THE UNIVERSITY OF NORTH CAROLINA AT ASHEVILLE
FACULTY SENATE

Senate Document Number 4516S
Date of Senate Approval 1/14/16

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Statement of Faculty Senate Action:

APC Document 37 **Change the narrative for Chemistry, and change the major and minor requirements for Chemistry**

Effective Date: Fall 2016

1. **Delete:** On page 99-101, the **Chemistry narrative, and the major requirements for Chemistry:**

As a central science, chemistry is an important component of many disciplines. Therefore, it is the goal of the department to actively contribute to raising the level of scientific literacy for all students, provide them with an understanding of the relationship of chemistry to society, and to nurture their appreciation of the character of chemistry as a humanistic activity. The department continues to implement an approach that is built around an experiential, explorative-based curriculum that integrates the lecture with the laboratory and introduces students to research pedagogy early in their education. This involves smaller classes, group work, interactive methods, longer-term laboratories (projects and/or discovery-based laboratories), much greater use of student-centered learning activities, and culminates with a collaborative student-faculty research project. The department provides students with a solid base of chemical knowledge including the structure and reactivity of matter, familiarity with mathematical models describing matter, and experience with characterizing and measuring properties of matter. Students are taught problem solving and self-directed learning skills and communicating effectively both in writing and speaking.

Because its constituency is so diverse, the department offers both the Bachelor of Science and the Bachelor of Arts degrees with specific concentrations in each. The B.S. with a Concentration in Chemistry is intended for students wishing to pursue careers in industry as practicing chemists immediately after graduation or for those who will be seeking advanced degrees in chemistry. After students have completed this course of study, the department certifies to the American Chemical Society (ACS) that the students have fulfilled all of the requirements for an ACS-approved program. The B.S. with a Concentration in Biochemistry is intended for students wishing to obtain employment in a biochemically related field, pursue graduate studies, or attend schools of medicine, dentistry, pharmacy or veterinary medicine. The B.S. with a Concentration in Chemistry of the Environment is intended for students wishing either to seek employment or to attend graduate school in the area of environmental chemistry. The B.A. with Concentration in Chemistry or Biochemistry allows students more flexibility in course selections and is appropriate for those interested in chemistry-related fields or careers in health professions. Students pursuing teacher licensure must complete, at a minimum, the B.A. requirements listed under Chemistry with Teacher Licensure. The department also offers a joint program with North Carolina State University in Chemistry and Textile Chemistry. (See the section on Joint Programs.) UNC Asheville's Chemistry Department prepares students for employment in chemistry-related fields, for careers in teaching, or for entry into graduate and/or professional schools.

Chemistry majors must fulfill the following requirements:

I. Required course in the major—30 hours, including: CHEM 145, 222, 231, 232, 236, 237, 314, 328, 332, 334, 336, 380, 436.
II. Required courses outside the major—16 hours, including MATH 191, 192; PHYS 221, 231 (or 222).
III. Other departmental requirements—Completion of one of the degree requirements outlined below. A grade of C or better in either CHEM 408 or 418 is required to demonstrate practical, written, computer, and oral competency in chemistry.

Bachelor of Science Degree Concentration in Chemistry

16-17 hours distributed as follows: CHEM 315, 335, 413, 416, 417, 418, 428, 429; one 2-3 hour upper-level CHEM course (CHEM 390, 411 or 499 cannot be used to fulfill this requirement). MATH 291 and MATH 365 are recommended for those planning on graduate study in chemistry.

Bachelor of Science Degree – Concentration in Biochemistry

21–22 hours as follows: CHEM 315, 335, 413, 416, 417, 418, 437, 440; BIOL 116 and one 3-4 hour upper-level BIOL course approved by the Chair of Chemistry.

Bachelor of Science Degree – Concentration in Chemistry of the Environment

17–18 hours as follows: CHEM 413, 416, 417, 418, 430 (environmental chemistry topic), and at least 4 credit hours of additional 300-400 level course work in CHEM (CHEM 390, 411 or 499 cannot be used to fulfill this requirement); ENVR 130; and one 3-4 hour upper-level ENVR course approved by the Chair of Chemistry.

