THE UNIVERSITY OF ARIZONA

Request for Substantial Changes to an Existing Program

Complete this form and submit to the Office of Curricular Affairs. You can review the route of approvals this form will go through here. Committees only meet during the academic year and break for summer.

I. Program Details
   a) Name (and Degree Type) of Academic Program: Chemistry BA
      i) Emphases (if applicable): None
   b) Academic Unit(s)/College(s): Dept of Chemistry & Biochemistry, College of Science

II. Primary Contact and Email: Dee Belle-Oudry, dbelle@arizona.edu

III. Planned start term for changes: Fall 2024

IV. Describe the proposed changes to the program as well as the rationale for making the specific changes and include any relevant supporting data.

Part of the impetus for changing the BA degree is to keep it aligned with the CHEM BS degree, which is undergoing substantial revision beginning Fall 2024. Since we are modifying the BS degree requirements by deleting some courses and creating new ones the BA degree will also be affected. The number of CHEM BA majors is very small in comparison to the CHEM BS number, so it makes sense that the BS program change drives similar changes in the BA.

A summary side-by-side comparison of the existing and proposed degree plans is shown in Appendix A. The main changes to the BA chemistry program are as follows:

a. Students will take three majors colloquium courses (CHEM 195a, 295a, and 395a)—one per year for the first three years of the program—rather than the single colloquium course (CHEM 395A) currently required. Each course will focus on topics relevant to their current year in the program, which will help students navigate the program, develop important skills for professional success, and prepare for their careers. These courses will also create cohorts of students and provide an important support structure that is currently lacking in the program.
b. A new general chemistry sequence (CHEM 181 and CHEM 182) will replace the multiple general chemistry options (15X, 16X, 14X) in the old degree plan. CHEM 181/182 is specifically designed for chemistry and biochemistry majors. These courses will better equip chemistry students with the appropriate knowledge and skills to succeed in their field. The new sequence will also create ***cohorts of majors*** in their first year of the program, providing a better connection to CBC faculty and a sense of community among the students at a crucial stage in their academic journey. The intent is to improve student retention and success in chemistry. Note that CHEM 181/182 is the preferred general chemistry sequence, but completion of non-majors' general chemistry (CHEM 151 + 152) or honors general chemistry (CHEM 161/163 + 162/164) will also satisfy this requirement.

c. The new BA program includes ***one-semester foundational lectures in four areas of chemistry***: organic, analytical, physical, and inorganic. Students will take these courses in their second and third year, giving them a broad overview of the different chemistry subdisciplines early in the program. In the existing BA degree, students typically concentrate only on organic chemistry coursework in their second year. This gives them a narrow view of the wide range of topics and activities in the various fields of chemistry—and could potentially lead to a loss of interest in the major. Early exposure to the ***full breadth of the field*** will help students develop a big-picture understanding of the different subject areas. They may identify a particular area that appeals to them and decide to pursue further advanced coursework and/or research in that area.

d. The new curriculum includes <u>two</u> foundational laboratory courses (*Syntheses* and *Chemical Measurements*) that <u>integrate</u> topics from all areas of chemistry. These labs provide students with an awareness of the ***interconnectedness of the chemistry subdisciplines***. The old degree program was very compartmentalized; students took separate courses and labs in organic, analytical, inorganic, and physical chemistry. This is not representative of how modern science is done. Solving problems of interest requires interdisciplinary understanding and effort. The new foundational lab courses impart a more realistic view of what chemists do in their careers.

e. We have ***changed the math and physics*** requirements, reducing the minimum number of units of ***supporting coursework*** from 14 to 10. Students will now be required to take only two semesters of calculus (rather than three) and one semester of physics (rather than two). Additionally, BA students can choose between calculus-based physics (PHYS 141) and algebra-based physics (PHYS 102(lec)+ PHYS 181 (lab)).

