

Undergraduate Curriculum Revision Proposal (Fall 2024)

Adam Hock, David Minh, Joy Chong, and Somdev Banerjee

Highlights

- The new university policy to reduce the total credit hours required for a BS degree to 120.
- Consistent format in core chemistry courses: Lecture (3 credit hours) and Lab (1 credit hour) **Analytical 247, Organic 239, Physical 344, Inorganic 415 (3 + 1 credits/course).**
- Change the MATH requirement for CHEM 344 (Physical Chemistry II) to MATH 251 **or** MATH 252.
- Add a Statistics course (3 CRH) required for all BS degrees.
- Change the credit hours for Chem 321 (Instrumental Analysis) from 4 to 3.
- Reduce the credit hours for CHEM 451 (Undergraduate Seminar) and CHEM 485 (Chemistry Colloquium).
- Merge CHEM 239 (Organic Chemistry II) and CHEM 240 (Organic Chemistry Lab) into a single integrated course.
- Merge CHEM 415 (Inorganic Chemistry) and CHEM 416 (Advanced Chemistry Lab) into a single integrated course.
- Increase the credit hours for CHEM 247 (Analytical Chemistry) from 3 to 4.
- Reduce the credit hours for free electives in the BS Chemistry degree from 12 to 6, while increasing the credit hours for chemistry electives from 6 to 12.
- Meets all ACS BS Chemistry requirements.
- ACS MSN and Green Chemistry topics distributed into the existing courses.
- Plan to present the proposed curriculum revisions to the University UGSC on **Oct 22**.
- Timely advising to support **14** chemistry undergraduates who are expected to graduate in Spring 25 and Spring 26.

Summary of BS CHEM Curriculum Revision

Course		Credit hour (Current)	Credit hour (Proposed)	Credit hour (+/-)
Analytical Chemistry	CHEM 247	3 (L-L)	4 (L-L)	+ 1
Organic Chemistry I	CHEM 237	4 (L-L)	4 (L-L)	0
Organic Chemistry II	CHEM 239	3 (L)	4 (L-L)	+ 1
Organic Chemistry Lab	CHEM 240	2 (L-L)	Merged into 239	- 2
Physical Chemistry I	CHEM 343	3 (L)	3 (L)	0
Physical Chemistry II	CHEM 344	4 (L-L)	4 (L-L)	0
Instrumental Analysis	CHEM 321	4 (L-L)	3 (L-L)	- 1
Inorganic Chemistry	CHEM 415	3 (L)	4 (L-L)	+ 1
Advanced Chem Lab	CHEM 416	3 (L-L)	Merged into 415	- 3
Spectroscopic Methods	CHEM 434	4 (L-L)	4 (L-L)	0
Undergraduate Seminar	CHEM 451	3	1	- 2
Statistics	MATH 425	3	3	+ 3
Colloquium	CHEM 485	2	1	- 1
MATH	251 or 252	4	0	- 4
				- 7 (Total)

Lecture and Lab (L-L) Lecture (L)

Rationale for Curriculum Revision

BS in Chemistry

- **Total Program Credit Hours: 120**

- **Rationale for change in program credit hours:**

We are making the following changes in compliance with the new university policy to reduce the total credit hours required for a BS degree to 120.

- 1) Reduce the credit hours for CHEM 451 (Undergraduate Seminar) and CHEM 485 (Chemistry Colloquium).
- 2) Reduce the credit hours for free electives from 12 to 6, while increasing the credit hours for chemistry electives from 6 to 12, allowing students to focus more on chemistry coursework and enhancing their expertise in the field.
- 3) Merge CHEM 239 (Organic Chemistry II) and CHEM 240 (Organic Chemistry Lab) into a single integrated course to enhance students' learning experience by providing a cohesive understanding of organic chemistry concepts and their practical applications.
- 4) Merge CHEM 415 (Inorganic Chemistry) and CHEM 416 (Advanced Chemistry Lab) into a single integrated course to enhance students' learning experience by providing a cohesive understanding of inorganic chemistry concepts and their practical applications.
- 5) Change the credit hours for Chem 321 (Instrumental Analysis) from 4 to 3 to emphasize laboratory work, allowing for a more hands-on learning experience that reinforces theoretical concepts.
- 6) Increase the credit hours for CHEM 247 (Analytical Chemistry) from 3 to 4 to maintain consistency in the format of the traditional core chemistry courses and to provide additional depth in the curriculum.
- 7) Change the MATH requirement for CHEM 344 (Physical Chemistry II) from both MATH 251 and MATH 252 to include one of these math courses.
- 8) Add a statistics course to the BS program in Chemistry to align with the American Chemical Society (ACS) guidelines and enhance students' data analysis skills.

