensic Chemistry
BS in Medicinal Chemistry
BS in Computational Chemistry and Biochemistry

Highlights

- The First and unique BS Programs in the Nation, the state of Illinois, and/or the city of Chicago
- No Change in BS Degree Requirement (**127-128 credits**)
- American Chemical Society (ACS)-Accredited BS Degree Programs
- Credit hours required for ACS-Approved BS program (**120**)
- Credit hours required for all Peer BS-Chemistry Programs in the Chicago area (**120**)
- MUST Present Benefits and Compelling Reasons for Enrollment in Illinois Tech Chemistry
- Use 18 Elective Credits (6 Chemistry and 12 Free Electives) for Recruiting and Advanced Training
- Created Attractive, Diverse, and Marketable New BS Programs
- Highly Affordable Programs that can be designed and taught by the Chemistry Department
- Chemistry Faculty anticipate creation of several T/TT faculty lines in the near future
- The Area-Focused BS programs to significantly increase undergraduate enrollment through aggressive marketing and recruiting.

I. BACKGROUND

In 2005, the Chemistry Division at the Department of Biological, Chemical, and Physical Sciences (BSPS) launched the following Optional BS degree programs in Chemistry.

- BS Chemistry with emphasis in Biological Chemistry
- BS Chemistry with emphasis in Chemical Education
- BS Chemistry with emphasis in Chemical Physics
- BS Chemistry with emphasis in Material Chemistry
- BS Chemistry with emphasis in Pharmaceutical Chemistry
- BS Chemistry with emphasis in Polymer Chemistry

However, enrollment in the optional degree programs has been extremely low. Over the past 10 years, only less than a total of 5 chemistry majors have been enrolled in the optional degree programs. One of the main reasons for such low enrollment is a very demanding curriculum including all standard-lecture based courses (15-18 credits) required for the optional BS degrees. As such, the optional degree programs present no clear benefit and have not been successful in recruiting students and improving visibility of Illinois Tech Chemistry

The Chemistry faculty now propose to **i)** Cancel the Optional BS Degree Programs and **ii)** Launch New *Viable and Marketable* BS programs to *significantly* increase undergraduate enrollment in Chemistry.

II. STRATEGY and DIRECTION: Systematic Review of Peer Chemistry Programs

As the first step to set a strategic direction to create successful new BS programs in Chemistry, the chemistry undergraduate program committee has conducted extensive search and review of American Chemical Society (ACS)-accredited chemistry programs offered by the peer institutions in USA. Our key findings are summarized below.

Figure 1. Search for ACS-Approved BS Programs in USA



More Affordable Peer Chemistry Programs (120 vs 128 credits): While ACS-approved chemistry programs at the major and local academic institutions require 120 credit hours, Illinois Tech Chemistry offers BS degree in Chemistry requiring higher credits (127-128 with 58 credits for required chemistry courses). Other peer chemistry programs at the academic institutions in the city of Chicago also require 120 credits (Table 1). Illinois Tech has provided students with a rigorous and high quality education in Chemistry as evidenced by the requirement of credits and chemistry courses. However, the demanding

credit requirement in compliance with Illinois Tech’s educational goal constitutes Illinois Tech Chemistry program the least affordable, at least in the Chicago land.

Table 1. Credits required for BS in Chemistry Degree in Peer Programs

	UIC	Loyola	DePaul	Illinois Tech
Credits Required for BS Degree	120	120	120	128
Credits for Required Chemistry Courses	46	45	48	58
Enrollment (Fall 2016)		> 440	> 130	27

Diverse, Specialized, Customized, and Area-Focused Undergraduate Programs: The committee concurs that many chemistry departments at US academic institutions offer diverse BS degree programs in addition to the traditional BS degree in Chemistry and have crafted specialized and area-focused BS programs with a good overlap in curriculum (Table 2). For instance, the department of chemistry at University of South Florida offers three medical-related BS degree programs, and one of the programs, BS in Biomedical Science has an unusually high undergraduate enrollment (> 3,000 majors).

Table 2. BS Programs in Chemistry Departments and Current Enrollment

	Ohio University	UC Davis	U. of South Florida	Michigan Tech U
Program	BS-Chem	BS-Chem	BS-Chem	BS in Chemistry
	BS-Biochemistry	BS in Chemical Physics	BS-Biomedical Sci	BS-Pharm Chem
	BS-Pre-Dentistry	BS in Pharm Chem	BS-Medical Technology	BS-Biochem/Mol Biol
	BS-Environmental Chem	BS-Environ Chem track	BS-Interdisc Natural Sci	BS-ChemInformatics
	BS-Forensic Chem	BS-Forensic Chem track		
Enrollment	> 400	~ 800	> 3,000	~ 100