f. The two-semester physical chemistry sequence (CHEM 480A + 480B) will be replaced by a ***one semester foundational physical chemistry course***, CHEM 385. This change allows us to eliminate the third semester math requirement (CHEM 380 or MATH 223) from the core requirements.

g. The new plan allows more flexibility in upper-level coursework. The existing BA degree mandated one advanced lab course. The new degree allows students to choose one course (lecture or lab) from a list of upper-level courses. There is ***no obligatory upper-level lab experience beyond the foundational coursework***.

h. The new plan offers an ***expanded list of advanced electives*** (Appendix B) compared to the existing CHEM BA. For new elective courses that fall outside CBC, we have obtained support from those departments (IMB, PCOL, BME, ENVS, CHEE, and MSE) to include their courses in our program. These letters are included in the *CHEM BS Substantial Change Request* we recently submitted for approval.

It is worth noting that although the minimum number of units in the major is increasing (from 34 to 36), the ***overall number of units*** including supporting coursework, core requirements, and in-depth coursework is ***comparable*** to the existing BA degree (Appendix A). The new degree requires less math and physics—courses which have historically been a challenge for many chemistry BA students. Elimination of these early roadblocks will greatly increase student success and may help retain students in the major. The core major requirement is the same in the new degree (27 units) despite the addition of the two colloquium courses (CHEM 195A and 295A) described in part c. The minimum number of upper-level units is increasing (from 16 to 18), but the expanded list of electives gives students much more choice in selecting subjects that interest them. ***Please see the total unit summary at the end of Appendix A***.

V. Comparison Chart – complete the appropriate chart below (delete the unnecessary one) to compare your current requirements to the proposed modifications.
Tools for course lookup: UA Course Catalog or UAnalytics (Catalog and Schedule Dashboard)

UNDERGRADUATE	Existing Major Requirements	Requirements For Modified Major
Name of major, emphasis (if applicable) and degree*	Chemistry, BA	Chemistry, BA
CIP Code –lookup here or contact the Office of Curricular Affairs for assistance, if needed	40.0501	40.0501
Total units required to complete the degree* (Note: this is for the entire degree, not just the major)	120	120
Upper division units required to complete the degree	42	42
Total CC transfer units that may apply to this degree*	64	64
Foundation courses		
Math	Substantial Math Strand	Substantial Math Strand
Second Language	Fourth Semester Proficiency	Fourth Semester Proficiency
General Education		
Introduction to General Education course (1 unit)	Introduction to General Education course (1 unit)	Introduction to General Education course (1 unit)
GE Exploring Perspectives: Choose one course from each domain. (12 units total)	Artist (1 course) Humanist (1 course) Natural Scientist (1 course) Social Scientist (1 course)	Artist (1 course) Humanist (1 course) Natural Scientist (1 course) Social Scientist (1 course)
GE Building Connections: Choose three courses (9 units) from two or more disciplines and/or perspectives.	GE Building Connections: Complete 3 courses, 9 units total.	GE Building Connections: Complete 3 courses, 9 units total.
GE Capstone course (1 unit)	GE Capstone course (1 unit)	GE Capstone course (1 unit)
Pre-major? (Yes/No)	No	No
List any special requirements to declare or gain admission to this major (completion of specific coursework, minimum GPA, interview, application, etc.)	None	None
Minimum # of units required in the major (units counting towards major units and major GPA)	34	36
Minimum # of upper-division units required in the major (upper division units counting towards major GPA)	16	18
Minimum # of residency units to be completed in the major	18	18
Required supporting coursework (courses that do not count towards	-Physics I (mechanics), choose one from the following:	-Physics I, choose one from the following:

major units and major GPA, but are required for the major). Courses listed must include prefix, number, units, and title. Include any limits/restrictions in place/needed (house number limit, etc.). Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department.	PHYS 141 (4) Introductory Mechanics OR PHYS 161H (4) Honors Introductory Mechanics -Physics II, choose from one of the following: PHYS 241 (4) Introductory Electricity & Magnetism OR PHYS 261H (4) Honors Introductory Electricity & Magnetism -Calculus I, choose from one of the following: (MATH 122A (1), Functions for Calculus + MATH 122B (4), First Semester Calculus) OR MATH 125 (3), Calculus I -MATH 129 (3), Calculus II -Third semester calculus, choose from one of the following: CHEM 380 (3), Mathematical Physics for Chemistry OR MATH 223 (3), Vector Calculus	PHYS 141 (4) Introductory Mechanics OR PHYS 161H (4) Honors Introductory Mechanics OR (PHYS 102 (3) Introductory Physics I + PHYS 181 Introductory Laboratory I) -Calculus I, choose from one of the following: (MATH 122A (1), Functions for Calculus + MATH 122B (4), First Semester Calculus) OR MATH 125 (3), Calculus I -MATH 129 (3), Calculus II
Major requirements. List all major requirements including core and electives. If applicable, list the emphasis requirements. Courses listed count towards major units and major GPA. Courses listed must include prefix, number, units, and title. Mark new coursework (New). Include any limits/restrictions in place/needed (house number limit, etc.). Provide email(s)/letter(s) of support from home department head(s) for courses being added and are not owned by your department. Recommend ordering requirements in the same order as your advisement report.	-First semester General Chemistry with lab-choose from one of the following: CHEM 151 (4) Chemical Thinking I OR (CHEM 161 (3) Honors Chemical Thinking I + CHEM 163 (1) Honors Fundamental Techniques of Chemistry) OR (CHEM 141 (3) General Chemistry Lecture I. Quantitative + CHEM 143 (1) General Chemistry Lab 1. Quantitative) -Second semester General Chemistry with lab-choose from one of the following: CHEM 152 (4) Chemical Thinking II OR (CHEM 162 (3) Honors Chemical Thinking II + CHEM 164 (1) Honors Fundamental Techniques of Chemistry) OR (CHEM 142 (3) General Chemistry Lecture II. Quantitative + CHEM 144 (1) General Chemistry Lab II. Quantitative)	-CHEM 181 (4) Majors General Chemistry I Note: this requirement may also be fulfilled by taking one of the following: CHEM 151 (4) Chemical Thinking I OR (CHEM 161 (3) Honors Chemical Thinking I + CHEM 163 (1) Honors Fundamental Techniques of Chemistry) -CHEM 182 (4) Majors General Chemistry II Note: this requirement may also be fulfilled by taking one of the following: CHEM 152 (4) Chemical Thinking II OR (CHEM 162 (3) Honors Chemical Thinking II + CHEM 164 (1) Honors Fundamental Techniques of Chemistry) -(New) CHEM 195A (1) First Year Chemistry Colloquium

	-First semester organic chemistry lecture, choose from one of the following: CHEM 246A (3) Lectures in Organic Chemistry OR CHEM 242A (3) Honors Lecture in Organic Chemistry -CHEM 247A (2) Organic Chemistry Laboratory -Second semester organic chemistry lecture, choose from one of the following: CHEM 246B (3) Lectures in Organic Chemistry OR CHEM 242B (3) Honors Lecture in Organic Chemistry -CHEM 247B (2) Organic Chemistry Laboratory -CHEM 480A (3) Physical Chemistry -CHEM 480B (3) Physical Chemistry -One 400-level lab from the following list: CHEM 400A (3) Chemical Measurements Laboratory CHEM 400B (3) Chemical Measurements Laboratory CHEM 412 (3) Inorganic Preparations CHEM 446 (3) Organic Preparations CHEM 447 (3) Organic Structural Analysis Laboratory Two advanced electives from the following list: CHEM 325 (2) Analytical Chemistry CHEM 326 (2) Analytical Chemistry Laboratory CHEM 401A (3) Instrumental Analysis CHEM 404A (3) Inorganic Chemistry CHEM 450 (3) Synthetic and Mechanistic Organic Chemistry	-(New) CHEM 246 (3) Principles of Organic Chemistry -(New) CHEM 256L (2) Synthesis Laboratory -(New) CHEM 227 (3) Principles of Analytical Chemistry -(New) CHEM 330L (2) Measurements Laboratory -(New) CHEM 295A (1) Second Year Chemistry Colloquium -(New) CHEM 385 (3) Principles of Physical Chemistry -(New) CHEM 310 (3) Principles of Inorganic Chemistry -CHEM 395A (1) Chemistry Majors Colloquium -**Advanced Chemistry Coursework**: choose <u>one</u> course from the following options: BIOC 384 (3) Foundations in Biochemistry BIOC 385 (3) Metabolic Biochemistry BIOC 462A (4) Biochemistry BIOC 462B (4) Biochemistry