Rationale for Curriculum Revision

BS in Environmental Chemistry

- **Total Program Credit Hours: 120**

- **Rationale for change in program credit hours:**

We are making the following changes in compliance with the new university policy to reduce the total credit hours required for a BS degree to 120.

- 1) Reduce the free elective credit hours from 9 to 3.
- 2) Remove CHEM 485 (Chemistry Colloquium) from the list of the required courses.
- 3) Merge CHEM 239 (Organic Chemistry II) and CHEM 240 (Organic Chemistry Lab) into a single integrated course to enhance students' learning experience by providing a cohesive understanding of organic chemistry concepts and their practical applications.
- 4) Merge CHEM 415 (Inorganic Chemistry) and CHEM 416 (Advanced Chemistry Lab) into a single integrated course to enhance students' learning experience by providing a cohesive understanding of inorganic chemistry concepts and their practical applications.
- 5) Change the credit hours for Chem 321 (Instrumental Analysis) from 4 to 3 to emphasize laboratory work, allowing for a more hands-on learning experience that reinforces theoretical concepts.
- 6) Increase the credit hours for CHEM 247 (Analytical Chemistry) from 3 to 4 to maintain consistency in the format of the traditional core chemistry courses and to provide additional depth in the curriculum.
- 7) Add a statistics course to the BS program in Chemistry to align with the American Chemical Society (ACS) guidelines and enhance students' data analysis skills.
- 8) Change the MATH requirement for CHEM 344 (Physical Chemistry II) from both MATH 251 and MATH 252 to include one of these math courses.

Rationale for Curriculum Revision

BS in Forensic Chemistry

- **Total Program Credit Hours: 120**

- **Rationale for change in program credit hours:**

We are making the following changes in compliance with the new university policy to reduce the total credit hours required for a BS degree to 120.

- 1) Reduce the free elective credit hours from 9 to 3.
- 2) Remove CHEM 485 (Chemistry Colloquium) from the list of the required courses.
- 3) Merge CHEM 239 (Organic Chemistry II) and CHEM 240 (Organic Chemistry Lab) into a single integrated course to enhance students' learning experience by providing a cohesive understanding of organic chemistry concepts and their practical applications.
- 4) Merge CHEM 415 (Inorganic Chemistry) and CHEM 416 (Advanced Chemistry Lab) into a single integrated course to enhance students' learning experience by providing a cohesive understanding of inorganic chemistry concepts and their practical applications.
- 5) Change the credit hours for Chem 321 (Instrumental Analysis) from 4 to 3 to emphasize laboratory work, allowing for a more hands-on learning experience that reinforces theoretical concepts.
- 6) Increase the credit hours for CHEM 247 (Analytical Chemistry) from 3 to 4 to maintain consistency in the format of the traditional core chemistry courses and to provide additional depth in the curriculum.
- 7) Add a statistics course to the BS program in Chemistry to align with the American Chemical Society (ACS) guidelines and enhance students' data analysis skills.
- 8) Change the MATH requirement for CHEM 344 (Physical Chemistry II) from both MATH 251 and MATH 252 to include one of these math courses.

Rationale for Curriculum Revision

BS in Medicinal Chemistry

- **Total Program Credit Hours: 120**

- **Rationale for change in program credit hours:**

We are making the following changes in compliance with the new university policy to reduce the total credit hours required for a BS degree to 120.

