The addition or removal of any restriction or change in credit hours in a course requires that this form, accompanied by any supporting documentation, be completed and approved as indicated below.

COLLEGE: Science

DEPARTMENT: Chemistry

REQUEST IS FOR CHANGE IN COURSE:  
G C H M 1 1 0 1  General Chemistry 1  
Prefix  Number  Course Title

TO BE INCLUDED IN 20 1 5  / 20 1 6 CATALOG AND EFFECTIVE IN THE BANNER SYSTEM FOR Fall 2015 TERM

Effective term must be a future term for which registration has not begun. Catalog year will be the next printed edition. Earlier terms/years will not be processed.

IS REQUEST FOR A CHANGE IN CREDIT FOR COURSE LISTED ABOVE? Yes  No  If yes, please the credits requested.

IS REQUEST TO CHANGE RESTRICTIONS FOR COURSE LISTED ABOVE? Add  Remove  Prerequisite  Corequisite  or  and

☐ Add  ☐ Remove  ☒ Prerequisite  ☐ Corequisite  M T H 1 0 1 1  or  and  or

☐ Add  ☐ Remove  ☐ Prerequisite  ☐ Corequisite  ☐ and  ☐ or

☐ Add  ☐ Remove  ☐ Prerequisite  ☐ Corequisite  ☐ and  ☐ or

☐ Add  ☐ Remove  ☐ Other Restrictions*  Yes  No  If yes, please list below:

*Other restrictions may include changing the grades applied to the course (P/F, S/U, A-F, CEU), majors or cross levels restricted from registration, or other restrictions.

Please see attached sheets for explanation.

OR PLACEMENT INTO HIGHER-LEVEL MATH

APPROVALS: Once appropriate department approvals are completed, submit form to Chair, Graduate Council, or Chair, Undergraduate Curriculum Committee for signatures below and forward to Catalog Director.

1) (Signature)  8/6/14  4) (Signature)  Date
Originator  Chair, Graduate Council  Date

2) (Signature)  8/7/14  OR
Department Head/Program Chair  Chair, Undergraduate Curriculum Committee  Date

3) (Signature)  8/7/14
Dean or Associate Dean  Date

CATALOG DIRECTOR'S USE ONLY

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R08-10-718
Summary

The Chemistry Department has found that students enrolled in an algebra course while also taking General Chemistry 1 do very poorly in General Chemistry 1. Since 2009, their rate of D/F/withdrawal is 82% (59% F or withdrawal) during the fall semesters. For this reason, the Chemistry Department wishes to require Precalculus A (MTH 1011) as a pre-requisite for General Chemistry 1. A similar pre-requisite currently exists at many Florida universities and colleges.

This pre-requisite will have a minimal effect on students’ schedules. The last section of this document lists alternative courses that students in each major could take if they cannot enroll in General Chemistry 1. Students who choose to not take any alternative courses will still have at least 12 credits. Given that these students are already deficient in mathematics (based on placement in Precalculus A), enrolling in fewer credits and not taking general chemistry could improve their overall chances for success at Florida Tech.

Explanation

A strong foundation in high school-level mathematics is a necessary requirement for students entering General Chemistry 1. Students must be fluent in algebraic equations, exponential and logarithmic functions and complex fractions. If a student has difficulty with rearranging a formula to solve for an unknown variable, then that student cannot learn the underlying chemical principle. Currently, we are allowing students to take General Chemistry 1 even if they lack the math skills necessary to succeed in the class. We are setting them up to fail.

Students who are placed in a lower level math class struggle with General Chemistry 1. The situation for students in algebra courses is especially dire. The following table shows the grade distributions for students in General Chemistry I (CHM 1101) while enrolled in various math courses for Fall semesters, 2009 - 2013.

<table>
<thead>
<tr>
<th>Math Class</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F</th>
<th>1100</th>
<th>% (D,F,1100)</th>
<th>% (F, 1100)</th>
<th># Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algebra</td>
<td>0</td>
<td>5</td>
<td>22</td>
<td>34</td>
<td>21</td>
<td>67</td>
<td>82%</td>
<td>59%</td>
<td>149</td>
</tr>
<tr>
<td>Precalculus</td>
<td>11</td>
<td>80</td>
<td>193</td>
<td>114</td>
<td>44</td>
<td>141</td>
<td>51%</td>
<td>32%</td>
<td>583</td>
</tr>
<tr>
<td>Calculus 1 w/ trig</td>
<td>3</td>
<td>17</td>
<td>30</td>
<td>14</td>
<td>7</td>
<td>12</td>
<td>40%</td>
<td>23%</td>
<td>83</td>
</tr>
<tr>
<td>calculus 1</td>
<td>91</td>
<td>202</td>
<td>238</td>
<td>94</td>
<td>46</td>
<td>82</td>
<td>29%</td>
<td>17%</td>
<td>753</td>
</tr>
</tbody>
</table>

The column “1100” indicates the numbers of students who withdrew from General Chemistry I at midterm (with a low F) and entered the remedial chemistry class (CHM 1100). These students had to retake General Chemistry in the future. Over half of the students in algebra had to retake General Chemistry 1. Another 23% earned a D and no algebra student has ever earned an A in General Chemistry 1. This problem affects engineering and science students to an equal extent.