	BIOC 384 (3) Foundations in Biochemistry *OR* BIOC 462A (4) Biochemistry BIOC 385 (3) Metabolic Biochemistry *OR* BIOC 462B (4) Biochemistry	BIOC 463A (4) Biochemical Laboratory Techniques CHEM 346 (3) Advanced Organic Chemistry CHEM 356L (3) Advanced Organic Synthesis Lab CHEM 380 (3), Mathematical Physics for Chemistry CHEM 401A (3) Instrumental Analysis (New) CHEM 485 (3) Advanced Physical Chemistry CHEM 400A (3) Chemical Measurements Laboratory CHEM 423A (3) Bioanalytical Chemistry CHEM 400B (3) Chemical Measurements Laboratory CHEM 412 (3) Inorganic Preparations CHEM 418 (3) Computational Chemistry CHEM 450 (3) Synthetic and Mechanistic Organic Chemistry CHEM 487 (3) Introduction to Molecular Spectroscopy -**Advanced Electives List**: choose at least 6 units from the *Advanced Chemistry Coursework* list above, or from the following list, or from approved 500-level CHEM courses: ASTR 488A (3) Astrochemistry BIOC/CHEM/ECOL/PLS/MCB 448A (3) Plant Biochemistry and Metabolic Engineering BME 420 (3) Biophotonics BME 447 (3) Sensors and Controls BME 485 (3) Nanoscience and Nanotechnology for Biomedical Engineers CHEE/MSE 432 (3) Organic Electronic Materials & Devices CHEE/CHEM/MSE 437 (3) Surface Science CHEM 422/522 (3) Electroanalytical Chemistry

		CHEM 425A/525A (3) Mass Spectrometry CHEM 426B/526B (3) Analytical Molecular Spectroscopy CHEM 427/527 (3) Separations CHEM 428B/528B (3) Advanced Analytical Chemistry Laboratory CHEM 442b/542b (3) Polymer Chemistry CHEM 449A/549A Topics in Chemical Biology ENVS 410 (3) Microbial Biogeochemistry and Global Change ENVS 425 (3) Environmental Microbiology ENVS/GEOS/HWRS 340 (3) Environmental Chemistry ENVS 462 (3) Environmental Soil and Water Chemistry ENVS 464 (3) Environmental Organic Chemistry GEOS 400 (3) Introduction to Geochemistry IMB 401 (3) Medical Microbiology & Immunobiology IMB 406 (3) Human Immunobiology MSE 460 (3) Materials Science of Polymers PCOL 410 (5) Medicinal Chemistry PCOL 350 ADME: (3) How the Body Changes Drugs PHYS 426 (3) Thermal Physics PHYS 431 (3) Molecular Biophysics PHYS 484 (3) Nuclear Magnetic Resonance Spectroscopy PTYS 407 (3) Chemistry of the Solar System PTYS 416 (3) Asteroids, Comets, and Kuiper Belt Objects CHEM 392 (1-6) Directed Research CHEM 392H (1-6) Honors Directed Research CHEM 399 (1-5) Independent Study CHEM 399H (1-5) Honors Independent Study CHEM 410/510 (3) Advanced Inorganic Chemistry CHEM 405A (1) Basic Laboratory Safety CHEM 405B (1) Advanced Laboratory Safety CHEM 405C (1) Chemical Hygiene and Regulations CHEM 491 (1-3) Preceptorship CHEM 491H (1-3) Honors Preceptorship CHEM 492 (1-6) Directed Research CHEM 492H (1-6) Honors Directed Research