III. JUSTIFICATION and CRITERIA: New BS Programs at Illinois Tech Chemistry

At Illinois Tech, the Chemistry Department has provided a rigorous and high quality education in Chemistry. Unlike other local peer programs based on 120 credit hours, the traditional Illinois Tech BS degree in Chemistry requires a minimum of 127/128 credits. We are proposing to use the extra demanding credits for advanced training in specialized areas. We anticipate that in the new BS programs, students will be trained as viable candidates with good entry-level skills in job market and for entrance to graduate programs including medical and pharmacy school. The students will have learning opportunities to gain various hands-on techniques by taking the lab courses customized for industrial need in addition to the standard lecture-based courses. The students are expected to develop good basic understanding of the subject matter and sound knowledge of chemical applications to the specialized fields. This in-depth and crafted training approach will benefit students in the specialized programs with requisite educational background to develop their competitive career paths.

We first identified the core areas for creation of new BS programs: Bio, Medicine, Data, Analytics, Environment, and Safety (Figure 2 and Table 3). We then selected the proposed BS degree programs based on our review of various factors: **i)** Unique BS degree programs, at least in the Chicago area; **ii)** Major areas attractive to high school and undergraduate students; **iii)** Specialized degrees in high demand from Industry; **iv)** Undergraduate programs in high growth and enrollment at peer institutions; **v)** Affordable programs that can be taught and designed by Illinois Tech Chemistry faculty; **vi)** Curriculum in good overlap for area-focused multi-degree programs.

Figure 2. Identification of the core area for new BS programs

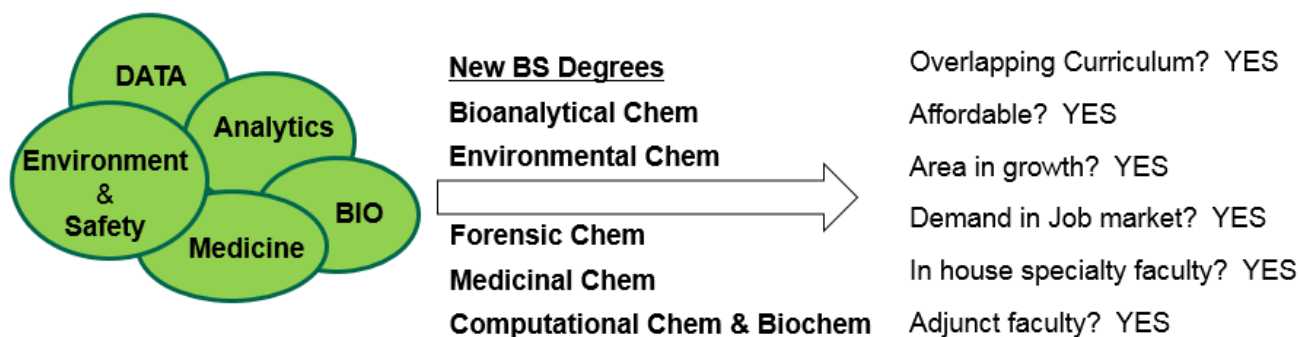


Table 3. Overlapping Curriculum

Program	Analytical	Data Analytics	Biological	Computational Drug Design
Bioanalytical Chemistry	X	X	X	
Environmental Chemistry	X	X	X	
Forensic Chemistry	X	X	X	
Medicinal Chemistry	X	X	X	X
Computational Chem & Biochem		X	X	X

IV. MARKET ANALYSIS and IMPACT on CHEMISTRY ENROLLMENT

We anticipate that the new BS degree program should make a significant impact on undergraduate enrollment in Illinois Tech Chemistry. The proposed new BS programs are unique, marketable, and attractive to high school and undergraduate students. No peer local institutions offer any of the new BS programs. Illinois Tech will be the FIRST institution to offer the Bioanalytical Chemistry program and will be one of 6 institutions to train students in Medicinal/Pharmaceutical Chemistry BS programs and will be the only institution to offer Forensic and Environmental Chemistry and Computational Chemistry and Biochemistry degrees in the city of Chicago.

Employment of Chemists is predicted to be in slow growth (3%, Figure 3, US BLS, 2014-24). However, jobs related to the new BS Chemistry programs including Environmental and Forensic Chemistry are projected to be in high demand with 8-21% projected employment growth rate, US BLS).

