

# REAL Curriculum Program Alignment Proposal

Department or School: ACSAT Enter dept/school name: Chemistry Date: 03/14/2020

Degree type: BS BA BBA BSN BM BFA BSW Minor Certificate

Program: Chemistry-Advanced Biochemistry Concentration

REAL Area Program Designation Sought (check all that apply): R E A L

Dept/School Contact: Dr. Chris Hermann, chermann@radford.edu

CHEM 111, CHEM 112, CHEM 216, CHEM 301, CHEM 302, CHEM 324, CHEM 350, CHEM 401, CHEM 402, CHEM 421, CHEM 450, CHEM 471, CHEM 472, CHEM 474, CHEM 481, CHEM 485, BIOL 132, BIOL 231, MATH 171, MATH

BS/BA Requirements: 172, PHYS 111 (or PHYS 221), PHYS 112 (or PHYS 222)

- Any degree program that fulfills a REAL area must include at least 9 unique credit hours for each area covered. At least 3 of these 9 credit hours must be at the 300 level or above
- A single major degree program may fulfill no more than three REAL areas for any one student, unless all four REAL areas are fulfilled by accreditation or licensure requirements.
- A single minor or certificate degree program may fulfill no more than two REAL areas.
- Degree program may cover up to two REAL areas using a single prefix.
- All courses documenting the coverage of a REAL area must fulfill all learning outcomes and be designated in that area.
- All courses that document fulfillment of a REAL area within a degree program of study are NOT required to be taught by the department/school. However, departments/schools are expected to formally communicate with other departments about reliance on and inclusion of courses in their degree program plans of study. Indicate this through signature of chair or director of the partnering department or school in the areas below.
- Departments or schools that seek to fulfill REAL areas must acknowledge assessment requirements for those areas. Assessment of degree seeking students is required to be conducted yearly by the department or school offering the degree program.
- If departments or schools want to use a menu of courses to fulfill a particular area, please duplicate the sections below for each REAL area and include information for each course included in the menu of options.
- Please save this file for submission as PROGRAM NAME\_ProgramType.docx (Example: Criminal Justice\_BS.docx)

By signing, the department/school acknowledges the above conditions and considerations:

Dept/School Signature <i>Christine K. Hermann</i>	Date: 4/16/20
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**Official Program Description:**

Please paste the entire official program description from the Radford University catalog in the space within this box. Find those here: <https://catalog.radford.edu/>

Please note that every department/school will have to submit a catalog change proposal for program that asks the Registrar's Office to insert language about the program coverage of the REAL areas into the official Radford University catalog upon approval.

Radford University

# Chemistry, B.S.

[Advanced Biochemistry Concentration](#)

[Forensics Concentration](#)

[Advanced Professional Chemist Concentration](#)

[Professional Chemist Concentration](#)

[Biochemistry: Life Sciences and Pre-Health Concentration](#)

## Core Curriculum Requirements (43-47 credits)

See [Core Curriculum](#) courses.

## Required Major Core Courses (32 credits)

[CHEM 111 - General Chemistry I \\*](#)

[CHEM 112 - General Chemistry II \\*](#)

[CHEM 216 - Inorganic Chemistry](#)

[CHEM 301 - Organic Chemistry I](#)

[CHEM 302 - Organic Chemistry II](#)

[CHEM 324 - Analytical Chemistry](#)

[CHEM 401 - Physical Chemistry I](#)

[CHEM 450 - Career and Professional Development](#)

[CHEM 471 - Biochemistry I](#)

**Note(s):**

\*[CHEM 111](#) and [CHEM 112](#) have been approved for Core Curriculum credit in Natural Sciences.

## Math Requirements (8-10 credits)

Option A

[MATH 171 - Calculus and Analytic Geometry I](#)

[MATH 172 - Calculus and Analytic Geometry II](#)

Option B

[MATH 168 - Calculus I with Integrated Precalculus I](#)

[MATH 169 - Calculus I with Integrated Precalculus II](#)

[MATH 172 - Calculus and Analytic Geometry II](#)

Note(s):

\*[MATH 168](#), [MATH 169](#), [MATH 171](#), and [MATH 172](#) have been approved for Core Curriculum credit in Mathematical Sciences.

## Biology Requirements (4 credits)

[BIOL 105 - Biology for Health Sciences](#)

or

[BIOL 132 - Biology of Cells and Microorganisms](#)

## B.S. Requirements

### B.S. (Non Teaching) Requirements (8 credits)

Bachelor of Science degree without a professional licensure in secondary education requires the following:

[PHYS 111 - General Physics](#) and

[PHYS 112 - General Physics](#)

or

[PHYS 221 - Physics](#) and

[PHYS 222 - Physics](#)

## Advanced Professional Chemist Concentration

This concentration is a rigorous four-year program that provides a strong background in chemistry for those students who plan to become professional chemists. It provides an excellent foundation for graduate study in chemistry or related fields and will prepare students for careers in industrial, academic or governmental settings. With this concentration, the student will have an ACS approved degree.

## Other Required Courses (27-28 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 416 - Advanced Inorganic Chemistry](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

One additional 300- or higher level course (3-4 credit hours) with CHEM prefix

[CHEM 421 - Polymer Chemistry](#)

[CHEM 481 - Undergraduate Research](#)

[CHEM 485 - Capstone Research Experience](#)

## Professional Chemist Concentration

This concentration is a rigorous four-year program that provides a strong background in chemistry for those students who plan to become professional chemists. It will prepare students for careers in industrial, academic or governmental settings.

## Other Required Courses (14 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

Four additional credits; select from 300- or higher level of courses with a CHEM prefix, including [CHEM 481](#)

## Biochemistry: Life Sciences and Pre-Health Concentration

This concentration is a rigorous four year program recommended for students planning a career in pharmacy, medicine, dentistry or veterinary medicine. The first three years are designed to optimally prepare students for the pre-entrance aptitude examination (PCAT, MCAT, DAT or GRE).

## Other Required Courses (16 credits)

[CHEM 472 - Biochemistry II](#)

[CHEM 474 - Biochemistry Laboratory](#)

[BIOL 231 - Genetics, Evolution and Development](#)

8 additional credits of 300- or higher level courses with CHEM or BIOL prefix.

## Advanced Biochemistry Concentration

This concentration is a rigorous four-year program recommended for students interested in a career in biochemistry. It provides a comprehensive foundation for graduate study in biochemistry, pharmacology, or related fields and prepares students for careers in industrial, governmental, or academic settings. With this concentration, the student will have an ACS approved degree.

### Other Required Courses (28 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 421 - Polymer Chemistry](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

[CHEM 472 - Biochemistry II](#)

[CHEM 474 - Biochemistry Laboratory](#)

[BIOL 231 - Genetics, Evolution and Development](#)

[CHEM 481 - Undergraduate Research](#)

[CHEM 485 - Capstone Research Experience](#)

## Forensics Concentration

This concentration is a rigorous four year program recommended for students planning a career in forensic science. It provides a comprehensive foundation for graduate study in forensic chemistry, forensic science, or analytical chemistry and prepares students for careers in industrial, governmental, or academic settings.

### Other Required Courses (28 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

[CHEM 465 - Forensic Chemistry](#)

[CHEM 481 - Undergraduate Research](#)

[BIOL 231 - Genetics, Evolution and Development](#)

[CRJU 100 - Introduction to Criminal Justice](#)

[CRJU 320 - Criminal Investigative Theory](#)

[CRJU 341 - Introduction to Forensic Science](#)

## Total Credits Needed for Degree 120

(Includes Core Curriculum requirements, required courses and electives. Students should consult with their academic advisors in selecting elective courses to complete the 120 semester hours required for graduation.)

## Graduation Requirements

To graduate with a major in chemistry, a student must attain an overall major grade point average of 2.0 or higher. Different courses are considered in the calculation of the major grade point average depending on the student's concentration. All courses required for a given concentration count towards the major grade point average. In cases where additional (beyond those required) electives listed for a given concentration are taken, all count towards the major grade point average calculation.

## Teaching Licensure

Students preparing to teach chemistry in the secondary schools are required to take courses in professional education in addition to Core Curriculum courses and courses required by the chemistry major. Interested students should contact the College of Education and Human Development for more information.