		CHEM 493 (1-5) Internship CHEM 496D (1) Chemistry Discovery CHEM 498 (3) Senior Capstone CHEM 498H (3) Honors Thesis CHEM 499 (1-6) Independent Study CHEM 499H (1-6) Honors Independent Study
Internship, practicum, applied course requirements. (Yes/No). If yes, provide description.	No	No
Senior thesis or senior project required (Yes/No). If yes, provide description.	No	No
Additional requirements (provide description)	Minimum 2.0 GPA in the major	Minimum 2.0 GPA in the major
Minor (optional or required)	optional	optional

* These changes require Arizona Board of Regents (ABOR) approval.

VI. Faculty impact – will new faculty hires be required to deliver the new, proposed curriculum?

As mentioned in section IV, the impetus for changing the CHEM BA is to align it with the proposed new CHEM BS degree. There will be no additional faculty or budgetary needs to align the BA with the BS degree plan. The paperwork for the *Request for Substantial Change to the existing CHEM BS* degree describes the full impact associated with these curricular changes.

VII. Budgetary impact – indicate new resources needed and source of funding to implement proposed changes. If reallocating resources, indicate where resources will be taken from and the impact this will have on students/faculty/program/unit.

As mentioned in section IV, the impetus for changing the CHEM BA is to align it with the proposed new CHEM BS degree. There will be no additional faculty or budgetary needs to align the BA with the BS degree plan. The paperwork for the *Request for Substantial Change to the existing CHEM BS* degree describes the full impact associated with these curricular changes.

VIII. Transfer Student Consideration

Students transferring into the chemistry BA program usually have completed one or two years of chemistry. In most programs (including Arizona community colleges), students take general chemistry in year one and organic chemistry in year two. Table 2 shows equivalencies for these courses in the new BA plan. General chemistry coursework completed at other institutions will be accepted as equivalent to the CHEM 181/182 sequence. Students who have completed organic chemistry I and II elsewhere will get credit for completing the foundational organic chemistry class (CHEM 246) and the Syntheses lab course (CHEM 256L).

Table 2. Equivalencies for most common transfer coursework in the new chemistry BA degree.

Coursework completed	Equivalency
General chemistry I with lab	CHEM 181 General chemistry I
General chemistry II with lab	CHEM 182 General chemistry II
Organic chemistry I & II (with lab)	CHEM 246 (Foundational organic) + CHEM 256L (Syntheses lab)

Students transferring in their second year will easily transition to the new program, as they will have completed general chemistry and will start the second year taking the same courses as non-transfer students. They will be exempt from the CHEM 195a colloquium requirement and enroll in CHEM 295a in the spring semester.

Students transferring in their third year will be exempt from both CHEM 195a and 295a. They will need to complete the remaining foundational coursework (CHEM 310, CHEM 385, CHEM 227, CHEM 330L) as well as the advanced electives. They can easily accomplish this in two years with the increased elective options and elimination of the upper-level lab requirement in the new BA program.