- 1) Reduce the free elective credit hours from 9 to 3.
- 2) Remove CHEM 485 (Chemistry Colloquium) from the list of the required courses.
- 3) Merge CHEM 239 (Organic Chemistry II) and CHEM 240 (Organic Chemistry Lab) into a single integrated course to enhance students' learning experience by providing a cohesive understanding of organic chemistry concepts and their practical applications.
- 4) Merge CHEM 415 (Inorganic Chemistry) and CHEM 416 (Advanced Chemistry Lab) into a single integrated course to enhance students' learning experience by providing a cohesive understanding of inorganic chemistry concepts and their practical applications.
- 5) Change the credit hours for Chem 321 (Instrumental Analysis) from 4 to 3 to emphasize laboratory work, allowing for a more hands-on learning experience that reinforces theoretical concepts.
- 6) Increase the credit hours for CHEM 247 (Analytical Chemistry) from 3 to 4 to maintain consistency in the format of the traditional core chemistry courses and to provide additional depth in the curriculum.
- 7) Add a statistics course to the BS program in Chemistry to align with the American Chemical Society (ACS) guidelines and enhance students' data analysis skills.
- 8) Change the MATH requirement for CHEM 344 (Physical Chemistry II) from both MATH 251 and MATH 252 to include one of these math courses.

Bachelor Science in Chemistry

Semester 1		Credits
CHEM 100	Introduction to Profession	2
CHEM 124	General Chemistry I	4
CS 105 or CS110	Intro to Programming Computing Principles	2
MATH 151	Calculus I	5
Humanities 200-level Course		3
		16
Semester 2		
CHEM 125	General Chemistry II	4
MATH 152	Calculus II	5
PHYS 123	General Physics I	4
Social Sciences Elective		3
		16
Semester 3		
CHEM 237	Organic Chemistry I	4
BIOL 107 or BIOL 115	General Biology Lectures Human Biology	3
PHYS 221	General Physics II	4
Humanities or Social Sciences Elective		3
		14
Semester 4		
CHEM 239	Organic Chemistry II	4
CHEM 247	Analytical Chemistry	4
MATH 251 or 252	Multivariate and Vector Calculus or Introduction to Differential Equation	4
Humanities Elective (300+)		3
		15
Semester 5		
CHEM 321	Instrumental Analysis	3
CHEM 343	Physical Chemistry I	3
I PRO Elective I		3
Chemistry Elective ¹		3
Social Sciences Elective (300+)		3
		15
Semester 6		
CHEM 344	Physical Chemistry II	4
CHEM 434	Spectroscopic Methods	4
Free Elective		3
Humanities Elective (300+)		3
		14
Semester 7		
CHEM 415	Inorganic Chemistry	4
BIOL 401	Introduction to Biochemistry	3
CHEM 451	Chemistry Information and Communication	1
Chemistry Elective ¹		3
Free Elective		3
		14

Semester 8		
Chemistry Elective ¹		3
CHEM 485	Chemistry Colloquium	1
IPRO Elective II		3
Chemistry Elective ¹		3
MATH 425	Statistical Methods	3
Social Sciences Elective (300+)		3
		16
Total Credit Hours		120

Chemistry Requirements		54
CHEM100, 124, 125, 237, 239, 247, 321, 343, 344, 415, 434, 451, 485		42
Chemistry Electives		12
Biology Requirements		6
BIOL107 or 115, BIOL 401		
Mathematics Requirements		17
MATH 151, 152, 425, 251 or 252		
Physics Requirements		8
PHYS 123, 221		
Computer Science Requirements		2
CS 105 or 110		
Humanities and Social Sciences Requirements		21
Interprofessional Projects (IPRO)		6
Free Electives		6

¹Chemistry Electives (Select 4 courses, 12 credits):

CHEM 416 Advanced Chemistry Lab
 CHEM 450 Undergraduate Research
 CHEM 452 Cheminformatics
 CHEM 454 Computational Quantum Chemistry
 CHEM 455 Advanced Organic Chemistry
 CHEM 456 Computational Biochemistry and Drug Design
 CHEM 463 Analytical Method Development Lab
 CHEM 467 Medicinal Chemistry
 CHEM 470 Introduction to Polymers
 CHEM 472 Environmental Chemistry
 CHEM 473 Environmental Analytical Chemistry
 CHEM 475 Forensic Chemistry
 CHEM 476 Forensic Chemistry Lab
 CHEM 487 Senior Thesis in Chemistry

¹Students planning to take CHEM 487 must complete CHEM 450 in a previous semester and are required to take one semester of CHEM 485.