## SCIENTIFIC AND QUANTITATIVE REASONING

<p>R Area:  Course Prefix: CHEM  Course Number: 111  Course Title: General Chemistry I  Credit Hours: 4  New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No    Projected student enrollment per academic year: 432</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input checked="" type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input type="checkbox"/> Every academic year <input checked="" type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>R Area:  Course Prefix: CHEM  Course Number: 112  Course Title: General Chemistry II  Credit Hours: 4  New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No    Projected student enrollment per academic year: 240</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>R Area:  Course Prefix: CHEM  Course Number: 301  Course Title: Organic Chemistry I  Credit Hours: 4  New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No    Projected student enrollment per academic year: 140</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>R Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: CHEM 111, CHEM 112, CHEM 120, CHEM 122, MATH 171, MATH 172, PHYS 111, PHYS 112</p>	

<p>R Area:  Learning Goal: To apply scientific and quantitative reasoning to questions about the natural world, mathematics, or related areas.</p>	
<p>Learning Outcome 1: Students apply scientific and quantitative information to test problems and draw conclusions.</p>	<p>Description of learning outcome assessment plan:    Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring</p>

	the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.
Learning Outcome 2: Students evaluate the quality of data, methods, or inferences used to generate scientific and quantitative knowledge.	Description of learning outcome assessment plan:  Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.
Additional information for REAL Council consideration:	

## HUMANISTIC OR ARTISTIC EXPRESSION

<b>E Area:</b> Course Prefix: Course Number: Course Title: Credit Hours: New course: <input type="checkbox"/> Yes <input type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Projected student enrollment per academic year:	Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other  Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:
<b>E Area:</b> Course Prefix: Course Number: Course Title: Credit Hours: New course: <input type="checkbox"/> Yes <input type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Projected student enrollment per academic year:	Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other  Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:
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Projected student enrollment per academic year:	Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:
E Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: (please list at least one, can also be listed above but does not need to be)	

E Area: Learning Goal: To explore humanistic or artistic expression through inquiry or creativity.	
Learning Outcome 1: Students demonstrate understanding of diverse ideas, languages, products, or processes of humanistic inquiry or artistic expression.	Description of learning outcome assessment plan:
Learning Outcome 2: Students critically evaluate, synthesize, or create forms of human expression or inquiry.	Description of learning outcome assessment plan:
Additional information for REAL Council consideration:	

## CULTURAL OR BEHAVIORAL ANALYSIS

<p>A Area:  Course Prefix:  Course Number:  Course Title:  Credit Hours:  New course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No    Projected student enrollment per academic year:</p>	<p>Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)    Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
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<p>A Area:  Course Prefix:  Course Number:  Course Title:  Credit Hours:  New course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No    Projected student enrollment per academic year:</p>	<p>Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)    Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>A Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: (please list at least one, can also be listed above but does not need to be)</p>	

<p>A Area:  Learning Goal: To examine the context and interactions of culture(s) and/or behavior(s).</p>	
<p>Learning Outcome 1: Students describe behaviors, beliefs, cultures, social institutions, and/or environments.</p>	<p>Description of learning outcome assessment plan:</p>
<p>Learning Outcome 2: Students analyze the interactions of behaviors, beliefs, cultures, social institutions, and/or environments.</p>	<p>Description of learning outcome assessment plan:</p>
<p>Additional information for REAL Council consideration:</p>	

## APPLIED LEARNING

<p>L Area: Course Prefix: CHEM Course Number: 302 Course Title: Organic Chemistry II Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 120</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>L Area: Course Prefix: CHEM Course Number: 324 Course Title: Analytical Chemistry Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 48</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input checked="" type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>L Area: Course Prefix: CHEM Course Number: 401 Course Title: Physical Chemistry I Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 24</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>L Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: PHYS 111, PHYS 112, MATH 171, MATH 172</p>	

<p>L Area: Learning Goal: To explore professional practice through the application of knowledge, skills, and critical reflection.</p>	
<p>Learning Outcome 1: Students apply acquired knowledge and skills to develop professional identity or professional practice.</p>	<p>Description of learning outcome assessment plan:</p> <p>Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.</p>

<p>Learning Outcome 2: Students critically reflect on their learning, abilities, experiences, or role within professional contexts.</p>	<p>Description of learning outcome assessment plan:</p> <p>Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.</p>
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Are existing material resources adequate to support this program alignment proposal?

Yes  No If not, what additional material resources would be needed?

Are existing space resources adequate to support this program alignment proposal?

Yes  No If not, what additional space resources would be needed?

Are existing human resources adequate to support this program alignment proposal?

Yes  No If not, what additional human resources would be needed?

Department Curriculum Committee Recommendation:	Signature: <i>Christopher J. Monahan</i>	Date:4/16/20
Chair/Dean on Behalf of Dept/School:	Signature: <i>Christine K. Heermann</i>	Date:4/16/20
College Curriculum Committee Approval:	Signature:	Date:
Dean/AVP Approval:	Signature:	Date:
REAL Council Recommendation:	Signature:	Date:
Faculty Senate Curriculum Committee Recommendation:	Signature:	Date:
Faculty Senate Approval:	Signature:	Date:
Provost Approval:	Signature:	Date:

# REAL Curriculum Program Alignment Proposal

Department or School: ACSAT Enter dept/school name: Chemistry Date: 03/14/2020

Degree type: BS BA BBA BSN BM BFA BSW Minor Certificate

Program: Chemistry-Advanced Professional Chemist Concentration

REAL Area Program Designation Sought (check all that apply):  R  E  A  L

Dept/School Contact: Dr. Chris Hermann, chermann@radford.edu

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Dept/School Signature <i>Christine K. Hermann</i>	Date: 4/16/20
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[Forensics Concentration](#)

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[MATH 172 - Calculus and Analytic Geometry II](#)

Note(s):

\*[MATH 168](#), [MATH 169](#), [MATH 171](#), and [MATH 172](#) have been approved for Core Curriculum credit in Mathematical Sciences.

## Biology Requirements (4 credits)

[BIOL 105 - Biology for Health Sciences](#)

or

[BIOL 132 - Biology of Cells and Microorganisms](#)

## B.S. Requirements

### B.S. (Non Teaching) Requirements (8 credits)

Bachelor of Science degree without a professional licensure in secondary education requires the following:

[PHYS 111 - General Physics](#) and

[PHYS 112 - General Physics](#)

or

[PHYS 221 - Physics](#) and

[PHYS 222 - Physics](#)

## Advanced Professional Chemist Concentration

This concentration is a rigorous four-year program that provides a strong background in chemistry for those students who plan to become professional chemists. It provides an excellent foundation for graduate study in chemistry or related fields and will prepare students for careers in industrial, academic or governmental settings. With this concentration, the student will have an ACS approved degree.

## Other Required Courses (27-28 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 416 - Advanced Inorganic Chemistry](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

One additional 300- or higher level course (3-4 credit hours) with CHEM prefix

[CHEM 421 - Polymer Chemistry](#)

[CHEM 481 - Undergraduate Research](#)

[CHEM 485 - Capstone Research Experience](#)

## Professional Chemist Concentration

This concentration is a rigorous four-year program that provides a strong background in chemistry for those students who plan to become professional chemists. It will prepare students for careers in industrial, academic or governmental settings.

## Other Required Courses (14 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

Four additional credits; select from 300- or higher level of courses with a CHEM prefix, including [CHEM 481](#)

## Biochemistry: Life Sciences and Pre-Health Concentration

This concentration is a rigorous four year program recommended for students planning a career in pharmacy, medicine, dentistry or veterinary medicine. The first three years are designed to optimally prepare students for the pre-entrance aptitude examination (PCAT, MCAT, DAT or GRE).

## Other Required Courses (16 credits)

[CHEM 472 - Biochemistry II](#)

[CHEM 474 - Biochemistry Laboratory](#)

[BIOL 231 - Genetics, Evolution and Development](#)

8 additional credits of 300- or higher level courses with CHEM or BIOL prefix.

## Advanced Biochemistry Concentration

This concentration is a rigorous four-year program recommended for students interested in a career in biochemistry. It provides a comprehensive foundation for graduate study in biochemistry, pharmacology, or related fields and prepares students for careers in industrial, governmental, or academic settings. With this concentration, the student will have an ACS approved degree.