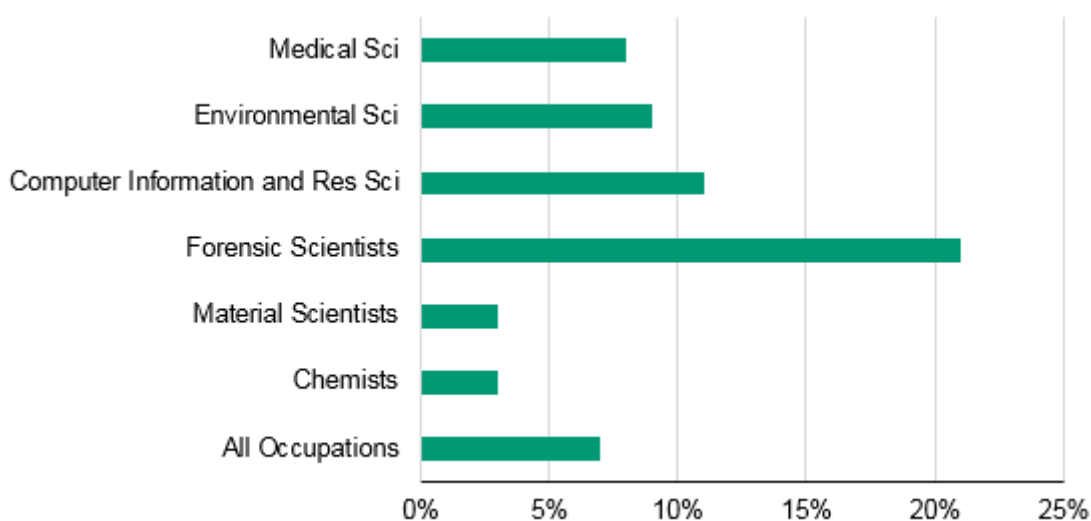
In-depth coursework in Analytical Chemistry is emphasized in the proposed curriculum of the new degree programs (Bioanalytical, Environmental, Forensic, and Medicinal Chemistry). Industrial demand for analytical chemists remains very high. Particularly, R&D analytical chemists and technicians for analytical method development and quality control and quality analysis (QC/QA) is in a growing demand. There are over 200 biotech and pharmaceutical and life science companies in the Chicago areas. A brief job search in *LinkedIn* using the two key words indicate the high employment population in bioanalytical and medicinal chemistry:

Chemist-2,276; Bioanalytical Chemist-408 (18% of chemist jobs); Medicinal/Pharmaceutical Chemist-462 (20% of chemist jobs).

Employment projection for Environmental and Forensic Chemists is reported to be promising. Forensic chemists and environment chemists can find numerous positions in US federal, state, and county labs. If successfully offered, Illinois Tech Environmental and Forensic Chemistry programs will be well linked to US Drug Enforcement Agency (DEA), Chicago Division, and Food & Drug Administration (FDA)/National Forensic Chemistry Center (FCC) and IL Environmental Protection Agency through internship programs.

Computational Chemistry and Information and Data Science have been continuously expanding and successfully applied to societal needs. Particularly, the area of data science and big data analytics is in a fast growth. The new BS program in Computational Chemistry and Biochemistry is suited to create the curriculum for education in molecular and data analysis in the areas of Medicinal, Environmental, and Forensic Chemistry.

Figure 3. Employment Projection (2014-2024, US Bureau of Labor Statistics)



V. PROGRAM INFORMATION

BS in Bioanalytical Chemistry

- Illinois Tech will be the FIRST institution for the BS program in USA.
- Curriculum with focus on Analysis of Biomolecules and Biologically Active Compounds.
- Biochemical, biomolecular, and instrumental analysis that are popular subjects for UG recruiting.
- R&D bioanalytical chemists and technicians for analytical method development and QC/QA in a growing and high demand.
- Students will learn chemical, biochemical, and instrumental techniques for qualitative and quantitative analysis of biomolecules including protein, peptide, and enzymes and biologically active molecules.
- Gain biomolecular analytic and biomolecular spectroscopic lab techniques: Purification and analysis of biomolecules including enzyme, protein, DNA, and peptides, sequencing, PCR, electroanalytical techniques, and LC/MS methods.

Topics: spectroscopy, separation, immunoassay, molecular imaging, electrochemistry, chromatography, and mass spectrometry using HPLC, fluorescence spectrometry, electrophoresis, UV-Vis spectroscopic assays, and microdialysis.

Workplace: Major and Local Pharma and Biotech. or Industry, QA/QC labs, Instrument lab for method development of separation of pharmaceuticals and agrochemicals, LC/MS Chromatographic method development lab, Biologic Process development lab, GMP and GLP quality lab, etc.

Required Courses (10 credits): Bioanalytical Chemistry (3), Bioanalytical Chemistry Lab (3), Biomolecular Analysis (3), Seminar in Special Topics (1)

Elective courses (Choose 2 courses, 6 credits): Statistics for Analytical Chemists (Chem513), Analytical Method Development (Chem508), Physical Biochemistry (Chem538), Analytical Method Development Lab, ChemInformatics, Medicinal Chemistry, Forensic Chemistry Lab, Environmental Chemistry, +++Inorganic Chemistry Lab (CHEM416). +++Required for ACS-Accredited BS degree.