Bachelor of Arts Degree – Concentration in Chemistry

7 hours as follows: CHEM 406, 407, 408, 413, and 3 additional hours of 300-400 level course work in CHEM (CHEM 390, 411 or 499 cannot be used to fulfill this requirement).

Bachelor of Arts Degree – Concentration in Biochemistry

20 hours as follows: CHEM 406, 407, 408, 437, and 3 additional hours of 300-400 level course work in CHEM (CHEM 390, 411 or 499 cannot be used to fulfill this requirement); BIOL 116 and 7 hours of 300-400 level course work in BIOL approved by the Chair of Chemistry.

Bachelor of Arts Degree – Concentration in Chemistry with Teacher Licensure

4 hours as follows: CHEM 413; ENVR 130; and those requirements indicated in the Education section of the catalog (see the appropriate advisor in the Education Department for additional information about teacher licensure). Students who wish to receive teacher licensure in 9-12 Comprehensive Science (as distinct from Chemistry) must complete the requirements for Chemistry with teacher Licensure, as well as BIOL 123, BIOL 124, and ENVR 105. Students seeking Middle School Licensure must complete the requirements listed for Chemistry with Teacher Licensure as well as BIOL 123 and BIOL 124. The chemistry research requirements and competency are satisfied by successfully completing EDUC 456 and required courses in Chemistry.

Add: On pages 99-101, in place of deleted entry:

As a central science, chemistry is an important component of many disciplines. Therefore, it is the goal of the department to actively contribute to raising the level of scientific literacy for all students, provide them with an understanding of the relationship of chemistry to society, and to nurture their appreciation of the character of chemistry as a humanistic activity. The department continues to implement an approach that is built around an experiential, explorative-based curriculum that integrates the lecture with the laboratory and introduces students to research pedagogy early in their education. This involves smaller classes, group work, interactive methods, longer-term laboratories (projects and/or discovery-based laboratories), much greater use of student-centered learning activities, and culminates with a collaborative student-faculty research project. The department provides students with a solid base of chemical knowledge including the structure and reactivity of matter, familiarity with mathematical models describing matter, and experience with characterizing and measuring properties of matter. Students are taught problem solving and self-directed learning skills and communicating effectively both in writing and speaking.

Because its constituency is so diverse, the department offers both the Bachelor of Science and the Bachelor of Arts degrees with the flexibility to tailor course options to meet specific needs of the students.

Bachelor of Science Degree

The B.S. degree is intended for students wishing to pursue a career in industry or government as a practicing chemist immediately after graduation, or for those who will be seeking advanced degrees in chemistry. After students have completed this course of study, the department certifies to the American Chemical Society (ACS) that the students have fulfilled all of the requirements for an ACS-approved program. UNC Asheville's Chemistry Department prepares students for employment in chemistry-related fields, for careers in teaching, or for entry into graduate and/or professional schools.

I. Required courses for the major—42 hours, including: CHEM 111, 132, 145, 222, 223, 231, 232, 233, 323, 331, 380, 416, 417, 418; 4 hours of 312; and 9 hours of CHEM at the 400-level.
II. Required courses outside the major—16 hours, including MATH 191, 192; PHYS 221 and either PHYS 222 or 231.
III. Other departmental requirements—A grade of C or better in CHEM 418 is required to demonstrate practical, written, computer, and oral competency in chemistry.

In fulfilling requirements for the B.S. chemistry degree, students should consider the following guidelines when choosing courses to tailor their educations:

- Students interested in a biochemistry focus are recommended to take CHEM 437 and 6 additional hours of CHEM at the 400-level across chemistry subdisciplines as their required 9 hours of CHEM at the 400-level. Students are also recommended to take 2 additional courses in Biology (BIOL 116 and BIOL 338, 339, 344, 434 or 443). This focus is recommended for students wishing to obtain employment in a biochemical related field or pursue graduate studies in biochemistry and is also beneficial for students wishing to attend medical, dental, pharmacy or veterinary school.
- Students interested in an environmental chemistry focus are recommended to take CHEM 439 and 6 hours of CHEM at the 400-level across chemistry subdisciplines as their required 9 hours of CHEM at the 400-level. Students are also recommended to take 2 additional courses in Environmental Studies (ENVR 130 and ENVR 320, 338, 362, 385 or a course recommended by the Chair of Chemistry). This focus is recommended for students wishing to obtain employment in an environmental related field or pursue graduate studies in environmental chemistry.
- Students planning on graduate study in chemistry are recommended to also take CHEM

409, MATH 291 and 365, and at least 9 hours of CHEM at the 400-level across chemistry subdisciplines.

Bachelor of Arts Degree

The B.A. degree allows students greatest flexibility in course selections and is advantageous for those interested in chemistry-related fields or careers in health professions. Students pursuing teacher licensure must complete, at a minimum, the B.A. degree requirements.

I. Required courses for the major—at least 38 hours, including: CHEM 111, 132, 145, 222, 223, 231, 232, 233, 323, 331, 409; 4 hours of 312; and 6 hours of CHEM, BIOL, and/or ENVR at the 300-400 level, with the following exceptions: CHEM 390, 411, 499, BIOL 398, 480, 498, 499, and ENVR 490 and 499. The approved BIOL and ENVR courses require prerequisites.
II. Required courses outside the major—16 hours, including MATH 191, 192; PHYS 221 and either PHYS 222 or 231.
III. Other departmental requirements—A grade of C or better in CHEM 409 is required to demonstrate practical, written, computer and oral competency in chemistry.

In fulfilling requirements for the B.A. chemistry degree, students should consider the following guidelines when choosing courses to tailor their educations:

- Students interested in the pre-health professions are recommended to take BIOL 136. They should also take CHEM 437 as one of their two required 300-400 level courses with the second course being in Biology (BIOL 338, 339, 344, 434, 443, or a course recommended by their advisor, depending on their professional school focus). This focus is recommended for students wishing to attend medical, dental, pharmacy or veterinary school. Students should consult their advisor on tailoring the B.A. Chemistry degree to specific health professions.

2. Delete: On Page 101, the requirements under **Minor in Chemistry:**

22 hours including CHEM 145, 231, 236, 328; and 12 additional hours in chemistry (8 of which must be at the 300 or 400 level). CHEM 390, 411 or 499 cannot be used as part of the 12 additional hours.

University-wide minimum requirements for a minor: 1) one-half of the hours required for a minor must be completed in residence at UNC Asheville, to include at least 6 hours at the 300-400 level; 2) students must have a cumulative grade-point-average of at least 2.0 on minor courses taken at UNC Asheville.

Add: On page 101, in place of deleted entry:

23 hours including CHEM 111, 132, 145, 223, 231, 233, and 9 hours of CHEM at the 200 level or above. Six of the 9 hours must be at the 300-400 level. CHEM 390, 411 or 499 cannot be used as part of the 9 additional hours.

University-wide minimum requirements for a minor: 1) one-half of the hours required for a minor must be completed in residence at UNC Asheville, to include at least 6 hours at the 300-400 level; 2) students must have a cumulative grade-point-average of at least 2.0 on minor courses taken at UNC Asheville.

Impact Statement: There will be minimal impact on the staffing and resources in the Department of Chemistry. Attached is a staffing table of the courses offered and contact hours of the existing curriculum and the new curriculum. During the last academic year, 168 contact hours were used to deliver the foundational chemistry curriculum (lecture and labs), 33 contact hours for upper-level laboratory and research courses, and 24 contact hours for upper-level lecture courses, totaling 225 contact hours. If enrollment stays constant, the total contact hours for the streamlined chemistry curriculum will decrease slightly to 219 contact hours, with 162 contact hours for foundational lecture and labs, 36 contact hours for upper-level laboratory and research courses, and 21 contact hours for upper-level lecture courses. While we are offering new fundamental courses (CHEM 223, 233, 323, 331), new project lab courses (CHEM 312), and new upper-level classes (CHEM 409, 419, 434, 438, 439, 446), these will replace existing courses to be removed from the curriculum (CHEM 236, 237, 314, 315, 328, 332, 334, 335, 336, 406, 407, 408, 413, 428, 435, 436, and 440).

The changes for the BS and BA majors and minor in Chemistry are only positive for students, as these changes reduce the complexity, number of credit hours, and number of concentrations in the chemistry major without reducing rigor. In addition, by having students choose from a menu of upper-level courses based on a common set of pre-requisites, the requirements are streamlined in terms of the specific course requirements and the minimum number of semesters needed to complete all major requirements.