### Other Required Courses (28 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 421 - Polymer Chemistry](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

[CHEM 472 - Biochemistry II](#)

[CHEM 474 - Biochemistry Laboratory](#)

[BIOL 231 - Genetics, Evolution and Development](#)

[CHEM 481 - Undergraduate Research](#)

[CHEM 485 - Capstone Research Experience](#)

## Forensics Concentration

This concentration is a rigorous four year program recommended for students planning a career in forensic science. It provides a comprehensive foundation for graduate study in forensic chemistry, forensic science, or analytical chemistry and prepares students for careers in industrial, governmental, or academic settings.

### Other Required Courses (28 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

[CHEM 465 - Forensic Chemistry](#)

[CHEM 481 - Undergraduate Research](#)

[BIOL 231 - Genetics, Evolution and Development](#)

[CRJU 100 - Introduction to Criminal Justice](#)

[CRJU 320 - Criminal Investigative Theory](#)

[CRJU 341 - Introduction to Forensic Science](#)

## Total Credits Needed for Degree 120

(Includes Core Curriculum requirements, required courses and electives. Students should consult with their academic advisors in selecting elective courses to complete the 120 semester hours required for graduation.)

## Graduation Requirements

To graduate with a major in chemistry, a student must attain an overall major grade point average of 2.0 or higher. Different courses are considered in the calculation of the major grade point average depending on the student's concentration. All courses required for a given concentration count towards the major grade point average. In cases where additional (beyond those required) electives listed for a given concentration are taken, all count towards the major grade point average calculation.

## Teaching Licensure

Students preparing to teach chemistry in the secondary schools are required to take courses in professional education in addition to Core Curriculum courses and courses required by the chemistry major. Interested students should contact the College of Education and Human Development for more information.

## SCIENTIFIC AND QUANTITATIVE REASONING

<p>R Area: Course Prefix: CHEM Course Number: 111 Course Title: General Chemistry I Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 432</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input checked="" type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input type="checkbox"/> Every academic year <input checked="" type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>R Area: Course Prefix: CHEM Course Number: 112 Course Title: General Chemistry II Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 240</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>R Area: Course Prefix: CHEM Course Number: 301 Course Title: Organic Chemistry I Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 140</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>R Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: CHEM 111, CHEM 112, CHEM 120, CHEM 122, MATH 171, MATH 172, PHYS 111, PHYS 112</p>	

<p>R Area: Learning Goal: To apply scientific and quantitative reasoning to questions about the natural world, mathematics, or related areas.</p>	
<p>Learning Outcome 1: Students apply scientific and quantitative information to test problems and draw conclusions.</p>	<p>Description of learning outcome assessment plan:</p> <p>Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring</p>

	the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.
Learning Outcome 2: Students evaluate the quality of data, methods, or inferences used to generate scientific and quantitative knowledge.	Description of learning outcome assessment plan:  Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.
Additional information for REAL Council consideration:	

## HUMANISTIC OR ARTISTIC EXPRESSION

<b>E Area:</b> Course Prefix: Course Number: Course Title: Credit Hours: New course: <input type="checkbox"/> Yes <input type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Projected student enrollment per academic year:	Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other  Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:
<b>E Area:</b> Course Prefix: Course Number: Course Title: Credit Hours: New course: <input type="checkbox"/> Yes <input type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Projected student enrollment per academic year:	Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other  Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:
<b>E Area:</b> Course Prefix: Course Number: Course Title: Credit Hours: New course: <input type="checkbox"/> Yes <input type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No	Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other

Projected student enrollment per academic year:	Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:
E Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: (please list at least one, can also be listed above but does not need to be)	

E Area: Learning Goal: To explore humanistic or artistic expression through inquiry or creativity.	
Learning Outcome 1: Students demonstrate understanding of diverse ideas, languages, products, or processes of humanistic inquiry or artistic expression.	Description of learning outcome assessment plan:
Learning Outcome 2: Students critically evaluate, synthesize, or create forms of human expression or inquiry.	Description of learning outcome assessment plan:
Additional information for REAL Council consideration:	

## CULTURAL OR BEHAVIORAL ANALYSIS

<p>A Area:  Course Prefix:  Course Number:  Course Title:  Credit Hours:  New course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No    Projected student enrollment per academic year:</p>	<p>Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)    Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>A Area:  Course Prefix:  Course Number:  Course Title:  Credit Hours:  New course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No    Projected student enrollment per academic year:</p>	<p>Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)    Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>A Area:  Course Prefix:  Course Number:  Course Title:  Credit Hours:  New course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No    Projected student enrollment per academic year:</p>	<p>Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)    Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>A Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: (please list at least one, can also be listed above but does not need to be)</p>	

<p>A Area:  Learning Goal: To examine the context and interactions of culture(s) and/or behavior(s).</p>	
<p>Learning Outcome 1: Students describe behaviors, beliefs, cultures, social institutions, and/or environments.</p>	<p>Description of learning outcome assessment plan:</p>
<p>Learning Outcome 2: Students analyze the interactions of behaviors, beliefs, cultures, social institutions, and/or environments.</p>	<p>Description of learning outcome assessment plan:</p>
<p>Additional information for REAL Council consideration:</p>	

## APPLIED LEARNING

<p>L Area: Course Prefix: CHEM Course Number: 302 Course Title: Organic Chemistry II Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 120</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>L Area: Course Prefix: CHEM Course Number: 324 Course Title: Analytical Chemistry Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 48</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input checked="" type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>L Area: Course Prefix: CHEM Course Number: 401 Course Title: Physical Chemistry I Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 24</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>L Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: PHYS 111, PHYS 112, MATH 171, MATH 172</p>	

<p>L Area: Learning Goal: To explore professional practice through the application of knowledge, skills, and critical reflection.</p>	
<p>Learning Outcome 1: Students apply acquired knowledge and skills to develop professional identity or professional practice.</p>	<p>Description of learning outcome assessment plan:</p> <p>Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.</p>

<p>Learning Outcome 2: Students critically reflect on their learning, abilities, experiences, or role within professional contexts.</p>	<p>Description of learning outcome assessment plan:</p> <p>Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.</p>
<p>Additional information for REAL Council consideration:</p>	

Are existing material resources adequate to support this program alignment proposal?

Yes  No If not, what additional material resources would be needed?

Are existing space resources adequate to support this program alignment proposal?

Yes  No If not, what additional space resources would be needed?

Are existing human resources adequate to support this program alignment proposal?

Yes  No If not, what additional human resources would be needed?

Department Curriculum Committee Recommendation:	Signature: <i>Christopher J. Monahan</i>	Date: 4/16/20
Chair/Dean on Behalf of Dept/School:	Signature: <i>Christine K. Heermann</i>	Date: 4/16/20
College Curriculum Committee Approval:	Signature:	Date:
Dean/AVP Approval:	Signature:	Date:
REAL Council Recommendation:	Signature:	Date:
Faculty Senate Curriculum Committee Recommendation:	Signature:	Date:
Faculty Senate Approval:	Signature:	Date:
Provost Approval:	Signature:	Date:

# REAL Curriculum Program Alignment Proposal

Department or School: ACSAT Enter dept/school name: Chemistry Date: 03/14/2020

Degree type: BS BA BBA BSN BM BFA BSW Minor Certificate

Program: Chemistry- Biochemistry: Life Sciences and Pre-Health Concentration

REAL Area Program Designation Sought (check all that apply):  R  E  A  L

Dept/School Contact: Dr. Chris Hermann, [chermann@radford.edu](mailto:chermann@radford.edu)

CHEM 111, CHEM 112, CHEM 216, CHEM 301, CHEM 302, CHEM 324, CHEM 401, CHEM 450, CHEM 471, CHEM 472, CHEM 474, CHEM/BIO (8 credit hrs 300/400 level), BIOL 132, BIOL 231, MATH 171, MATH 172, PHYS 111 (or

BS/BA Requirements: PHYS 221), PHYS 112 (or PHYS 222)

- Any degree program that fulfills a REAL area must include at least 9 unique credit hours for each area covered. At least 3 of these 9 credit hours must be at the 300 level or above
- A single major degree program may fulfill no more than three REAL areas for any one student, unless all four REAL areas are fulfilled by accreditation or licensure requirements.
- A single minor or certificate degree program may fulfill no more than two REAL areas.
- Degree program may cover up to two REAL areas using a single prefix.
- All courses documenting the coverage of a REAL area must fulfill all learning outcomes and be designated in that area.
- All courses that document fulfillment of a REAL area within a degree program of study are NOT required to be taught by the department/school. However, departments/schools are expected to formally communicate with other departments about reliance on and inclusion of courses in their degree program plans of study. Indicate this through signature of chair or director of the partnering department or school in the areas below.
- Departments or schools that seek to fulfill REAL areas must acknowledge assessment requirements for those areas. Assessment of degree seeking students is required to be conducted yearly by the department or school offering the degree program.
- If departments or schools want to use a menu of courses to fulfill a particular area, please duplicate the sections below for each REAL area and include information for each course included in the menu of options.
- Please save this file for submission as PROGRAM NAME\_ProgramType.docx (Example: Criminal Justice\_BS.docx)

By signing, the department/school acknowledges the above conditions and considerations:

Dept/School Signature <i>Christine K. Hermann</i>	Date: 4/16/20
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**Official Program Description:**

Please paste the entire official program description from the Radford University catalog in the space within this box. Find those here: <https://catalog.radford.edu/>

Please note that every department/school will have to submit a catalog change proposal for program that asks the Registrar's Office to insert language about the program coverage of the REAL areas into the official Radford University catalog upon approval.