Advisory Chemistry Faculty: Joy Chong, Richard Guan, and Rong Wang

BS in Medicinal Chemistry

- Illinois Tech Chemistry will be the only department to offer the BS degree in the State of Illinois.
- Study of Medicine and Drugs and Pharmaceutical and Biomedical applications.
- The goal is to recruit and educate undergraduates seeking a career in major and local Pharma and make the program attractive to undergraduates with interest in MD or Pharm D.
- No Chemistry department in Chicago area offers BS in Medicinal or Pharmaceutical Chemistry.
- Only six Chemistry Departments in USA offer BS in Pharm or Med Chem.
- Five pharmacy graduate schools are located in the Chicago area, UIC, Roosevelt, Midwestern, SIU, and Chicago State.
- Students will be better prepared for entrance to graduate and pharmacy schools.
- R&D Medicinal chemists and technicians for analytical method development and QC/QA in a growing and high demand.

Topics: Drug synthesis, Drug metabolism and pharmacology, drug design and simulation, bimolecular analysis, bioanalytical chemistry, instrumental method development for drug analysis and characterization.

Required Courses (10 credits): Medicinal Chemistry (3), Drug design and Simulation (3), Bioanalytical Chemistry Lab (3), Seminar in Special Topics (1).

Elective courses (Choose 2 courses, 6 credits): Advanced Organic Chemistry (Chem455), Statistics for Analytical Chemists (Chem513), Analytical Method Development (Chem508); ChemInformatics, Analytical Method Development Lab, Biomolecular Analysis, Bioanalytical Chemistry Lab, Forensic Chemistry, Forensic Chemistry Lab, ⁺⁺⁺Inorganic Chemistry Lab (CHEM416).

⁺⁺⁺Required for ACS-Accredited BS degree.

Workplace: Major and Local Pharma and Biotech, Hospitals, or Industry, QA/QC labs, Pharmacology and pharmacokinetics and pharmacodynamics-related R&D labs, Instrument labs for method development of separation of pharmaceuticals and agrochemicals, Chromatographic method development lab, Biologic Process development lab, GMP and GLP quality lab, etc.

Advisory Chemistry Faculty: Joy Chong and David Minh

BS in Environmental Chemistry

- Environmental Chemistry deals with the current issues, global warming, environmental safety, alternative energy, and other workplace/lab safety issues.
- The goal is to train students to be a viable environmental scientist with good background and sound lab training in environmental chemistry and practical knowledge of environmental science, analytical environmental chemistry, and toxicology.
- No Chemistry Department in the Chicago area offers BS degree in Environmental Chemistry.
- A job demand for Environmental Scientists is growing. IL Dept employment security (IDES) projects an increasing job demand (14%, 2014-24) and BLS employment projection (9%).
- Students will be well-trained for advanced lab techniques in Forensic Chemistry at the First class chemistry teaching lab located in Wishnick Hall.

Topics: Environmental Analytical Chemistry-trace elements, toxicants, and organics, Climate Change, Spectrometry, Chromatography, Aquatic Chemistry, Atmospheric Chemistry, Energy and Material Chemistry (fuel and CO₂ and H₂ storage)

Required courses (10 credits): Environmental Chemistry I (3), Environmental Chemistry II (3), Analytical Method Development Lab (3), Seminar in Special Topics (1)

Elective courses (Choose 2 courses, 6 credits): Science of Climate Change (CHEM410), Statistics for Analytical Chemists (Chem513), Physical Biochemistry (CHEM538), Analytical Method Development (Chem 508), Bioanalytical Chemistry, Bioanalytical Chemistry Lab, ChemInformatics, Forensic Chemistry, Forensic Chemistry Lab, ChemInformatics, ⁺⁺⁺Inorganic Chemistry Lab (CHEM416).

⁺⁺⁺Required for ACS-Accredited BS degree.

Workplace: US Environmental Protection Agency (EPA), US Department of Agriculture (Federal, State, and County), US Department of Defense (Federal, State, and County), Safety Officers at Industry and Academic institutions, Field Chemists, Waste Analysis Lab, and Environmental sampling and remediation control labs, etc.

Advisory Chemistry Faculty: Joy Chong, Richard Guan, Adam Hock, Braja Mandal

BS in Forensic Chemistry

- A study of chemical applications for analysis and characterization of drugs and their metabolites and biomolecules including spectroscopic and instrumental analysis.
- No Chemistry Department in the Chicago area offers BS degree in Forensic Chemistry.
- Forensic scientists in a VERY high job demand (IL Dept employment security (IDES) projection (21%) and BLS employment projection (27%).
- High undergraduate enrollment in the peer programs.
- Highly affordable program that is attractive to high school and undergraduate students.
- Students will be well-trained for advanced lab techniques in Forensic Chemistry at the First class chemistry teaching lab located in Wishnick Hall.