There will be minimal and manageable impact on current students who are partway through the chemistry curriculum. Following is a proposal for handling students in two sets of circumstances.

1) Currently-declared majors who need to finish on the original curriculum
2) Students who have not declared but have progressed along our current curriculum at least as far as CHEM 236 (where the curricula deviate)

The following is a set of direct course substitutions between all courses removed from the current curriculum and the new curriculum, which results in a net change of zero hours and no extra pre-requisites for students on all degree tracks, and transfers all current courses to new courses. The exception is the concentration in Chemistry of the Environment, which requires one additional credit hour in the substitutions. However, at the time of submitting this document, all currently-enrolled majors on this degree track are expected to graduate before Fall 2016 and these substitutions will not be necessary.

Courses required of all majors

CURRENT CURRICULUM		NEW CURRICULUM	
CHEM 236	Gen Chem II (3)	CHEM 233	Foundations Inorg (3)
CHEM 237	Analytical Chem(2)	CHEM 312	Project Lab (2)
CHEM 328	Inorg Chem (3)	CHEM 419	Nanochem (3)
CHEM 332 +CHEM 314	Instrumental(2) +P Chem Lab (1)	CHEM 223	Foundation Analytical (3)
CHEM 334	P Chem 1 (3)	CHEM 331	Foundations P Chem (3)
CHEM 336	Bio-organic (3)	CHEM 323	Foundations Biochem (3)
CHEM 436	Biochem 1 (3)	CHEM 432	Medicinal Chem (3)

Courses required for B.S. Chem

CURRENT CURRICULUM		NEW CURRICULUM	
CHEM 413 +CHEM 315	Inorg Lab (1) + Pchem 2 Lab (1)	CHEM 312	Project Lab (2)
CHEM 335	P Chem 2 (3)	CHEM 439	Atmospheric Chem (3)
CHEM 428	Comp Chem (3)	CHEM 438	Spectroscopy (3)

Courses required for B.S. Biochem

CURRENT CURRICULUM		NEW CURRICULUM	
CHEM 413 +CHEM 315	Inorg Lab (1) + Pchem 2 Lab (1)	CHEM 312	Project Lab (2)
CHEM 335	P Chem 2 (3)	CHEM 439	Atmospheric Chem (3)
CHEM 440	Bioinformatics (3)	CHEM 423	Organic Mechanism (3)

Courses required for B.S. Chem of the Environment

CURRENT CURRICULUM		NEW CURRICULUM	
CHEM 413	Inorg Lab (1)	CHEM 312	Project Lab (2)
CHEM 430	Atmospheric Chem (3)	CHEM 439	Atmospheric Chem (3)

Rationale: Our department is streamlining our major requirements to allow us to lower our required major course hours from 62-68 hours for the B.S. degree (depending on concentration) to 58 hours as one B.S. degree without decreasing rigor and without hidden prerequisites; the B.A degree hours also decrease from 53-66 hours (depending on concentration) to 54-58 hours in a single B.A degree option without decreasing rigor and without hidden pre-requisites. These changes also enable the Department of Chemistry majors to have less than 100 credit hours of combined credit hours for the major and Liberal Arts Core courses.

The streamlining of the major is being accomplished by developing 4 foundation courses (233, 223, 323 and 331) combined with a 5th currently-offered CHEM 231/232 foundational course sequence upon which the upper 300-400 level courses will build. This will offer a logical progression through the foundation courses during the first 5 semesters of a chemistry major with fewer prerequisites. Since the 300-400 level courses will build upon these 5 foundation courses, it would now be possible for a student to complete the major within 6 semesters. And by adapting some of the advanced curricular topics in chemistry to the new 200- and 300- foundational level courses, these changes would allow transfer students to begin the chemistry major coursework at a more introductory level without increasing the number of required course hours not offered at the community college level. Reducing the number of concentrations to only a B.S. and B.A. degree option still allows our majors to tailor their chemistry degree to specific fields such as biochemistry, environmental chemistry, and other chemistry foci, based on their choices of courses at the 400-level.

We are changing our minor requirements to not only follow our new major course requirements but are also working to make our minor more accessible to students in other departments by lowering the course requirement hours from 26 hours (due to hidden CHEM 132 and 111 prerequisites) to 23 hours.