Precalculus A is the name for the class that covers algebraic topics for students who major in science and engineering. It is the appropriate pre-requisite for students who take General Chemistry 1.
This is becoming a bigger problem each year. In 2012, 35 students took an algebra course and General Chemistry 1. In 2013, 54 students did this. Their poor grades are consistent year-to-year.

Other schools in Florida address this problem by requiring college algebra as a pre-requisite for general chemistry also. This list of schools includes the UF, FSU, UCF, USF, Miami and Florida Gulf Coast University. Even Eastern Florida State University (formerly Brevard Community College) requires some algebra as a pre-requisite for general chemistry.

Students who have not completed algebra lack the mathematical skills and experience required to solve calculations in General Chemistry 1. Therefore, the Chemistry Department recommends that Precalculus A (MTH 1011) serve as a pre-requisite for General Chemistry 1.

Delaying General Chemistry 1 for these students will not jeopardize their graduation date. As the table above shows, most of these students will have to retake General Chemistry 1 anyway. Engineering and science majors who enroll in Precalculus A are already a year behind in their mathematics requirements so they are not graduating in four years. In fact, by taking another class such as a social science elective, these students can make progress towards their degree when they delay enrollment in General Chemistry 1.

The Freshman Advisors support this recommendation. They have found many fall classes which allow students to maintain full-time status while taking Precalculus A and postponing General Chemistry 1. The following is a list of alternative courses for all majors that must take general chemistry in the fall of the freshman year. With just the removal of General Chemistry 1, all students have the option of another class to take and/or will be enrolled in at least 12 credit hours without taking any additional classes.

**College of Engineering:**

- **Chemical Engineering**
  - If only Chemistry was affected they would be in 12 credit hours without an additional class

- **General Engineering**
  - Intro to Software Development: C++, CSE 1502 or Fortran, CSE 1503
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303

- **Electrical Engineering**
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303
  - If only Chemistry was affected they would be in 12 credit hours without an additional class
• **Computer Engineering**
  o Social Science Elective: PSY 1411, BUS 1301, BUS 2303
  o If only Chemistry was affected they would be in 12 credit hours without an additional class

• **Civil Engineering**
  o Social Science Elective: PSY 1411, BUS 1301, BUS 2303
  o Business Elective: Intro to Financial Accounting BUS 2211 or Legal & Social Environments of Business BUS 2601
  o If only Chemistry was affected they would be in 12 credit hours without an additional class

• **Aerospace Engineering**
  o Social Science- PSY1411, BUS1301, BUS2303
  o If only Chemistry was affected they would be in 12 credit hours without an additional class

• **Construction Management**
  o Environmental Geology, OCN 2602
    ▪ Preferred option since it’s not offered in the Spring though the curriculum reflects it to be taken then
  o Basic Economics, BUS 1301
  o If only Chemistry was affected they would be in 12 credit hours without an additional class

• **Biomedical Engineering**
  o Biological Discovery 1: BIO1010 or Biological Discovery 2: BIO 1020
  o Social Science Elective: PSY 1411, BUS 1301, BUS 2303

• **Oceanography**
  o Oceanography OCN1010
  o Environmental Geology OCN2602
  o If only Chemistry was affected they would be in 12 credit hours without an additional class

• **Ocean Engineering**
  o Basic Economics BUS 1301 or Social Science Elective PSY 1411, BUS 2303
• **Mechanical Engineering**
  - Intro to Software Development (C++ or Fortran) CSE 1502/3
  - If only Chemistry was affected they would be in 12 credit hours without an additional class

• **Environmental Science**
  - Oceanography: OCN1010
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303

• **Meteorology:**
  - Aviation Metrology AVS 1201
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303

**College of Science:**

• **Biological Sciences—General Biology**
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303
  - If only Chemistry was affected they would be in 12 credit hours without an additional class

• **Biological Sciences—Marine Biology**
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303
  - If only Chemistry was affected they would be in 12 credit hours without an additional class