Radford University

# Chemistry, B.S.

OBJ:

[Advanced Biochemistry Concentration](#)

[Forensics Concentration](#)

[Advanced Professional Chemist Concentration](#)

[Professional Chemist Concentration](#)

[Biochemistry: Life Sciences and Pre-Health Concentration](#)

## Core Curriculum Requirements (43-47 credits)

See [Core Curriculum](#) courses.

## Required Major Core Courses (32 credits)

[CHEM 111 - General Chemistry I \\*](#)

[CHEM 112 - General Chemistry II \\*](#)

[CHEM 216 - Inorganic Chemistry](#)

[CHEM 301 - Organic Chemistry I](#)

[CHEM 302 - Organic Chemistry II](#)

[CHEM 324 - Analytical Chemistry](#)

[CHEM 401 - Physical Chemistry I](#)

[CHEM 450 - Career and Professional Development](#)

[CHEM 471 - Biochemistry I](#)

Note(s):

\*[CHEM 111](#) and [CHEM 112](#) have been approved for Core Curriculum credit in Natural Sciences.

## Math Requirements (8-10 credits)

Option A

[MATH 171 - Calculus and Analytic Geometry I](#)

[MATH 172 - Calculus and Analytic Geometry II](#)

Option B

[MATH 168 - Calculus I with Integrated Precalculus I](#)

[MATH 169 - Calculus I with Integrated Precalculus II](#)

[MATH 172 - Calculus and Analytic Geometry II](#)

Note(s):

\*[MATH 168](#), [MATH 169](#), [MATH 171](#), and [MATH 172](#) have been approved for Core Curriculum credit in Mathematical Sciences.

## Biology Requirements (4 credits)

[BIOL 105 - Biology for Health Sciences](#)

or

[BIOL 132 - Biology of Cells and Microorganisms](#)

## B.S. Requirements

### B.S. (Non Teaching) Requirements (8 credits)

Bachelor of Science degree without a professional licensure in secondary education requires the following:

[PHYS 111 - General Physics](#) and

[PHYS 112 - General Physics](#)

or

[PHYS 221 - Physics](#) and

[PHYS 222 - Physics](#)

## Advanced Professional Chemist Concentration

This concentration is a rigorous four-year program that provides a strong background in chemistry for those students who plan to become professional chemists. It provides an excellent foundation for graduate study in chemistry or related fields and will prepare students for careers in industrial, academic or governmental settings. With this concentration, the student will have an ACS approved degree.

## Other Required Courses (27-28 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 416 - Advanced Inorganic Chemistry](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

One additional 300- or higher level course (3-4 credit hours) with CHEM prefix

[CHEM 421 - Polymer Chemistry](#)

[CHEM 481 - Undergraduate Research](#)

[CHEM 485 - Capstone Research Experience](#)

## Professional Chemist Concentration

This concentration is a rigorous four-year program that provides a strong background in chemistry for those students who plan to become professional chemists. It will prepare students for careers in industrial, academic or governmental settings.

## Other Required Courses (14 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

Four additional credits; select from 300- or higher level of courses with a CHEM prefix, including [CHEM 481](#)

## Biochemistry: Life Sciences and Pre-Health Concentration

This concentration is a rigorous four year program recommended for students planning a career in pharmacy, medicine, dentistry or veterinary medicine. The first three years are designed to optimally prepare students for the pre-entrance aptitude examination (PCAT, MCAT, DAT or GRE).

## Other Required Courses (16 credits)

[CHEM 472 - Biochemistry II](#)

[CHEM 474 - Biochemistry Laboratory](#)

[BIOL 231 - Genetics, Evolution and Development](#)

8 additional credits of 300- or higher level courses with CHEM or BIOL prefix.

## Advanced Biochemistry Concentration

This concentration is a rigorous four-year program recommended for students interested in a career in biochemistry. It provides a comprehensive foundation for graduate study in biochemistry, pharmacology, or related fields and prepares students for careers in industrial, governmental, or academic settings. With this concentration, the student will have an ACS approved degree.

### Other Required Courses (28 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 421 - Polymer Chemistry](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

[CHEM 472 - Biochemistry II](#)

[CHEM 474 - Biochemistry Laboratory](#)

[BIOL 231 - Genetics, Evolution and Development](#)

[CHEM 481 - Undergraduate Research](#)

[CHEM 485 - Capstone Research Experience](#)

## Forensics Concentration

This concentration is a rigorous four year program recommended for students planning a career in forensic science. It provides a comprehensive foundation for graduate study in forensic chemistry, forensic science, or analytical chemistry and prepares students for careers in industrial, governmental, or academic settings.

### Other Required Courses (28 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

[CHEM 465 - Forensic Chemistry](#)

[CHEM 481 - Undergraduate Research](#)

[BIOL 231 - Genetics, Evolution and Development](#)

[CRJU 100 - Introduction to Criminal Justice](#)

[CRJU 320 - Criminal Investigative Theory](#)

[CRJU 341 - Introduction to Forensic Science](#)

## Total Credits Needed for Degree 120

(Includes Core Curriculum requirements, required courses and electives. Students should consult with their academic advisors in selecting elective courses to complete the 120 semester hours required for graduation.)

## Graduation Requirements

To graduate with a major in chemistry, a student must attain an overall major grade point average of 2.0 or higher. Different courses are considered in the calculation of the major grade point average depending on the student's concentration. All courses required for a given concentration count towards the major grade point average. In cases where additional (beyond those required) electives listed for a given concentration are taken, all count towards the major grade point average calculation.

## Teaching Licensure

Students preparing to teach chemistry in the secondary schools are required to take courses in professional education in addition to Core Curriculum courses and courses required by the chemistry major. Interested students should contact the College of Education and Human Development for more information.

## SCIENTIFIC AND QUANTITATIVE REASONING

<p>R Area: Course Prefix: CHEM Course Number: 111 Course Title: General Chemistry I Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 432</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input checked="" type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input type="checkbox"/> Every academic year <input checked="" type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>R Area: Course Prefix: CHEM Course Number: 112 Course Title: General Chemistry II Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 240</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>R Area: Course Prefix: CHEM Course Number: 301 Course Title: Organic Chemistry I Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 140</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>R Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: CHEM 111, CHEM 112, CHEM 120, CHEM 122, MATH 171, MATH 172, PHYS 111, PHYS 112</p>	

<p>R Area: Learning Goal: To apply scientific and quantitative reasoning to questions about the natural world, mathematics, or related areas.</p>	
<p>Learning Outcome 1: Students apply scientific and quantitative information to test problems and draw conclusions.</p>	<p>Description of learning outcome assessment plan:</p> <p>Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring</p>

	the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.
Learning Outcome 2: Students evaluate the quality of data, methods, or inferences used to generate scientific and quantitative knowledge.	<b>Description of learning outcome assessment plan:</b>  Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.
Additional information for REAL Council consideration:	

## HUMANISTIC OR ARTISTIC EXPRESSION

<b>E Area:</b> Course Prefix: Course Number: Course Title: Credit Hours: New course: <input type="checkbox"/> Yes <input type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Projected student enrollment per academic year:	Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other  Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:
<b>E Area:</b> Course Prefix: Course Number: Course Title: Credit Hours: New course: <input type="checkbox"/> Yes <input type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Projected student enrollment per academic year:	Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other  Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:
<b>E Area:</b> Course Prefix: Course Number: Course Title: Credit Hours: New course: <input type="checkbox"/> Yes <input type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No	Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other