IX. Required signatures

Program Director/Main Proposer (print name and title): Dee Belle-Oudry
CBC Associate Dept Head, Education & Academic Affairs

Program Director/Main Proposer signature:
Date: 11/3/2023

Department Head (print name and title): Craig Aspinwall
CBC Department Head, Professor of Chemistry

Department Head's signature:
Date: 11/3/23

Associate/Assistant Dean (print name): Rebecca Gomez

Associate/Assistant Dean's signature:
Date: 11/14/23

Dean (print name): Carmala Garzione

Dean's signature:
Date: 11/14/2023

Graduate: For use by Curricular Affairs (for majors):

Committee	Approval date
GPERC	
Graduate Council	

College Academic Administrators Council	
Arizona Board of Regents (if applicable)	

For minors and certificates:

Committee	Approval date
GPERC	

UG: For use by Curricular Affairs (for majors):

Committee	Approval date
APC	
Undergraduate Council	
U-CAAC	

For minors and certificates:

Committee	Approval date
APS	
Undergraduate Council	

Appendix A

Comparison of existing CHEM BA requirements with new proposed degree

Requirements for existing CHEM BA

Course number	Units	
MATH 122A/B or 125 Calc I	3-5	Supporting coursework
MATH 129 Calc II	3	
PHYS 141	4	
PHYS 241	4	
Total units	**14-16**	

Gen Chem I & II	8	Core major requirements
CHEM 246a + 246b	6	
CHEM 247a + 247b	4	
CHEM 380 (or MATH 223)	3	
CHEM 480A + 480B	6	
Total units	**27**	

One of the following labs:	(2-3 units)	In-depth coursework
CHEM 326	2	
CHEM 400A	3	
CHEM 400B	3	
CHEM 412	3	
CHEM 446	3	
CHEM 447	3	
Two advanced elective courses from:	(5-8 units)	
BIOC 384 OR 462A	3 or 4	
BIOC 385 OR 462B	3 or 4	
CHEM 325	2	
CHEM 401A	3	
CHEM 404A	3	
CHEM 450	3	
One elective from:	(3-4 units)	
CHEM 400A	3	
CHEM 400B	3	
CHEM 412	3	
CHEM 446	3	
CHEM 447	3	
BIOC 384 OR 462A	3 or 4	
BIOC 385 OR 462A	3 or 4	
CHEM 325	2	
CHEM 326	2	
CHEM 401A	3	
CHEM 404A	3	
CHEM 450	3	
Total units	**10-15**	

Total units including supporting, core, and in-depth coursework	**51-58**

Requirements for new CHEM BA

Course number	Units	
MATH 122A/B or 125 Calc I	3-5	Supporting coursework
MATH 129 Calc II	3	
PHYS 141 OR (PHYS 102 + PHYS 181)*	4	
Total units	**10-12**	

*note: PHYS 141 satisfies Gen Ed natural science requirement. PHYS 102/181 do not.

CHEM 181 & 182	8	Core major requirements
CHEM 195a	1	
CHEM 246 found org	3	
CHEM 310 found inorg	3	
CHEM 227 found analyt	3	
CHEM 385 found pchem	3	
CHEM 256L synth lab	2	
CHEM 330L meas lab	2	
CHEM 295a	1	
CHEM 395a	1	
Total units	**27**	

One course from the following:	3-4	In-depth coursework
BIOC 384 or 462A		
BIOC 385 or 462B (prereq BIOC 462A)		
BIOC 463A (prereq BIOC 462A)		
CHEM 380		
CHEM 401A		
CHEM 485 adv pchem (co-req CHEM 380)		
CHEM 410 adv inorg		
CHEM 346 adv org		
CHEM 423A/523A		
CHEM 487/587 (prereq CHEM 485)		
CHEM 418/518 (co-req CHEM 485)		
CHEM 446 (co-req CHEM 346)		
CHEM 447 (co-req CHEM 346)		
CHEM 450/550 (prereq CHEM 346)		
CHEM 400A (prereq CHEM 401A)		
CHEM 400B (co-req CHEM 485)		
CHEM 356L adv synth lab (co-req CHEM 346)		
CHEM 412 (co-req CHEM 410)		
Advanced Electives (List A or B)	6	
Total units	**9-11**	