• **Biological Sciences—Molecular Biology**
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303
  - If only Chemistry was affected they would be in 12 credit hours without an additional class

• **Biological Sciences—Aquaculture**
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303
  - If only Chemistry was affected they would be in 12 credit hours without an additional class

• **Biological Sciences—Premedical Biology**
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303
  - If only Chemistry was affected they would be in 12 credit hours without an additional class
• **Biological Sciences—Conservation Biology and Ecology**
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303
  - If only Chemistry was affected they would be in 12 credit hours without an additional class

• **Biochemistry**
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303
  - If only Chemistry was affected they would be in 12 credit hours without an additional class

• **Chemistry—General Chemistry**
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303

• **Chemistry—Research Chemistry**
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303

• **Chemistry—Preclinical Chemistry**
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303

• **Physics**
  - Intro to Software Development (C++ or Fortran) CSE 1502\3
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303
  - If only Chemistry was affected they would be in 12 credit hours without an additional class

• **Space Sciences: Astronomy and Astrophysics**
  - Intro to Software Development (C++ or Fortran) CSE 1502\3
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303
  - If only Chemistry was affected they would be in 12 credit hours without an additional class

• **Space Sciences: Astrobiology**
  - Biological Discovery 1 BIO 1010 or Biological Discovery 2 BIO 1020
  - Intro to Software Development (C++ or Fortran) CSE 1502\3
  - Social Science Elective: PSY 1411, BUS 1301, BUS 2303
  - If only Chemistry was affected they would be in 12 credit hours without an additional class
• **Planetary Science**
  o Intro to Software Development (C++ or Fortran) CSE 1502\3
  o Social Science Elective: PSY 1411, BUS 1301, BUS 2303
  o If only Chemistry was affected they would be in 12 credit hours without an additional class

• **Physics: Premedical Physics**
  o Social Science Elective: PSY 1411, BUS 1301, BUS 2303
  o Introduction to C++ CSE1502
  o If only Chemistry was affected they would be in 12 credit hours without an additional class

• **Biomathematics**
  o Intro to Software Development C++ CSE 1502
  o Fundamentals of Software Development 1 CSE 1001
  o If only Chemistry was affected they would be in 12 credit hours without an additional class

Note: All degrees below do not have a semester breakdown on the curriculum page online, therefore number of credit hours is not calculated.

• **Mathematical Sciences**
  o Biological Discovery 1 BIO 1010 or Biological Discovery 2 BIO 1020
  o Social Science Elective: PSY 1411, BUS 1301, BUS 2303

• **Mathematical Sciences: Applied Mathematics**
  o Social Science Elective: PSY 1411, BUS 1301, BUS 2303

• **General Science**
  o Social Science Elective: PSY 1411, BUS 1301, BUS 2303

• **Interdisciplinary Science**
  o Biological Discovery 1 BIO 1010 or Biological Discovery 2 BIO 1020
    ▪ Preferred because they should probably be in a Science class if their majoring in Science.
  o Intro to Software Development (C++ or Fortran) CSE 1502\3
• **Interdisciplinary Science—Military Science**
  o Biological Discovery 1 BIO 1010 or Biological Discovery 2 BIO 1020
    - Preferred because they should probably be in a Science class if their majoring in Science.
  o Intro to Software Development (C++ or Fortran) CSE 1502/3

• **Interdisciplinary Science—Aeronautics**
  o Biological Discovery 1 BIO 1010 or Biological Discovery 2 BIO 1020
    - Preferred because they should probably be in a Science class if their majoring in Science.
  o Intro to Software Development (C++ or Fortran) CSE 1502/3

**Implementation Plan for Fall 2015**

The Registrar’s Office, Freshman Advisors and the Chemistry Department developed this plan to implement the Precalculus A pre-requisite for the fall 2015 semester. The Registrar’s Office is confident that they can add the necessary changes to Banner in time for block registration during summer 2015. The Freshman Advisors will work with departments and students to substitute other courses for General Chemistry 1 as necessary. Our plan includes the following steps:

• Freshman Advisors provide the Registrar’s Office with a list of potential substitute courses for students to take instead of General Chemistry 1,
• Registrar’s Office staff add a Precalculus A pre-requisite to General Chemistry 1 and alternative courses into Banner,
• Banner performs block registration, prevents students in Precalculus A from enrolling in General Chemistry 1, and enrolls them in another course as necessary,
• Freshman Advisors create class schedules for those students in Precalculus A who complete the math placement exam after block registration (approximately 30 students), and
• Freshman Advisors and the Chemistry Department advise students with transfer credit for college algebra on a case-by-case basis.

All substitute courses will be electives which fulfill a course requirement for graduation.