Topics: Spectrometric Analysis (IR, GC-MS, AAS, NMR, UV, Fluorescence, Raman, XRD, AFM) Chromatographic Analysis (LC, GC, HPLC, TLC); Fingerprint and PalmPrint Analysis; Drug analysis

Required Courses (10 credits): Forensic Chemistry (3 credits), Forensic Chemistry Lab (3 credits), Analytical Method Development Lab (3 credits), Seminar in Special Topics (1 credit)

Elective Courses (Choose 2 courses, 6 credits): Statistics for Analytical Chemists (Chem513), Analytical Method Development (Chem508), Physical Biochemistry (Chem538), Medicinal Chemistry, Biomolecular Analysis, Bioanalytical Chemistry, Bioanalytical Chemistry Lab, ChemInformatics, Environmental Chemistry, ⁺⁺⁺Inorganic Chemistry Lab (CHEM416).

⁺⁺⁺Required for ACS-Accredited BS degree.

Workplace: Government, Pharmaceutical, and Industrial analytical lab positions

US Department of Justice, Drug Enforcement Administration (DEA), Chicago Division

US DHHS Food & Drug Administration (FDA), National Forensic Chemistry Center (FCC)

US Federal Bureau of Investigation (FBI), Forensic Chemistry Unit

US Department of Forensic Science (DFS); US Department of Defense, Forensic Science Center

US Army, Criminal Investigation-Drug Chemistry-Lab; US Crime Scene Investigation (CSI) Labs (Federal, State, County); US Police Departments; US Department of Public Safety (Federal, State, and County); US Bureau of Investigation (Federal, State, and County)

Advisory Chemistry Faculty: Jean-Luc Ayitou, Joy Chong, Richard Guan, and Braja Mandal

BS in Computational Chemistry and Biochemistry

- Two in-house computational biochemist and quantum chemists lead well-funded and active research programs in Chemistry.
- Information and data science in continuous expansion and societal needs. Training students in the ever-growing field is critical.
- The area of data science and big data analytics is in a fast growth. This computation-based new program is well linked to data analytics in other new programs, Medicinal, Environmental, Forensic Chemistry programs. Big data analysis in Environmental, Forensic, and Medicinal/Pharmaceutical science remains high in job market.

- Students in this program will be trained in the area of chemical data analysis, computational chemical biology, computational drug design, and chemical and molecular modeling and simulation, and computational techniques for data analysis.
- Illinois Tech Chemistry operates the Pauling Computer Lab for Quantum Chemistry and Molecular Modeling and Simulation. The Pauling Lab was created by College of Science for teaching and research.
- Possible joint program with IIT Computer Science and Data Science Departments.

Topics: Chemical modeling, chemical data analysis, statistics, computational_chemical biology, computational drug design, molecular modeling and simulation and docking.

Required courses (10 credits): Chemical Modeling and Simulation (3), Drug Design and Simulation (3 credits), ChemInformatics (3 credits), Seminar in Special Topics (1 credit)

Elective courses (Choose 2 courses, 6 credits): Physical Biochemistry (Chem538), Statistics for Analytical Chemists (Chem513), Advanced Organic Chemistry (Chem455), Medicinal Chemistry, Bioanalytical Chemistry, Biomolecular Analysis, ⁺⁺⁺Inorganic Chemistry Lab (CHEM416).
⁺⁺⁺Required for ACS-Accredited BS degree

Workplace: Major and Local Pharma and Biotech. Hospitals, or Industry, Government agencies requiring chemical data analysis in Environmental, Forensic, and Medical sciences.

Advisory Chemistry Faculty: David Minh and Andrey Rogachev

Potential Elective Courses available in Chemistry and Other Departments

CHEM410 Science of Climate Change
 CHEM454 Chemical Modeling and Simulation
 CHEM455 Advanced Organic Chemistry
 CHEM508 Analytical Method Development
 CHEM513 Statistics for Analytical Chemists
 CHEM538 Physical Biochemistry
 CHEM539 Introduction to Pharmaceutical Chemistry
 ENVE 501 Environmental Chemistry
 BIOL 514 Toxicology
 CAE 589 Groundwater Hydrology and Sampling
 ITMS 538 Cyber Forensics
 BIOL 210 Microbiology
 BIOL 402 Metabolic Biochemistry
 BIOL 410 Medical Microbiology
 BIOL 445 Cell Biology
 BIOL 550 Bioinformatics
 BIOL 527 Immunology and Immunochemistry
 MATH 476 Statistics
 CS331 Data Structures and Algorithms & CS/MATH many courses