Projected student enrollment per academic year:	Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:
E Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: (please list at least one, can also be listed above but does not need to be)	

E Area: Learning Goal: To explore humanistic or artistic expression through inquiry or creativity.	
Learning Outcome 1: Students demonstrate understanding of diverse ideas, languages, products, or processes of humanistic inquiry or artistic expression.	Description of learning outcome assessment plan:
Learning Outcome 2: Students critically evaluate, synthesize, or create forms of human expression or inquiry.	Description of learning outcome assessment plan:
Additional information for REAL Council consideration:	

## CULTURAL OR BEHAVIORAL ANALYSIS

<p>A Area:  Course Prefix:  Course Number:  Course Title:  Credit Hours:  New course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No    Projected student enrollment per academic year:</p>	<p>Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)    Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>A Area:  Course Prefix:  Course Number:  Course Title:  Credit Hours:  New course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No    Projected student enrollment per academic year:</p>	<p>Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)    Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>A Area:  Course Prefix:  Course Number:  Course Title:  Credit Hours:  New course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No    Projected student enrollment per academic year:</p>	<p>Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)    Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>A Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: (please list at least one, can also be listed above but does not need to be)</p>	

<p>A Area:  Learning Goal: To examine the context and interactions of culture(s) and/or behavior(s).</p>	
<p>Learning Outcome 1: Students describe behaviors, beliefs, cultures, social institutions, and/or environments.</p>	<p>Description of learning outcome assessment plan:</p>
<p>Learning Outcome 2: Students analyze the interactions of behaviors, beliefs, cultures, social institutions, and/or environments.</p>	<p>Description of learning outcome assessment plan:</p>
<p>Additional information for REAL Council consideration:</p>	

## APPLIED LEARNING

<p>L Area:  Course Prefix: CHEM  Course Number: 302  Course Title: Organic Chemistry II  Credit Hours: 4  New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 120</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>L Area:  Course Prefix: CHEM  Course Number: 324  Course Title: Analytical Chemistry  Credit Hours: 4  New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 48</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input checked="" type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>L Area:  Course Prefix: CHEM  Course Number: 401  Course Title: Physical Chemistry I  Credit Hours: 4  New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 24</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>L Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: PHYS 111, PHYS 112, MATH 171, MATH 172</p>	

<p>L Area:  Learning Goal: To explore professional practice through the application of knowledge, skills, and critical reflection.</p>	
<p>Learning Outcome 1: Students apply acquired knowledge and skills to develop professional identity or professional practice.</p>	<p><b>Description of learning outcome assessment plan:</b></p> <p>Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.</p>

<p>Learning Outcome 2: Students critically reflect on their learning, abilities, experiences, or role within professional contexts.</p>	<p><b>Description of learning outcome assessment plan:</b></p> <p>Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.</p>
<p>Additional information for REAL Council consideration:</p>	

Are existing material resources adequate to support this program alignment proposal?

Yes  No If not, what additional material resources would be needed?

Are existing space resources adequate to support this program alignment proposal?

Yes  No If not, what additional space resources would be needed?

Are existing human resources adequate to support this program alignment proposal?

Yes  No If not, what additional human resources would be needed?

Department Curriculum Committee Recommendation:	Signature: <i>Christopher J. Monahan</i>	Date: 4/16/20
Chair/Dean on Behalf of Dept/School:	Signature: <i>Christine K. Heermann</i>	Date: 4/16/20
College Curriculum Committee Approval:	Signature:	Date:
Dean/AVP Approval:	Signature:	Date:
REAL Council Recommendation:	Signature:	Date:
Faculty Senate Curriculum Committee Recommendation:	Signature:	Date:
Faculty Senate Approval:	Signature:	Date:
Provost Approval:	Signature:	Date:

# REAL Curriculum Program Alignment Proposal

Department or School: ACSAT Enter dept/school name: Chemistry Date: 03/14/2020

Degree type: BS BA BBA BSN BM BFA BSW Minor Certificate

Program: Chemistry-Forensics

REAL Area Program Designation Sought (check all that apply):  R  E  A  L

Dept/School Contact: Dr. Chris Hermann, [chermann@radford.edu](mailto:chermann@radford.edu)

CHEM 111, CHEM 112, CHEM 216, CHEM 301, CHEM 302, CHEM 350, CHEM 324, CHEM 401, CHEM 402, CHEM 424, CHEM 450, CHEM 465, CHEM 471, CHEM 481, BIOL 132, BIOL 231, MATH 171, MATH 172, PHYS 111 (or PHYS

BS/BA Requirements: 221), PHYS 112 (or PHYS 222), CRJU 100, CRJU 320, CRJU 341

- Any degree program that fulfills a REAL area must include at least 9 unique credit hours for each area covered. At least 3 of these 9 credit hours must be at the 300 level or above
- A single major degree program may fulfill no more than three REAL areas for any one student, unless all four REAL areas are fulfilled by accreditation or licensure requirements.
- A single minor or certificate degree program may fulfill no more than two REAL areas.
- Degree program may cover up to two REAL areas using a single prefix.
- All courses documenting the coverage of a REAL area must fulfill all learning outcomes and be designated in that area.
- All courses that document fulfillment of a REAL area within a degree program of study are NOT required to be taught by the department/school. However, departments/schools are expected to formally communicate with other departments about reliance on and inclusion of courses in their degree program plans of study. Indicate this through signature of chair or director of the partnering department or school in the areas below.
- Departments or schools that seek to fulfill REAL areas must acknowledge assessment requirements for those areas. Assessment of degree seeking students is required to be conducted yearly by the department or school offering the degree program.
- If departments or schools want to use a menu of courses to fulfill a particular area, please duplicate the sections below for each REAL area and include information for each course included in the menu of options.
- Please save this file for submission as PROGRAM NAME\_ProgramType.docx (Example: Criminal Justice\_BS.docx)

By signing, the department/school acknowledges the above conditions and considerations:

Dept/School Signature <i>Christine K. Hermann</i>	Date: 4/16/20
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**Official Program Description:**

Please paste the entire official program description from the Radford University catalog in the space within this box. Find those here: <https://catalog.radford.edu/>

Please note that every department/school will have to submit a catalog change proposal for program that asks the Registrar's Office to insert language about the program coverage of the REAL areas into the official Radford University catalog upon approval.

Radford University

# Chemistry, B.S.

[Advanced Biochemistry Concentration](#)

[Forensics Concentration](#)

[Advanced Professional Chemist Concentration](#)

[Professional Chemist Concentration](#)

[Biochemistry: Life Sciences and Pre-Health Concentration](#)

## Core Curriculum Requirements (43-47 credits)

See [Core Curriculum](#) courses.

## Required Major Core Courses (32 credits)

[CHEM 111 - General Chemistry I \\*](#)

[CHEM 112 - General Chemistry II \\*](#)

[CHEM 216 - Inorganic Chemistry](#)

[CHEM 301 - Organic Chemistry I](#)

[CHEM 302 - Organic Chemistry II](#)

[CHEM 324 - Analytical Chemistry](#)

[CHEM 401 - Physical Chemistry I](#)

[CHEM 450 - Career and Professional Development](#)

[CHEM 471 - Biochemistry I](#)

**Note(s):**

\*[CHEM 111](#) and [CHEM 112](#) have been approved for Core Curriculum credit in Natural Sciences.

## Math Requirements (8-10 credits)

Option A

[MATH 171 - Calculus and Analytic Geometry I](#)

[MATH 172 - Calculus and Analytic Geometry II](#)

Option B

[MATH 168 - Calculus I with Integrated Precalculus I](#)

[MATH 169 - Calculus I with Integrated Precalculus II](#)

[MATH 172 - Calculus and Analytic Geometry II](#)

Note(s):

\*[MATH 168](#), [MATH 169](#), [MATH 171](#), and [MATH 172](#) have been approved for Core Curriculum credit in Mathematical Sciences.