Total units including supporting, core, and in-depth coursework	**46-50**

Appendix B

Electives lists for CHEM BA degree

Course
CHEM 346 (3) Advanced Organic Chemistry
CHEM 356L (3) Advanced Synthesis Laboratory
CHEM 410/510 (3) Advanced Inorganic Chemistry
CHEM 412 (3) Inorganic Preparations
CHEM 442b/542b (3) Polymer Chemistry
CHEM 446 (3) Organic Preparations
CHEM 447 (3) Organic Structural Analysis Laboratory
CHEM 449A/549A Topics in Chemical Biology
MSE 460 (3) Materials Science of Polymers
PCOL 410 (5) Medicinal Chemistry
CHEM 450/550 (3) Synthetic and Mechanistic Organic Chemistry
PCOL 350 ADME: (3) How the Body Changes Drugs
CHEM 400A (3) Chemical Measurements Laboratory
CHEM 401a (3) Instrumental Analysis
CHEM 422/522 (3) Electroanalytical Chemistry
CHEM 423a/523a (3) Bioanalytical Chemistry
CHEM 426B/526B (3) Analytical Molecular Spectroscopy
CHEM 425A/525A (3) Mass Spectrometry
CHEM 427/527 (3) Separations
CHEM 428B/528B (3) Advanced Analytical Chemistry Laboratory
BME 420 (3) Biophotonics
BME 447 (3) Sensors and Controls
BME 485 (3) Nanoscience and Nanotechnology for Biomedical Engineers
IMB 401 (4) Medical Microbiology & Immunobiology
IMB 406 (3) Human Immunobiology
ENVS 410 (3) Microbial Biogeochemistry and Global Change
ENVS 425 (3) Environmental Microbiology
ASTR 488A (3) Astrochemistry
CHEE/MSE 432 (3) Organic Electronic Materials & Devices
CHEE/CHEM/MSE 437 (3) Surface Science
CHEM 380 (3) Mathematical Physics for Chemistry
CHEM 400B (3) Chemical Measurements Laboratory
CHEM 485 (3) Advanced Physical Chemistry
CHEM 487/587 (3) Introduction to Molecular Spectroscopy
CHEM 418/518 (3) Computational Chemistry
PHYS 426 (3) Thermal Physics
PHYS 431 (3) Molecular Biophysics
PHYS 484 (3) Nuclear Magnetic Resonance Spectroscopy
PTYS 407 (3) Chemistry of the Solar System
PTYS 416 (3) Asteroids, Comets, and Kuiper Belt Objects
BIOC 385 (3) Metabolic Biochemistry
BIOC/CHEM/ECOL/PLS/MCB 448A (3) Plant Biochemistry and Metabolic Engineering
BIOC 462B (4) Biochemistry
BIOC 463A (4) Biochemical Laboratory Techniques
ENVS/GEOS/HWRS 340 (3) Environmental Chemistry
ENVS 462 (3) Environmental Soil and Water Chemistry
ENVS 464 (3) Environmental Organic Chemistry
GEOS 400 (3) Introduction to Geochemistry

Course
CHEM 392 (1-6) Directed Research
CHEM 392H (1-6) Honors Directed Research
CHEM 399 (1-5) Independent Study
CHEM 399H (1-5) Honors Independent Study
CHEM 405A (1) Basic Laboratory Safety
CHEM 405B (1) Advanced Laboratory Safety
CHEM 405C (1) Chemical Hygiene and Regulations
CHEM 491 (1-3) Preceptorship
CHEM 491H (1-3) Honors Preceptorship
CHEM 492 (1-6) Directed Research
CHEM 492H (1-6) Honors Directed Research
CHEM 493 (1-5) Internship
CHEM 496D (1) Chemistry Discovery
CHEM 498 (3) Senior Capstone
CHEM 498H (3) Honors Thesis
CHEM 499 (1-6) Independent Study
CHEM 499H (1-6) Honors Independent Study

Color Key:
green = appropriate for Building Molecules track
blue = appropriate for Bioanalytical track
peach = appropriate for Quantum Molecular Universe track