VI. CURRICULUM DEVELOPMENT

Illinois Tech Bachelor of Science Degree in Chemistry (Fall 2016)					
Chemistry Requirements		54	Mathematics Requirements		18
CHEM 100	Introduction to the Profession	2	MATH 151	Calculus I	5
CHEM 124	Principles of Chemistry I with Lab	4	MATH 152	Calculus II	5
CHEM 125	Principles of Chemistry II with Lab	4	MATH 251	Multivariate and Vector Calculus	4
CHEM 237	Organic Chemistry I	4	MATH 252	Introduction to Differential Equations	4
CHEM 239	Organic Chemistry II	3	Physics Requirements		8
CHEM 240	Organic Chemistry Lab	2	PHYS 123	General Physics I: Mechanics	4
CHEM 247	Analytical Chemistry	3	PHYS 221	General Physics II: Electricity and Magnetism	4
CHEM 321	Instrumental Analysis	4	Computer Science Requirement		2
CHEM 343	Physical Chemistry I	3	CS 105	Intro to Computer Programming	2
CHEM 344	Physical Chemistry II	4	or CS 110	Computing Principles	
CHEM 415	Inorganic Chemistry	3	Humanities and Social Sciences Requirements		21
CHEM 434	Spectroscopic Methods	4	See IIT Core Curriculum, sections B and C		21
CHEM 416	Inorganic Chemistry lab	3	Interprofessional Projects (IPRO)		6
CHEM 451	Undergraduate Seminar	3	See IIT Core Curriculum, section E		6
CHEM 485	Chemistry Colloquium	1	Free Electives		3 + 9
CHEM 485	Chemistry Colloquium	1	Select 12 credit hours		12
Chem elective		3	Total Credit Hours		127-128
Chem elective		3			
Biology Requirements		(6-7)			
BIOL 107	General Biology Lectures	3			
or BIOL 115	Human Biology				
BIOL 401	Introductory Biochemistry	4			
or BIOL 403	Biochemistry				

Note: The courses highlighted (16 Credits) can be replaced with required and elective courses for New BS Degree Programs.

BS in Bioanalytical Chemistry (NEW)

Chemistry Requirements		54	Mathematics Requirements		18
CHEM 100	Introduction to the Profession	2	MATH 151	Calculus I	5
CHEM 124	Principles of Chemistry I with Lab	4	MATH 152	Calculus II	5
CHEM 125	Principles of Chemistry II with Lab	4	MATH 251	Multivariate and Vector Calculus	4
CHEM 237	Organic Chemistry I	4	MATH 252	Introduction to Differential Equations	4
CHEM 239	Organic Chemistry II	3	Physics Requirements		8
CHEM 240	Organic Chemistry Lab	2	PHYS 123	General Physics I: Mechanics	4
CHEM 247	Analytical Chemistry	3	PHYS 221	General Physics II: Electricity and Magnetism	4
CHEM 321	Instrumental Analysis	4	Computer Science Requirement		2
CHEM 343	Physical Chemistry I	3	CS 105	Intro to Computer Programming	2
CHEM 344	Physical Chemistry II	4	or CS 110	Computing Principles	2
CHEM 415	Inorganic Chemistry	3	Humanities and Social Sciences Requirements		21
CHEM 434	Spectroscopic Methods	4	See IIT Core Curriculum, sections B and C		21
CHEM 4XX	Bioanalytical Chemistry	3	Interprofessional Projects (IPRO)		6
CHEM 4XX	Biomolecular Analysis	3	See IIT Core Curriculum, section E		6
CHEM 495	Seminar in Special Topics	1	Bioanalytical Chemistry Elective		3
CHEM 485	Chemistry Colloquium	1	Free Electives		9
CHEM 4XX	Bioanalytical Chemistry Lab	3	Select 6 credit hours		9
CHEM 4XX	Bioanalytical Chem Lab	3	Total Credit Hours		127-128
Biology Requirements		(6-7)			
BIOL 107 or BIOL 115	General Biology Lectures Human Biology	3			
BIOL 401 or BIOL 403	Introductory Biochemistry Biochemistry	4			

Bioanalytical Chemistry Elective Courses (Choose 2)

Analytical Method Development Lab, ChemInformatics, Statistics for Analytical Chemists, Medicinal Chemistry, Forensic Chemistry Lab, Physical Biochemistry, Environmental Chemistry, ***Inorganic Chemistry Lab (CHEM416). ***Required for ACS-Accredited BS degree.