Bachelor Science in Environmental Chemistry

Semester 1		Credits
CHEM 100	Introduction to Profession	2
CHEM 124	General Chemistry I	4
CS 105 or CS110	Intro to Computer Programming Computing Principles	2
MATH 151	Calculus I	5
Humanities-200 level course		3
		16
Semester 2		
CHEM 125	General Chemistry II	4
MATH 152	Calculus II	5
PHYS 123	General Physics I	4
Social Sciences Elective		3
		16
Semester 3		
CHEM 237	Organic Chemistry I	4
BIOL 107 or BIOL 115	General Biology Lectures Human Biology	3
PHYS 221	General Physics II	4
Humanities or Social Sciences Elective		3
		14
Semester 4		
CHEM 239	Organic Chemistry II	3
CHEM 240	Organic Chemistry Lab	2
CHEM 247	Analytical Chemistry	4
MATH 251 or 252	Multivariate and Vector Calculus or Introduction to Differential Equation	4
Humanities Elective (300+)		3
		16
Semester 5		
CHEM 321	Instrumental Analysis	3
CHEM 343	Physical Chemistry I	3
IPRO Elective I		3
Social Sciences Elective (300+)		3
Free Elective ²		3
		15
Semester 6		
CHEM 344	Physical Chemistry II	4
CHEM 434	Spectroscopic Methods	4
CHEM 472	Environmental Chemistry	3
Humanities Elective (300+)		3
		14
Semester 7		
CHEM 415	Inorganic Chemistry	4
BIOL 401	Introduction to Biochemistry	3
CHEM 473	Environmental Analytical Chemistry	3
CHEM 463	Analytical Method Development Lab	3
MATH 425	Statistical Methods	3
		16

Semester 8	
Environmental Chemistry Elective ¹	3
Environmental Chemistry Elective ¹	3
CHEM 495 Seminar in Special Topics	1
IPRO Elective II	3
Social Sciences Elective (300+)	3
	13
Total Credit Hours	120
¹Environmental Chemistry Electives (Select at least 2 courses, 6 Credits):	
CHEM 410 Science of Climate Change	
CHEM 452 Cheminformatics	
CHEM 454 Computational Quantum Chemistry	
CHEM 455 Advanced Organic Chemistry	
CHEM 456 Computational Biochemistry and Drug Design	
CHEM 460 Bioanalytical Chemistry	
CHEM 461 Bioanalytical Chemistry Lab	
CHEM 470 Polymer Chemistry	
CHEM 467 Medicinal Chemistry	
CHEM 475 Forensic Chemistry	
CHEM 476 Forensic Chemistry Lab	
²Free Electives (Suggested, Select 1 courses, 3 credits):	
BIOL 210 Microbiology	
BIOL 514 Toxicology	
BIOL 445 Molecular Biology	
ENVE 404 Water and Wastewater Engineering	
ENVE 463 Introduction to Air Pollution Control	
ITMD 521 Client/Server Technologies and Applications	
ITMD 525 Topics in Data Science and Management	
ITMD 527 Data Analytics	
Environmental Chemistry Requirements	57
CHEM100, 124, 125, 237, 239, 247, 321, 343, 344, 415, 434	41
CHEM 472 Environmental Chemistry	3
CHEM 473 Environmental Analytical Chemistry	3
CHEM 463 Analytical Method Development Lab	3
CHEM 495 Seminar In Special Topics	1
Environmental Chemistry Electives	6
Biology Requirements	6
BIOL107 or 115, BIOL 401 or 403	
Mathematics Requirements	17
MATH 151, 152, 425, 251 or 252	
Physics Requirements	8
PHYS 123, 221	
Computer Science Requirements	2
CS 105 or 110	
Humanities and Social Sciences Requirements	21
Interprofessional Projects (IPRO)	6
Free Electives	3