## Biology Requirements (4 credits)

[BIOL 105 - Biology for Health Sciences](#)

or

[BIOL 132 - Biology of Cells and Microorganisms](#)

## B.S. Requirements

### B.S. (Non Teaching) Requirements (8 credits)

Bachelor of Science degree without a professional licensure in secondary education requires the following:

[PHYS 111 - General Physics](#) and

[PHYS 112 - General Physics](#)

or

[PHYS 221 - Physics](#) and

[PHYS 222 - Physics](#)

## Advanced Professional Chemist Concentration

This concentration is a rigorous four-year program that provides a strong background in chemistry for those students who plan to become professional chemists. It provides an excellent foundation for graduate study in chemistry or related fields and will prepare students for careers in industrial, academic or governmental settings. With this concentration, the student will have an ACS approved degree.

## Other Required Courses (27-28 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 416 - Advanced Inorganic Chemistry](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

One additional 300- or higher level course (3-4 credit hours) with CHEM prefix

[CHEM 421 - Polymer Chemistry](#)

[CHEM 481 - Undergraduate Research](#)

[CHEM 485 - Capstone Research Experience](#)

## Professional Chemist Concentration

This concentration is a rigorous four-year program that provides a strong background in chemistry for those students who plan to become professional chemists. It will prepare students for careers in industrial, academic or governmental settings.

## Other Required Courses (14 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

Four additional credits; select from 300- or higher level of courses with a CHEM prefix, including [CHEM 481](#)

## Biochemistry: Life Sciences and Pre-Health Concentration

This concentration is a rigorous four year program recommended for students planning a career in pharmacy, medicine, dentistry or veterinary medicine. The first three years are designed to optimally prepare students for the pre-entrance aptitude examination (PCAT, MCAT, DAT or GRE).

## Other Required Courses (16 credits)

[CHEM 472 - Biochemistry II](#)

[CHEM 474 - Biochemistry Laboratory](#)

[BIOL 231 - Genetics, Evolution and Development](#)

8 additional credits of 300- or higher level courses with CHEM or BIOL prefix.

## Advanced Biochemistry Concentration

This concentration is a rigorous four-year program recommended for students interested in a career in biochemistry. It provides a comprehensive foundation for graduate study in biochemistry, pharmacology, or related fields and prepares students for careers in industrial, governmental, or academic settings. With this concentration, the student will have an ACS approved degree.

### Other Required Courses (28 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 421 - Polymer Chemistry](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

[CHEM 472 - Biochemistry II](#)

[CHEM 474 - Biochemistry Laboratory](#)

[BIOL 231 - Genetics, Evolution and Development](#)

[CHEM 481 - Undergraduate Research](#)

[CHEM 485 - Capstone Research Experience](#)

## Forensics Concentration

This concentration is a rigorous four year program recommended for students planning a career in forensic science. It provides a comprehensive foundation for graduate study in forensic chemistry, forensic science, or analytical chemistry and prepares students for careers in industrial, governmental, or academic settings.

### Other Required Courses (28 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

[CHEM 465 - Forensic Chemistry](#)

[CHEM 481 - Undergraduate Research](#)

[BIOL 231 - Genetics, Evolution and Development](#)

[CRJU 100 - Introduction to Criminal Justice](#)

[CRJU 320 - Criminal Investigative Theory](#)

[CRJU 341 - Introduction to Forensic Science](#)

## Total Credits Needed for Degree 120

(Includes Core Curriculum requirements, required courses and electives. Students should consult with their academic advisors in selecting elective courses to complete the 120 semester hours required for graduation.)

## Graduation Requirements

To graduate with a major in chemistry, a student must attain an overall major grade point average of 2.0 or higher. Different courses are considered in the calculation of the major grade point average depending on the student's concentration. All courses required for a given concentration count towards the major grade point average. In cases where additional (beyond those required) electives listed for a given concentration are taken, all count towards the major grade point average calculation.

## Teaching Licensure

Students preparing to teach chemistry in the secondary schools are required to take courses in professional education in addition to Core Curriculum courses and courses required by the chemistry major. Interested students should contact the College of Education and Human Development for more information.

## SCIENTIFIC AND QUANTITATIVE REASONING

<p>R Area: Course Prefix: CHEM Course Number: 111 Course Title: General Chemistry I Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 432</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input checked="" type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input type="checkbox"/> Every academic year <input checked="" type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>R Area: Course Prefix: CHEM Course Number: 112 Course Title: General Chemistry II Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 240</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>R Area: Course Prefix: CHEM Course Number: 301 Course Title: Organic Chemistry I Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 140</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>R Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: CHEM 111, CHEM 112, CHEM 120, CHEM 122, MATH 171, MATH 172, PHYS 111, PHYS 112, BIO 132</p>	

<p>R Area: Learning Goal: To apply scientific and quantitative reasoning to questions about the natural world, mathematics, or related areas.</p>	
<p>Learning Outcome 1: Students apply scientific and quantitative information to test problems and draw conclusions.</p>	<p>Description of learning outcome assessment plan:  Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring</p>

	the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.
Learning Outcome 2: Students evaluate the quality of data, methods, or inferences used to generate scientific and quantitative knowledge.	Description of learning outcome assessment plan:  Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.
Additional information for REAL Council consideration:	

## HUMANISTIC OR ARTISTIC EXPRESSION

<b>E Area:</b> Course Prefix: Course Number: Course Title: Credit Hours: New course: <input type="checkbox"/> Yes <input type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Projected student enrollment per academic year:	Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other  Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:
<b>E Area:</b> Course Prefix: Course Number: Course Title: Credit Hours: New course: <input type="checkbox"/> Yes <input type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Projected student enrollment per academic year:	Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other  Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:
<b>E Area:</b> Course Prefix: Course Number: Course Title: Credit Hours: New course: <input type="checkbox"/> Yes <input type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No	Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year

Projected student enrollment per academic year:	<input type="checkbox"/> At least once every three years <input type="checkbox"/> Other Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:
E Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: (please list at least one, can also be listed above but does not need to be)	

E Area: Learning Goal: To explore humanistic or artistic expression through inquiry or creativity.	
Learning Outcome 1: Students demonstrate understanding of diverse ideas, languages, products, or processes of humanistic inquiry or artistic expression.	Description of learning outcome assessment plan:
Learning Outcome 2: Students critically evaluate, synthesize, or create forms of human expression or inquiry.	Description of learning outcome assessment plan:
Additional information for REAL Council consideration:	

## CULTURAL OR BEHAVIORAL ANALYSIS

<p>A Area:  Course Prefix:  Course Number:  Course Title:  Credit Hours:  New course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No    Projected student enrollment per academic year:</p>	<p>Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)    Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>A Area:  Course Prefix:  Course Number:  Course Title:  Credit Hours:  New course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No    Projected student enrollment per academic year:</p>	<p>Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)    Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>A Area:  Course Prefix:  Course Number:  Course Title:  Credit Hours:  New course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No    Projected student enrollment per academic year:</p>	<p>Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)    Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>A Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: (please list at least one, can also be listed above but does not need to be)</p>	

<p>A Area:  Learning Goal: To examine the context and interactions of culture(s) and/or behavior(s).</p>	
<p>Learning Outcome 1: Students describe behaviors, beliefs, cultures, social institutions, and/or environments.</p>	<p>Description of learning outcome assessment plan:</p>
<p>Learning Outcome 2: Students analyze the interactions of behaviors, beliefs, cultures, social institutions, and/or environments.</p>	<p>Description of learning outcome assessment plan:</p>
<p>Additional information for REAL Council consideration:</p>	

## APPLIED LEARNING

<p>L Area: Course Prefix: CHEM Course Number: 302 Course Title: Organic Chemistry II Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 120</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>L Area: Course Prefix: CHEM Course Number: 324 Course Title: Analytical Chemistry Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 48</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input checked="" type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>L Area: Course Prefix: CHEM Course Number: 401 Course Title: Physical Chemistry I Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 24</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>L Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: PHYS 111, PHYS 112, MATH 171, MATH 172, BIO 132</p>	

<p>L Area: Learning Goal: To explore professional practice through the application of knowledge, skills, and critical reflection.</p>	
<p>Learning Outcome 1: Students apply acquired knowledge and skills to develop professional identity or professional practice.</p>	<p>Description of learning outcome assessment plan:</p> <p>Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.</p>

<p>Learning Outcome 2: Students critically reflect on their learning, abilities, experiences, or role within professional contexts.</p>	<p>Description of learning outcome assessment plan:</p> <p>Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.</p>
<p>Additional information for REAL Council consideration:</p>	

Are existing material resources adequate to support this program alignment proposal?