BS in Environmental Chemistry (NEW)

Chemistry Requirements		54	Mathematics Requirements		18
CHEM 100	Introduction to the Profession	2	MATH 151	Calculus I	5
CHEM 124	Principles of Chemistry I with Lab	4	MATH 152	Calculus II	5
CHEM 125	Principles of Chemistry II with Lab	4	MATH 251	Multivariate and Vector Calculus	4
CHEM 237	Organic Chemistry I	4	MATH 252	Introduction to Differential Equations	4
CHEM 239	Organic Chemistry II	3	Physics Requirements		8
CHEM 240	Organic Chemistry Lab	2	PHYS 123	General Physics I: Mechanics	4
CHEM 247	Analytical Chemistry	3	PHYS 221	General Physics II: Electricity and Magnetism	4
CHEM 321	Instrumental Analysis	4	Computer Science Requirement		2
CHEM 343	Physical Chemistry I	3	CS 105	Intro to Computer Programming	2
CHEM 344	Physical Chemistry II	4	or CS 110	Computing Principles	2
CHEM 415	Inorganic Chemistry	3	Humanities and Social Sciences Requirements		21
CHEM 434	Spectroscopic Methods	4	See IIT Core Curriculum, sections B and C		21
CHEM 4XX	Environmental Chemistry I	3	Interprofessional Projects (IPRO)		6
CHEM 4XX	Environmental Chemistry II	3	See IIT Core Curriculum, section E		6
CHEM 495	Seminar in Special Topics	1	Environmental Chemistry Elective		3
CHEM 485	Chemistry Colloquium	1	Free Electives		9
CHEM 4XX	Analytical Method Development Lab	3	Select 9 credit hours		9
CHEM 4XX	Environmental Chem Elective	3	Total Credit Hours		127-128
Biology Requirements		(6-7)			
BIOL 107	General Biology Lectures	3			
or BIOL 115	Human Biology				
BIOL 401	Introductory Biochemistry	4			
or BIOL 403	Biochemistry				

Environmental Chemistry Elective Courses (Choose 2)

Science of Climate Change, Bioanalytical Chemistry, Bioanalytical Chemistry Lab, ChemInformatics, Forensic Chemistry, Forensic Chemistry Lab, Statistics for Analytical Chemists, Physical Biochemistry, ChemInformatics, ***Inorganic Chemistry Lab (CHEM416). ***Required for ACS-Accredited BS degree.

BS in Forensic Chemistry (NEW)

Chemistry Requirements		54	Mathematics Requirements		18
CHEM 100	Introduction to the Profession	2	MATH 151	Calculus I	5
CHEM 124	Principles of Chemistry I with Lab	4	MATH 152	Calculus II	5
CHEM 125	Principles of Chemistry II with Lab	4	MATH 251	Multivariate and Vector Calculus	4
CHEM 237	Organic Chemistry I	4	MATH 252	Introduction to Differential Equations	4
CHEM 239	Organic Chemistry II	3	Physics Requirements		8
CHEM 240	Organic Chemistry Lab	2	PHYS 123	General Physics I: Mechanics	4
CHEM 247	Analytical Chemistry	3	PHYS 221	General Physics II: Electricity and Magnetism	4
CHEM 321	Instrumental Analysis	4	Computer Science Requirement		2
CHEM 343	Physical Chemistry I	3	CS 105	Intro to Computer Programming Principles	2
CHEM 344	Physical Chemistry II	4	or CS 110		
CHEM 415	Inorganic Chemistry	3	Humanities and Social Sciences Requirements		21
CHEM 434	Spectroscopic Methods	4	See IIT Core Curriculum, sections B and C		21
CHEM 4XX	Forensic Chemistry	3	Interprofessional Projects (IPRO)		6
CHEM 4XX	Forensic Chem Lab Seminar in Special Topics	3	See IIT Core Curriculum, section E		6
CHEM 495	Forensic Chemistry Elective	1	Forensic Chemistry Elective		3
CHEM 485	Chemistry Colloquium Analytical Method	1	Free Electives		9
CHEM 4XX	Developmental Lab	3	Select 9 credit hours		9
CHEM 4XX	Forensic Chemistry Elective	3	Total Credit Hours		127-128
Biology Requirements		(6-7)			
BIOL 107 or BIOL 115	General Biology Lectures Human Biology	3			
BIOL 401 or BIOL 403	Introductory Biochemistry Biochemistry	4			

Forensic Chemistry Elective Courses (Choose 2)

Biomolecular Analysis, Bioanalytical Chemistry, Bioanalytical Chemistry Lab, ChemInformatics, Environmental Chemistry, Statistics for Analytical Chemists, Medicinal Chemistry, Physical Biochemistry, ***Inorganic Chemistry Lab (CHEM416). ***Required for ACS-Accredited BS degree.