Bachelor Science in Forensic Chemistry

Semester 1		Credits
CHEM 100	Introduction to Profession	2
CHEM 124	General Chemistry I	4
CS 105 or CS110	Intro to Computer Programming Computing Principles	2
MATH 151	Calculus I	5
Humanities-200 level course		3
		16
Semester 2		
CHEM 125	General Chemistry II	4
MATH 152	Calculus II	5
PHYS 123	General Physics I	4
Social Sciences Elective		3
		16
Semester 3		
CHEM 237	Organic Chemistry I	4
BIOL 107 or BIOL 115	General Biology Lectures Human Biology	3
PHYS 221	General Physics II	4
Humanities or Social Sciences Elective		3
		14
Semester 4		
CHEM 239	Organic Chemistry II	3
CHEM 240	Organic Chemistry Lab	2
CHEM 247	Analytical Chemistry	4
MATH 251 or 252	Multivariate and Vector Calculus or Introduction to Differential Equation	4
Humanities Elective (300+)		3
		16
Semester 5		
CHEM 321	Instrumental Analysis	3
CHEM 343	Physical Chemistry I	3
IPRO Elective I		3
Social Sciences Elective (300+)		3
Free Elective ²		3
		15
Semester 6		
CHEM 344	Physical Chemistry II	4
CHEM 434	Spectroscopic Methods	4
CHEM 475	Forensic Chemistry	3
Humanities Elective (300+)		3
		14
Semester 7		
CHEM 415	Inorganic Chemistry	4
BIOL 401	Introduction to Biochemistry	3
CHEM 476	Forensic Chemistry Lab	3
CHEM 463	Analytical Method Development Lab	3
MATH 425	Statistical Methods	3
		16

Semester 8		
Forensic Chemistry Elective ¹		3
Forensic Chemistry Elective ¹		3
CHEM 495	Seminar in Special Topics	1
IPRO Elective II		3
Social Sciences Elective (300+)		3
		13
Total Credit Hours		120

¹Forensic Chemistry Electives (Select at least 2 courses, 6 credits):

CHEM 452 Cheminformatics
 CHEM 454 Computational Quantum Chemistry
 CHEM 455 Advanced Organic Chemistry
 CHEM 456 Computational Biochemistry and Drug Design
 CHEM 460 Bioanalytical Chemistry
 CHEM 461 Bioanalytical Chemistry Lab
 CHEM 470 Polymer Chemistry
 CHEM 472 Environmental Chemistry
 CHEM 473 Environmental Analytical Chemistry
 CHEM 467 Medicinal Chemistry

²Free Electives (Suggested, Select 3 courses, 9 credits):

BIOL 210 Microbiology
 BIOL 214 Genetics
 BIOL 514 Toxicology
 BIOL 445 Molecular Biology
 BIOL 550 Bioinformatics
 ITMD 521 Client/Server Technologies and Applications
 ITMD 525 Topics in Data Science and Management
 ITMD 527 Data Analytics
 ITMS 538 Cyber Forensics

Forensic Chemistry Requirements	57
CHEM100, 124, 125, 237, 239, 247, 321, 343, 344, 415, 434	41
CHEM 475 Forensic Chemistry	3
CHEM 476 Forensic Chemistry Lab	3
CHEM 463 Analytical Method Development Lab	3
CHEM 495 Seminar In Special Topics	1
Forensic Chemistry Electives	6
Biology Requirements	6
BIOL107 or 115, BIOL 401 or 403	
Mathematics Requirements	17
MATH 151, 152, 425, 251 or 252	
Physics Requirements	8
PHYS 123, 221	
Computer Science Requirements	2
CS 105 or 110	
Humanities and Social Sciences Requirements	21
Interprofessional Projects (IPRO)	6
Free Electives	3