Yes  No If not, what additional material resources would be needed?

Are existing space resources adequate to support this program alignment proposal?

Yes  No If not, what additional space resources would be needed?

Are existing human resources adequate to support this program alignment proposal?

Yes  No If not, what additional human resources would be needed?

Department Curriculum Committee Recommendation:	Signature: <i>Christopher J. Monahan</i>	Date: 4/16/20
Chair/Dean on Behalf of Dept/School:	Signature: <i>Christine K. Heermann</i>	Date: 4/16/20
College Curriculum Committee Approval:	Signature:	Date:
Dean/AVP Approval:	Signature:	Date:
REAL Council Recommendation:	Signature:	Date:
Faculty Senate Curriculum Committee Recommendation:	Signature:	Date:
Faculty Senate Approval:	Signature:	Date:
Provost Approval:	Signature:	Date:

# REAL Curriculum Program Alignment Proposal

Department or School: ACSAT Enter dept/school name: Chemistry Date: 03/14/2020

Degree type: BS BA BBA BSN BM BFA BSW Minor Certificate

Program: Chemistry-Professional Chemist Concentration

REAL Area Program Designation Sought (check all that apply):  R  E  A  L

Dept/School Contact: Dr. Chris Hermann, [chermann@radford.edu](mailto:chermann@radford.edu)

CHEM 111, CHEM 112, CHEM 216, CHEM 301, CHEM 302, CHEM 324, CHEM 350, CHEM 401, CHEM 402, CHEM 424, CHEM 450, CHEM 471, CHEM elective (4 hrs of 300 or 400 level), BIOL 132, MATH 171, MATH 172, PHYS

BS/BA Requirements: 111 (or PHYS 221), PHYS 112 (or PHYS 222)

- Any degree program that fulfills a REAL area must include at least 9 unique credit hours for each area covered. At least 3 of these 9 credit hours must be at the 300 level or above
- A single major degree program may fulfill no more than three REAL areas for any one student, unless all four REAL areas are fulfilled by accreditation or licensure requirements.
- A single minor or certificate degree program may fulfill no more than two REAL areas.
- Degree program may cover up to two REAL areas using a single prefix.
- All courses documenting the coverage of a REAL area must fulfill all learning outcomes and be designated in that area.
- All courses that document fulfillment of a REAL area within a degree program of study are NOT required to be taught by the department/school. However, departments/schools are expected to formally communicate with other departments about reliance on and inclusion of courses in their degree program plans of study. Indicate this through signature of chair or director of the partnering department or school in the areas below.
- Departments or schools that seek to fulfill REAL areas must acknowledge assessment requirements for those areas. Assessment of degree seeking students is required to be conducted yearly by the department or school offering the degree program.
- If departments or schools want to use a menu of courses to fulfill a particular area, please duplicate the sections below for each REAL area and include information for each course included in the menu of options.
- Please save this file for submission as PROGRAM NAME\_ProgramType.docx (Example: Criminal Justice\_BS.docx)

By signing, the department/school acknowledges the above conditions and considerations:

Dept/School Signature <i>Christine K Hermann</i>	Date: 4/16/20
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**Official Program Description:**

Please paste the entire official program description from the Radford University catalog in the space within this box. Find those here: <https://catalog.radford.edu/>

Please note that every department/school will have to submit a catalog change proposal for program that asks the Registrar's Office to insert language about the program coverage of the REAL areas into the official Radford University catalog upon approval.

Radford University

# Chemistry, B.S.

[Advanced Biochemistry Concentration](#)

[Forensics Concentration](#)

[Advanced Professional Chemist Concentration](#)

[Professional Chemist Concentration](#)

[Biochemistry: Life Sciences and Pre-Health Concentration](#)

## Core Curriculum Requirements (43-47 credits)

See [Core Curriculum](#) courses.

## Required Major Core Courses (32 credits)

[CHEM 111 - General Chemistry I \\*](#)

[CHEM 112 - General Chemistry II \\*](#)

[CHEM 216 - Inorganic Chemistry](#)

[CHEM 301 - Organic Chemistry I](#)

[CHEM 302 - Organic Chemistry II](#)

[CHEM 324 - Analytical Chemistry](#)

[CHEM 401 - Physical Chemistry I](#)

[CHEM 450 - Career and Professional Development](#)

[CHEM 471 - Biochemistry I](#)

**Note(s):**

\*[CHEM 111](#) and [CHEM 112](#) have been approved for Core Curriculum credit in Natural Sciences.

## Math Requirements (8-10 credits)

Option A

[MATH 171 - Calculus and Analytic Geometry I](#)

[MATH 172 - Calculus and Analytic Geometry II](#)

Option B

[MATH 168 - Calculus I with Integrated Precalculus I](#)

[MATH 169 - Calculus I with Integrated Precalculus II](#)

[MATH 172 - Calculus and Analytic Geometry II](#)

Note(s):

\*[MATH 168](#), [MATH 169](#), [MATH 171](#), and [MATH 172](#) have been approved for Core Curriculum credit in Mathematical Sciences.

## Biology Requirements (4 credits)

[BIOL 105 - Biology for Health Sciences](#)

or

[BIOL 132 - Biology of Cells and Microorganisms](#)

## B.S. Requirements

### B.S. (Non Teaching) Requirements (8 credits)

Bachelor of Science degree without a professional licensure in secondary education requires the following:

[PHYS 111 - General Physics](#) and

[PHYS 112 - General Physics](#)

or

[PHYS 221 - Physics](#) and

[PHYS 222 - Physics](#)

## Advanced Professional Chemist Concentration

This concentration is a rigorous four-year program that provides a strong background in chemistry for those students who plan to become professional chemists. It provides an excellent foundation for graduate study in chemistry or related fields and will prepare students for careers in industrial, academic or governmental settings. With this concentration, the student will have an ACS approved degree.

## Other Required Courses (27-28 credits)

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[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 416 - Advanced Inorganic Chemistry](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

One additional 300- or higher level course (3-4 credit hours) with CHEM prefix

[CHEM 421 - Polymer Chemistry](#)

[CHEM 481 - Undergraduate Research](#)

[CHEM 485 - Capstone Research Experience](#)

## Professional Chemist Concentration

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This concentration is a rigorous four-year program that provides a strong background in chemistry for those students who plan to become professional chemists. It will prepare students for careers in industrial, academic or governmental settings.

## Other Required Courses (14 credits)

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[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

Four additional credits; select from 300- or higher level of courses with a CHEM prefix, including [CHEM 481](#)

## Biochemistry: Life Sciences and Pre-Health Concentration

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This concentration is a rigorous four year program recommended for students planning a career in pharmacy, medicine, dentistry or veterinary medicine. The first three years are designed to optimally prepare students for the pre-entrance aptitude examination (PCAT, MCAT, DAT or GRE).

## Other Required Courses (16 credits)

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[CHEM 472 - Biochemistry II](#)

[CHEM 474 - Biochemistry Laboratory](#)

[BIOL 231 - Genetics, Evolution and Development](#)

8 additional credits of 300- or higher level courses with CHEM or BIOL prefix.

## Advanced Biochemistry Concentration

This concentration is a rigorous four-year program recommended for students interested in a career in biochemistry. It provides a comprehensive foundation for graduate study in biochemistry, pharmacology, or related fields and prepares students for careers in industrial, governmental, or academic settings. With this concentration, the student will have an ACS approved degree.

### Other Required Courses (28 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 421 - Polymer Chemistry](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

[CHEM 472 - Biochemistry II](#)

[CHEM 474 - Biochemistry Laboratory](#)

[BIOL 231 - Genetics, Evolution and Development](#)

[CHEM 481 - Undergraduate Research](#)

[CHEM 485 - Capstone Research Experience](#)

## Forensics Concentration

This concentration is a rigorous four year program recommended for students planning a career in forensic science. It provides a comprehensive foundation for graduate study in forensic chemistry, forensic science, or analytical chemistry and prepares students for careers in industrial, governmental, or academic settings.