BS in Medicinal Chemistry (NEW)

Chemistry Requirements		54	Mathematics Requirements		18
CHEM 100	Introduction to the Profession	2	MATH 151	Calculus I	5
CHEM 124	Principles of Chemistry I with Lab	4	MATH 152	Calculus II	5
CHEM 125	Principles of Chemistry II with Lab	4	MATH 251	Multivariate and Vector Calculus	4
CHEM 237	Organic Chemistry I	4	MATH 252	Introduction to Differential Equations	4
CHEM 239	Organic Chemistry II	3	Physics Requirements		8
CHEM 240	Organic Chemistry Lab	2	PHYS 123	General Physics I: Mechanics	4
CHEM 247	Analytical Chemistry	3	PHYS 221	General Physics II: Electricity and Magnetism	4
CHEM 321	Instrumental Analysis	4	Computer Science Requirement		2
CHEM 343	Physical Chemistry I	3	CS 105	Intro to Computer Programming	2
CHEM 344	Physical Chemistry II	4	or CS 110	Computing Principles	2
CHEM 415	Inorganic Chemistry	3	Humanities and Social Sciences Requirements		21
CHEM 434	Spectroscopic Methods	4	See IIT Core Curriculum, sections B and C		21
CHEM 4XX	Medicinal Chemistry Bioanalytical Chemistry Lab	3	Interprofessional Projects (IPRO)		6
CHEM 4XX	Lab	3	See IIT Core Curriculum, section E		6
CHEM 495	Seminar in Special Topics	1	Medicinal Chemistry Elective		3
CHEM 485	Chemistry Colloquium	1	Free Electives		9
CHEM 4XX	Drug Design and Simulation	3	Select 9 credit hours		9
CHEM 4XX	Medicinal Chemistry Elective	3	Total Credit Hours		127-128
Biology Requirements		(6-7)			
BIOL 107 or BIOL 115	General Biology Lectures Human Biology	3			
BIOL 401 or BIOL 403	Introductory Biochemistry Biochemistry	4			

Medicinal Chemistry Elective Courses (Choose 2)

Advanced Organic Chemistry, ChemInformatics, Analytical Method Development Lab, Biomolecular Analysis, Bioanalytical Chemistry Lab, Forensic Chemistry, Forensic Chemistry Lab, Statistics for Analytical Chemists, ***Inorganic Chemistry Lab (CHEM416). ***Required for ACS-Accredited BS degree.

BS in Computational Chemistry and Biochemistry (NEW)

Chemistry Requirements		54	Mathematics Requirements		18
CHEM 100	Introduction to the Profession	2	MATH 151	Calculus I	5
CHEM 124	Principles of Chemistry I with Lab	4	MATH 152	Calculus II	5
CHEM 125	Principles of Chemistry II with Lab	4	MATH 251	Multivariate and Vector Calculus	4
CHEM 237	Organic Chemistry I	4	MATH 252	Introduction to Differential Equations	4
CHEM 239	Organic Chemistry II	3	Physics Requirements		8
CHEM 240	Organic Chemistry Lab	2	PHYS 123	General Physics I: Mechanics	4
CHEM 247	Analytical Chemistry	3	PHYS 221	General Physics II: Electricity and Magnetism	4
CHEM 321	Instrumental Analysis	4	Computer Science Requirement		2
CHEM 343	Physical Chemistry I	3	CS 105	Intro to Computer Programming	2
CHEM 344	Physical Chemistry II	4	or CS 110	Computing Principles	
CHEM 415	Inorganic Chemistry	3	Humanities and Social Sciences Requirements		21
CHEM 434	Spectroscopic Methods	4	See IIT Core Curriculum, sections B and C		21
CHEM 454	Chemical Modeling and Simulation	3	Interprofessional Projects (IPRO)		6
CHEM 4XX	Drug Design and Simulation	3	See IIT Core Curriculum, section E		6
CHEM 495	Seminar in Special Topics	1	Computational Chem/Biochem Elective		3
CHEM 485	Chemistry Colloquium	1	Free Electives		9
CHEM 4XX	ChemInformatics	3	Select 6 credit hours		9
CHEM 4XX	Computational Chem/Biochem Elective	3	Total Credit Hours		127-128
Biology Requirements		(6-7)			
BIOL 107 or BIOL 115	General Biology Lectures	3			
BIOL 401 or BIOL 403	Human Biology	4			
	Introductory Biochemistry	4			
	Biochemistry	4			

Computational Chemistry and Biochemistry Elective Courses (Choose 2)

Physical Biochemistry, Physical Statistics, Statistics for Analytical Chemists, Medicinal Chemistry, Advanced Organic Chemistry, Bioanalytical Chemistry, Biomolecular Analysis, ***Inorganic Chemistry Lab (CHEM416). ***Required for ACS-Accredited BS degree.