Bachelor Science in Medicinal Chemistry

Semester 1		Credits
CHEM 100	Introduction to Profession	2
CHEM 124	General Chemistry I	4
CS 105 or CS110	Intro to Computer Programming Computing Principles	2
MATH 151	Calculus I	5
Humanities-200 level course		3
		16
Semester 2		
CHEM 125	General Chemistry II	4
MATH 152	Calculus II	5
PHYS 123	General Physics I	4
Social Sciences Elective		3
		16
Semester 3		
CHEM 237	Organic Chemistry I	4
BIOL 107 or BIOL 115	General Biology Lectures Human Biology	3
PHYS 221	General Physics II	4
Humanities or Social Sciences Elective		3
		14
Semester 4		
CHEM 239	Organic Chemistry II	3
CHEM 240	Organic Chemistry Lab	2
CHEM 247	Analytical Chemistry	4
MATH 251 or 252	Multivariate and Vector Calculus or Introduction to Differential Equation	4
Humanities Elective (300+)		3
		16
Semester 5		
CHEM 321	Instrumental Analysis	3
CHEM 343	Physical Chemistry I	3
IPRO Elective I		3
Social Sciences Elective (300+)		3
Free Elective ²		3
		15
Semester 6		
CHEM 344	Physical Chemistry II	4
CHEM 434	Spectroscopic Methods	4
CHEM 456	Computational Biochemistry and Drug Design	3
Humanities Elective (300+)		3
		14
Semester 7		
CHEM 415	Inorganic Chemistry	4
BIOL 401	Introduction to Biochemistry	3
CHEM 467	Medicinal Chemistry	3
CHEM 463	Analytical Method Development Lab	3
MATH 425	Statistical Methods	3
		16

Semester 8		
Medicinal Chemistry Elective ¹		3
Medicinal Chemistry Elective ¹		3
CHEM 495	Seminar in Special Topics	1
IPRO Elective II		3
Social Sciences Elective (300+)		3
		13
Total Credit Hours		120

¹Medicinal Chemistry Electives (Select at least 2 courses, 6 Credits):

CHEM 452 Cheminformatics
 CHEM 454 Computational Quantum Chemistry
 CHEM 455 Advanced Organic Chemistry
 CHEM 460 Bioanalytical Chemistry
 CHEM 461 Bioanalytical Chemistry Lab
 CHEM 472 Environmental Chemistry
 CHEM 473 Environmental Analytical Chemistry
 CHEM 475 Forensic Chemistry
 CHEM 476 Forensic Chemistry Lab

²Free Electives (Suggested, Select 3 courses, 9 credits):

BIOL 210 Microbiology
 BIOL 445 Cell Biology
 BIOL 514 Toxicology
 BIOL 527 Immunology and Immunochemistry
 BIOL 550 Bioinformatics
 ITMD 521 Client/Server Technologies and Applications
 ITMD 525 Topics in Data Science and Management
 ITMD 527 Data Analytics

Medicinal Chemistry Requirements	57
CHEM100, 124, 125, 237, 239, 240, 247, 321, 343, 344, 415, 434, 485	41
CHEM 4M1 Medicinal Chemistry	3
CHEM 4C1 Computer-Aided Drug Design	3
CHEM 4B3 Analytical Method Development Lab	3
CHEM 495 Seminar In Special Topics	1
Medicinal Chemistry Electives	6
Biology Requirements	6
BIOL107 or 115, BIOL 401 or 403	
Mathematics Requirements	17
MATH 151, 152, 425, 251 or 252	
Physics Requirements	8
PHYS 123, 221	
Computer Science Requirements	2
CS 105 or 110	
Humanities and Social Sciences Requirements	21
Interprofessional Projects (IPRO)	6
Free Electives	3

Course Description

CHEM 238

Organic Chemistry II

This course emphasizes core concepts in organic chemistry, focusing on the structures, properties, reactions, and synthesis of various organic compounds and provides a brief introduction to the applications and biological significance of organic molecules.

Prerequisite(s): CHEM 237 or (CHEM 236 and CHEM 235)

Lecture: 3 Lab: 0 Credits: 3

CHEM 239

Organic Chemistry II

This course emphasizes core concepts in organic chemistry, focusing on the structures, properties, reactions, and synthesis of various organic compounds and provides a brief introduction to the applications and biological significance of organic molecules. A weekly four-hour lab session offers hands-on experience in synthesis and characterization of organic molecules.

Prerequisite(s): CHEM 237 or (CHEM 236 and CHEM 235)

Lecture: 3 Lab: 4 Credits: 4

CHEM 240

Organic Chemistry Laboratory

A weekly four-hour lab session offers hands-on experience in synthesis and characterization of organic molecules.

Prerequisite(s): CHEM 239*, An asterisk (*) designates a course which may be taken concurrently.

Lecture: 0 Lab: 4 Credits: 1

Satisfies: Communications (C)

CHEM 247

Analytical Chemistry

This course introduces students to the theory and applications of quantitative analytical chemistry. Topics covered include: statistical data analysis; equilibrium constants expressions; acid-base reactions; volumetric analysis; and fundamentals of spectroscopy, electrochemistry, and of separations science. Laboratory experiments include learning about analytical process, calibration of glassware and equipment, wet chemical analysis, electrochemistry, spectroscopy, and chromatography.

Prerequisite(s): CHEM 125

Lecture: 3 Lab: 4 Credits: 4

CHEM 321

Instrumental Analysis

This course offers a comprehensive introduction to the theory and application of modern analytical instruments in chemistry. Topics include atomic spectroscopy, luminescence spectroscopy, electrochemistry, ultraviolet-visible (UV-Vis) spectroscopy, high-performance liquid chromatography (HPLC), gas chromatography, sample preparation techniques, and separation techniques. Other relevant topics in advanced chemical instrumentation and analytical techniques will also be discussed, emphasizing their practical applications in chemical analysis and data interpretation. A weekly seven-hour laboratory is included.

Prerequisite(s): CHEM 247

Lecture: 1 Lab: 7 Credits: 3

CHEM 415

Inorganic Chemistry

In-depth introduction to the vast subfield of the discipline dealing with all of the elements in the periodic table. Presents balanced blend of facts and theories in modern inorganic chemistry. Emphasis is on bonding, electronic, magnetic, and structural features exhibited by inorganic and organometallic compounds and their reactivities. Modern concepts including symmetry and group theory and their relevance in solving chemical problems. Bioinorganic chemistry and high tech inorganic materials and solids are introduced. A weekly four-hour laboratory is included.

Prerequisite(s): CHEM 239 or Graduate standing

Lecture: 3 Lab: 4 Credits: 4

CHEM 434

Spectroscopic Methods in Identification and Analysis

This course covers the theory and application of various spectroscopic methods for the identification, characterization, and analysis of compounds. Topics include mass spectrometry, vibrational spectroscopy (infrared and Raman), nuclear magnetic resonance (1D and 2D NMR), ultraviolet-visible (UV-Vis) spectroscopy, and structure-spectra correlations applied to small and complex molecules. Laboratory work will provide hands-on experience in the spectroscopic characterization and identification of diverse compounds.

Prerequisite(s): CHEM 247 and CHEM 239*, An asterisk (*) designates a course which may be taken concurrently.

Lecture: 3 Lab: 4 Credits: 4

CHEM 451

Chemical Information and Communication

An overview of a variety of chemical information tools and major scientific databases for navigating primary scientific literature. There will be a focus on the written and oral presentation of scientific research and the critical evaluation of the same types of scientific communication.

Prerequisite(s): CHEM 125

Lecture: 1 Lab: 0 Credits: 1

CHEM 463

Analytical Method Development Laboratory

In this laboratory course, students will learn about method development and assessment for analysis of chemicals, organic compounds, polymers, drugs, pharmaceuticals, and biopharmaceuticals. Students will gain hands-on experience in quantitative analysis and quality assurance and control of diverse chemicals and bioactive agents. This course will foster students to develop quantitative and technical analysis techniques, literature comprehension, critical thinking, problem-solving, and communication skills. Potential topics include chromatographic separation, microscopic and spectroscopic methods for chemical analysis and bioanalysis; preparations and storage of samples and standard solutions, and analytical method validation.

Prerequisite(s): CHEM 321 and CHEM 343 and CHEM 434

Lecture: 1 Lab: 7 Credits: 3

CHEM 470

Introduction to polymers

Introductory course covering fundamental aspects of polymers with major emphasis on synthesis, polymerization mechanisms, chain architecture, relationship between polymer structures and properties, measurement and control of molecular weights, thermal and

mechanical properties, and polymer processing. A weekly four-hour lab session offers hands-on experience.

Prerequisite(s): CHEM 239 or Graduate standing

Lecture: 2 Lab: 4 Credits: 3

CHEM 495

Seminar in Special Topics

This seminar course is designed to provide students with opportunities to learn about recent development in specialized chemistry areas including environmental chemistry, forensic chemistry, medicinal chemistry. Students are expected to develop written and oral communication skills on the advanced and specialized topics. Prerequisites or Instructor Approval.

Prerequisite(s): CHEM 125

Lecture: 1 Lab: 0 Credits: 1