### Other Required Courses (28 credits)

[CHEM 350 - Chemistry Research Methods](#)

[CHEM 402 - Physical Chemistry II](#)

[CHEM 424 - Instrumental Methods of Analysis](#)

[CHEM 465 - Forensic Chemistry](#)

[CHEM 481 - Undergraduate Research](#)

[BIOL 231 - Genetics, Evolution and Development](#)

[CRJU 100 - Introduction to Criminal Justice](#)

[CRJU 320 - Criminal Investigative Theory](#)

[CRJU 341 - Introduction to Forensic Science](#)

## Total Credits Needed for Degree 120

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(Includes Core Curriculum requirements, required courses and electives. Students should consult with their academic advisors in selecting elective courses to complete the 120 semester hours required for graduation.)

## Graduation Requirements

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To graduate with a major in chemistry, a student must attain an overall major grade point average of 2.0 or higher. Different courses are considered in the calculation of the major grade point average depending on the student's concentration. All courses required for a given concentration count towards the major grade point average. In cases where additional (beyond those required) electives listed for a given concentration are taken, all count towards the major grade point average calculation.

## Teaching Licensure

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Students preparing to teach chemistry in the secondary schools are required to take courses in professional education in addition to Core Curriculum courses and courses required by the chemistry major. Interested students should contact the College of Education and Human Development for more information.

## SCIENTIFIC AND QUANTITATIVE REASONING

<p>R Area: Course Prefix: CHEM Course Number: 111 Course Title: General Chemistry I Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  Projected student enrollment per academic year: 432</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input checked="" type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input type="checkbox"/> Every academic year <input checked="" type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other  Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>R Area: Course Prefix: CHEM Course Number: 112 Course Title: General Chemistry II Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  Projected student enrollment per academic year: 240</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other  Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>R Area: Course Prefix: CHEM Course Number: 301 Course Title: Organic Chemistry I Credit Hours: 4 New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  Projected student enrollment per academic year: 140</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other  Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>R Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: CHEM 111, CHEM 112, CHEM 120, CHEM 122, MATH 171, MATH 172, PHYS 111, PHYS 112</p>	

<p>R Area: Learning Goal: To apply scientific and quantitative reasoning to questions about the natural world, mathematics, or related areas.</p>	
<p>Learning Outcome 1: Students apply scientific and quantitative information to test problems and draw conclusions.</p>	<p>Description of learning outcome assessment plan:  Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring</p>

	the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.
Learning Outcome 2: Students evaluate the quality of data, methods, or inferences used to generate scientific and quantitative knowledge.	Description of learning outcome assessment plan:  Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.
Additional information for REAL Council consideration:	

## HUMANISTIC OR ARTISTIC EXPRESSION

<b>E Area:</b> Course Prefix: Course Number: Course Title: Credit Hours: New course: <input type="checkbox"/> Yes <input type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Projected student enrollment per academic year:	Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other  Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:
<b>E Area:</b> Course Prefix: Course Number: Course Title: Credit Hours: New course: <input type="checkbox"/> Yes <input type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Projected student enrollment per academic year:	Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other  Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:
<b>E Area:</b> Course Prefix: Course Number: Course Title: Credit Hours: New course: <input type="checkbox"/> Yes <input type="checkbox"/> No Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No	Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No If no, collaborating dept/school must also complete the remaining elements, and must sign below.  Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)  Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year

Projected student enrollment per academic year:	<input type="checkbox"/> At least once every three years <input type="checkbox"/> Other Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:
E Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: (please list at least one, can also be listed above but does not need to be)	

E Area: Learning Goal: To explore humanistic or artistic expression through inquiry or creativity.	
Learning Outcome 1: Students demonstrate understanding of diverse ideas, languages, products, or processes of humanistic inquiry or artistic expression.	Description of learning outcome assessment plan:
Learning Outcome 2: Students critically evaluate, synthesize, or create forms of human expression or inquiry.	Description of learning outcome assessment plan:
Additional information for REAL Council consideration:	

## CULTURAL OR BEHAVIORAL ANALYSIS

<p>A Area:  Course Prefix:  Course Number:  Course Title:  Credit Hours:  New course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No    Projected student enrollment per academic year:</p>	<p>Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)    Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>A Area:  Course Prefix:  Course Number:  Course Title:  Credit Hours:  New course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No    Projected student enrollment per academic year:</p>	<p>Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)    Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>A Area:  Course Prefix:  Course Number:  Course Title:  Credit Hours:  New course: <input type="checkbox"/> Yes <input type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input type="checkbox"/> No    Projected student enrollment per academic year:</p>	<p>Is this course required or an elective for your degree program? <input type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.    Course Rotation: <input type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)    Intended Frequency: <input type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other    Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>A Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: (please list at least one, can also be listed above but does not need to be)</p>	

<p>A Area:  Learning Goal: To examine the context and interactions of culture(s) and/or behavior(s).</p>	
<p>Learning Outcome 1: Students describe behaviors, beliefs, cultures, social institutions, and/or environments.</p>	<p>Description of learning outcome assessment plan:</p>
<p>Learning Outcome 2: Students analyze the interactions of behaviors, beliefs, cultures, social institutions, and/or environments.</p>	<p>Description of learning outcome assessment plan:</p>
<p>Additional information for REAL Council consideration:</p>	

## APPLIED LEARNING

<p>L Area:  Course Prefix: CHEM  Course Number: 302  Course Title: Organic Chemistry II  Credit Hours: 4  New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 120</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input checked="" type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>L Area:  Course Prefix: CHEM  Course Number: 324  Course Title: Analytical Chemistry  Credit Hours: 4  New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 48</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input checked="" type="checkbox"/> Fall <input checked="" type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>L Area:  Course Prefix: CHEM  Course Number: 401  Course Title: Physical Chemistry I  Credit Hours: 4  New course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  Revised course: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>Projected student enrollment per academic year: 24</p>	<p>Is this course required or an elective for your degree program? <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective  Is this course offered within your dept/school? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  If no, collaborating dept/school must also complete the remaining elements, and must sign below.</p> <p>Course Rotation: <input checked="" type="checkbox"/> Fall <input type="checkbox"/> Spring <input type="checkbox"/> Intersession <input type="checkbox"/> Other (Explain below)</p> <p>Intended Frequency: <input checked="" type="checkbox"/> Every academic year <input type="checkbox"/> Every semester <input type="checkbox"/> Every other year  <input type="checkbox"/> At least once every three years <input type="checkbox"/> Other</p> <p>Signature of collaborating chair/director indicating acknowledgement for inclusion and designation if not offered in dept/school:</p>
<p>L Designated Course Required within the Program of Study Approved for Inclusion in the General Education Coursework: PHYS 111, PHYS 112, MATH 171, MATH 172</p>	

<p>L Area:  Learning Goal: To explore professional practice through the application of knowledge, skills, and critical reflection.</p>	
<p>Learning Outcome 1: Students apply acquired knowledge and skills to develop professional identity or professional practice.</p>	<p>Description of learning outcome assessment plan:</p> <p>Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.</p>

Learning Outcome 2: Students critically reflect on their learning, abilities, experiences, or role within professional contexts.	<p>Description of learning outcome assessment plan:</p> <p>Data will be collected from the REAL General Studies Minor assessments conducted by the university in the student's senior year. Once the data is received in the department the department's assessment committee will review the data to determine if corrective action is necessary. If needed the assessment committee will develop an improvement plan in combination with faculty teaching classes in this area and the department's curriculum committee. The agreed upon changes will be incorporated into the classes. The department's assessment committee will then continue monitoring the collected assessment data to determine the effectiveness of the corrective action and determine further actions if necessary.</p>
Additional information for REAL Council consideration:	

Are existing material resources adequate to support this program alignment proposal?

Yes  No If not, what additional material resources would be needed?

Are existing space resources adequate to support this program alignment proposal?

Yes  No If not, what additional space resources would be needed?

Are existing human resources adequate to support this program alignment proposal?

Yes  No If not, what additional human resources would be needed?

Department Curriculum Committee Recommendation:	Signature: <i>Christopher J. Monahan</i>	Date: 4/16/20
Chair/Dean on Behalf of Dept/School:	Signature: <i>Christine K. Heermann</i>	Date: 4/16/20
College Curriculum Committee Approval:	Signature:	Date:
Dean/AVP Approval:	Signature:	Date:
REAL Council Recommendation:	Signature:	Date:
Faculty Senate Curriculum Committee Recommendation:	Signature:	Date:
Faculty Senate Approval:	Signature:	Date:
Provost Approval:	Signature:	Date: