FACULTY CURRICULUM COMMITTEE
SIGNATURE PAGE

- In section A, list ALL of the forms covered by this signature page. If you submit a form that is not listed in A, your proposal will be held back until we receive a new, updated signature page.
- You must obtain the signature of your department chair and dean before submitting your proposal.

A. FORMS COVERED BY THIS SIGNATURE PAGE. List each form you are submitting—for instance, PSYC 383, Course Form; PSYC, Change of Major Form; PSYC, Change of Minor Form.

Math 250 Course Form
Math 203 Course Form

B. APPROVAL AND SIGNATURES.

1. Signature of Department Chair or Program Director:

   [Signature]
   Date: 11/6/2013

2. Signature of Academic Dean:

   [Signature]
   Date: 11/6/2013

3. Signature of Provost:

   [Signature]
   Date: 1/5/2014

4. Signature of Business Affairs (only for course fees):

   [Signature]
   Date: ____________
   ☐ fee approved on ________
   ☐ BOT approval pending

5. Signature of Curriculum Committee Chair:

   [Signature]
   Date: ____________

6. Signature of Budget Committee Chair (only for new programs):

   [Signature]
   Date: ____________

7. Signature of Academic Planning Committee Chair (only for new programs):

   [Signature]
   Date: ____________

8. Signature of Faculty Senate Secretary:

   [Signature]
   Date: ____________

   Date Approved by Faculty Senate: ________________
FACULTY CURRICULUM COMMITTEE
COURSE FORM

Instructions:
- Please fill out one of these forms for each course you are adding, changing, deactivating, or reactivating.
- Fill out the parts of the form specified in part B. You must do this before your request can move forward!
- Remember that your changes will not be implemented until the next catalog year at the earliest.
- If you have questions, start by checking the instructions on the website. Please feel free to contact the committee chairs with any remaining questions you might have.

A. CONTACT/COURSE INFORMATION.

Name: Bob Mignone Phone: 953-5740 Email: migner@cofc.edu

Department or Program: Mathematics School: Science and Mathematics

Subject Acronym and Course Number: MATH 203

Catalog Year in which changes will take effect: FALL __2014-2015________

B. TYPE OF REQUEST. Please check all that apply, then fill out the specified parts of the form.

☐ Add a New Course (complete parts C, D, F, G, H, I, J, K)
☒ Change Part of an Existing Course (complete parts C, D, E, F, G, I, J, K)
  ☐ Course Number
  ☐ Course Name
  ☐ Course Description
  ☐ Credit/Contact Hours
  ☒ Restrictions (prerequisites, co-requisites, junior/senior standing, etc.)
☐ Deactivate an Existing Course (complete parts C, D, E, G, I, J, K)
☐ Reactivate a Previously-Deactivated Course (complete parts C, D, E, G, I, J, K)

C. RATIONALE AND EXPLANATION. Please describe your request and explain why you are making it.

The Math department proposes a change to the prerequisites for MATH 203. The current prerequisites are either Math 220 or permission of instructor. We propose to change the prerequisites to either Math 120 or permission of instructor. Requiring Math 120 would still ensure a maturity level of mathematics necessary to be successful in Math 203 and allow access to Math 203 for other majors that require Math 120 but not Math 220.

D. IMPACT ON EXISTING PROGRAMS AND COURSES. Please briefly describe the impact of your request on your own programs and courses as well other programs and courses. If another program requires the course, you must submit their written acknowledgement with this proposal. Also, the affected program must describe any change in the number of credit hours they require. Include a list of similar courses in other departments and explain any overlap.

Changing the prerequisite to either Math 120 or permission of instructor allows access to the course for other majors such as Computer Science and Biology.

This form was last updated on 06/03/13 and replaces all others.
EXISTING COURSE INFORMATION. If you are proposing a new course, just leave this blank. Otherwise, please fill out all fields.

Department: Math  School: SSM  Subject Acronym: MATH  Course Number: 203

Credit hours: ___3 lecture ___ lab ___ seminar ___ independent study
Contact hours: ___3 lecture ___ lab ___ seminar ___ independent study

Course title: Linear Algebra

Course description (maximum 50 words, exactly as it appears in the catalog):

Systems of linear equations, vector spaces, linear dependence, bases, dimensions, linear mappings, matrices, determinants, and quadratic forms

Restrictions (pre-requisites, co-requisites, majors only, etc.):
Prerequisites are either Math 220, or permission of instructor

Cross-listing, if any:

Is this course repeatable? ☐ yes ☒ no  If yes, how many total credit hours may the student earn? ___

E. NEW COURSE INFORMATION. If you are deactivating a course, leave this blank. Otherwise, please fill out all fields. For changed courses, use **boldface** for the information that is changing.

Department:  School:  Subject Acronym:  Course Number:

Credit hours: ___ lecture ___ lab ___ seminar ___ independent study
Contact hours: ___ lecture ___ lab ___ seminar ___ independent study

Course title:

Course description (maximum 50 words, exactly as it appears in the catalog):

Restrictions (pre-requisites, co-requisites, majors only, etc.): **MATH 120 or permission of instructor**

If this is a newly-created course, is it intended to be the equivalent of an existing course and replace it? ☐ yes ☒ no
If so, which course? ________________________________
Note: You must deactivate that course by submitting an additional Course Form.

Cross-listing, if any (submit approval from relevant department):
Note: Cross-listed courses are equivalent.

Is this course repeatable? ☐ yes ☒ no  If yes, how many total credit hours may the student earn? ___

Is there an activity, lab, or other fee associated with this course? ☐ yes ☒ no  What is the fee? $_____
Note: The Senate cannot approve new fees; Business Affairs will submit any such request to the Board of Trustees. The course can still be created, but the fee will not be attached until the Board has approved it.

This form was last updated on 06/03/13 and replaces all others.
F. COSTS. List all of the new costs or cost savings (including new faculty/staff requests, library, equipment, etc.) associated with your request.

H. STUDENT LEARNING OUTCOMES AND ASSESSMENT.

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
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<td>What will students know and be able to do when they complete the course?</td>
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1. 

2. 

3. 

4. 

How does this course align with the student learning outcomes articulated for the major, program, or general education? What program-level outcome or outcomes does it support? Is the content or skill introduced, reinforced, or demonstrated in this course?

I. PROGRAM CHANGES. Will this course be added to the existing degree requirements or list of approved electives of a major, minor, or concentration? □ yes □ no

If yes, please attach a Change Minor and/or Change Major/Program Form as appropriate.
J. CHECKLIST.

☐ I have completed all relevant parts of the form.

☐ I have attached a cover letter that describes my request and lists all the documents I am submitting.

☐ (For new courses only) I have attached a syllabus.

☐ (For courses used in any way by other departments, including cross-listing) I have attached an acknowledgement from the relevant department.

☐ (For courses intended to fulfill a Gen Ed requirement) I have submitted the proposal to the Gen Ed committee.

☐ I have submitted one Signature Form that lists all of the different forms I am submitting.
FACULTY CURRICULUM COMMITTEE  
COURSE FORM

Instructions:
• Please fill out one of these forms for each course you are adding, changing, deactivating, or reactivating.
• Fill out the parts of the form specified in part B. You must do this before your request can move forward!
• Remember that your changes will not be implemented until the next catalog year at the earliest.
• If you have questions, start by checking the instructions on the website. Please feel free to contact the committee chairs with any remaining questions you might have.

A. CONTACT/COURSE INFORMATION.

Name: Bob Mignone  Phone: 953-5740  Email: mignonr@cofc.edu

Department or Program: Mathematics  School: Science and Mathematics

Subject Acronym and Course Number: MATH 250

Catalog Year in which changes will take effect: FALL 2014-2015

B. TYPE OF REQUEST. Please check all that apply, then fill out the specified parts of the form.

☐ Add a New Course (complete parts C, D, F, G, H, I, J, K)
☒ Change Part of an Existing Course (complete parts C, D, E, F, G, I, J, K)
☐ Course Number
☐ Course Name
☐ Course Description
☐ Credit/Contact Hours
☒ Restrictions (prerequisites, co-requisites, junior/senior standing, etc.)
☐ Deactivate an Existing Course (complete parts C, D, E, G, I, J, K)
☐ Reactivate a Previously-Deactivated Course (complete parts C, D, E, G, I, J, K)

C. RATIONALE AND EXPLANATION. Please describe your request and explain why you are making it.

The Math department proposes a change to the prerequisites for MATH 250. The current prerequisites are either Math 111, Math 120, or permission of instructor. We propose to change the prerequisites to either Math 105 with a C- or better, Math 111, Math 120, or permission of instructor. The content in Math 105 is applicable to the material that is covered in Math 250. Allowing this prerequisite change will provide access to Math 250 for other majors, such as Psychology and Business.

D. IMPACT ON EXISTING PROGRAMS AND COURSES. Please briefly describe the impact of your request on your own programs and courses as well other programs and courses. If another program requires the course, you must submit their written acknowledgement with this proposal. Also, the affected program must describe any change in the number of credit hours they require. Include a list of similar courses in other departments and explain any overlap.

Changing the prerequisites to include Math 105 with a C- or better will allow majors who require Math 105 but not Math 111 or Math 120, to enroll in Math 250.

This form was last updated on 06/03/13 and replaces all others.
EXISTING COURSE INFORMATION. If you are proposing a new course, just leave this blank. Otherwise, please fill out all fields.

Department: Math School: SSM Subject Acronym: MATH Course Number: 250

Credit hours: ___3 lecture ___ lab ___ seminar ___ independent study
Contact hours: ___3 lecture ___ lab ___ seminar ___ independent study

Course title: Statistical Methods I

Course description (maximum 50 words, exactly as it appears in the catalog):

Course topics will include descriptive statistics, probability, probability distributions, estimation, hypothesis testing, correlation and simple linear regression. Statistical quality control, analysis of variance, and other topics will be introduced as time permits. A statistical software package will be used.

Restrictions (pre-requisites, co-requisites, majors only, etc.):

Prerequisites are either Math 111 or Math 120, or permission of instructor

Cross-listing, if any:

Is this course repeatable? □ yes □ no If yes, how many total credit hours may the student earn? _____

E. NEW COURSE INFORMATION. If you are deactivating a course, leave this blank. Otherwise, please fill out all fields. For changed courses, use boldface for the information that is changing.

Department: School: Subject Acronym: Course Number:

Credit hours: ___ lecture ___ lab ___ seminar ___ independent study
Contact hours: ___ lecture ___ lab ___ seminar ___ independent study

Course title:

Course description (maximum 50 words, exactly as it appears in the catalog):

Restrictions (pre-requisites, co-requisites, majors only, etc.):

If this is a newly-created course, is it intended to be the equivalent of an existing course and replace it? □ yes □ no
If so, which course? ________________
Note: You must deactivate that course by submitting an additional Course Form.

Cross-listing, if any (submit approval from relevant department):
Note: Cross-listed courses are equivalent.

Is this course repeatable? □ yes □ no If yes, how many total credit hours may the student earn? _____

Is there an activity, lab, or other fee associated with this course? □ yes □ no What is the fee? $_______
Note: The Senate cannot approve new fees; Business Affairs will submit any such request to the Board of Trustees. The course can still be created, but the fee will not be attached until the Board has approved it.

F. COSTS. List all of the new costs or cost savings (including new faculty/staff requests, library, equipment, etc.) associated with your request.

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I. PROGRAM CHANGES. Will this course be added to the existing degree requirements or list of approved electives of a major, minor, or concentration? □ yes □ no

If yes, please attach a Change Minor and/or Change Major/Program Form as appropriate.

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J. CHECKLIST.

☐ I have completed all relevant parts of the form.

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☐ (For courses intended to fulfill a Gen Ed requirement) I have submitted the proposal to the Gen Ed committee.

☐ I have submitted one Signature Form that lists all of the different forms I am submitting.
Hello Debby:

The description of your curriculum proposal (provided below) has been circulated to the members of the Department of Marketing and Supply Chain Management and this note is to let you know we support this proposal.

Please let me know if I can provide any additional information.

thanks,

julie

julia e. close, ph.d.
chair, department of marketing and supply chain management
school of business
college of charleston
(843) 953-7659
blosej@cofc.edu

The Math department proposes a change to the prerequisites for MATH 250. The current prerequisites are either Math 111, Math 120, or permission of instructor. We propose to change the prerequisites to either Math 105 with a C- or better, Math 111, Math 120, or permission of instructor. The content in Math 105 is applicable to the material that is covered in Math 250 and allowing this prerequisite change will provide access to Math 250 for other majors, such as Psychology and Business. Changing the prerequisites to include Math 105 with a C- or better will allow majors which require Math 105 but not Math 111 or Math 120, to enroll in Math 250.

The Math Department plans to submit this change to the Provost’s Office as soon as possible. It will then be forwarded to the Faculty Curriculum Committee and the Faculty Senate. Since this change could potentially affect your department we appreciate your feedback and your acknowledgement of our proposed change. Please respond to me by email and we can include your responses with our proposal.

Thanks in advance for your input and support.

Best,

Debby

Debby Jeter
Associate Chair
We support your proposal.

Jocelyn,

I think both of the proposed changes will help our students. I support the changes.

Calvin Blackwell
Associate Professor
Department of Economics & Finance
College of Charleston
Charleston, SC 29424
e: blackwellc@cofc.edu
t: 843.953.7836
http://sb.cofc.edu/academicdepartments/economics/faculty/blackwell-calvin.php

Any concerns

The Math department proposes a change to the prerequisites for MATH 250. The current prerequisites are either Math 111, Math 120, or permission of instructor. We propose to change the prerequisites to either Math 105 with a C- or better, Math 111, Math 120, or permission of instructor. The content in Math 105 is applicable to the material that is covered in Math 250 and allowing this prerequisite change will provide access to Math 250 for other majors, such as Psychology and Business. Changing the prerequisites to include Math 105 with a C- or better will allow majors which require Math 105 but not Math 111 or Math 120, to enroll in Math 250.

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we appreciate your feedback and your acknowledgement of our proposed change. Please respond to me by email and we can include your responses with our proposal.

Thanks in advance for your input and support.

Best,

Debby

Debby Jeter
Associate Chair
Department of Mathematics
College of Charleston
66 George Street
Charleston, SC 29424
Phone: 843 953-8023
Fax 843 953-1410
Email: jeterd@cofc.edu
We see no problem with the prerequisite changes,

Thank you for asking,

Meta

Sent from my iPad

On Dec 3, 2013, at 2:36 PM, "Jeter, Deborah W" <JeterD@cofc.edu> wrote:

The Math department proposes a change to the prerequisites for MATH 250. The current prerequisites are either Math 111, Math 120, or permission of instructor. We propose to change the prerequisites to either Math 105 with a C- or better, Math 111, Math 120, or permission of instructor. The content in Math 105 is applicable to the material that is covered in Math 250 and allowing this prerequisite change will provide access to Math 250 for other majors, such as Psychology and Business. Changing the prerequisites to include Math 105 with a C- or better will allow majors which require Math 105 but not Math 111 or Math 120, to enroll in Math 250.

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Thanks in advance for your input and support.

Best,
Debby
Greenberg, Dan

From: Jeter, Deborah W
Sent: Monday, January 13, 2014 2:19 PM
To: Greenberg, Dan
Subject: FW: prerequisite change for Math 250

Dan,

Here is the response I got from Rhonda.

Debby

Debby Jeter
Associate Chair
Department of Mathematics
College of Charleston
66 George Street
Charleston, SC 29424
Phone: 843 953-8023
Fax 843 953-1410
Email: jeterd@cofc.edu

From: Swickert-Hittner, Rhonda
Sent: Sunday, January 12, 2014 7:34 PM
To: Jeter, Deborah W
Subject: RE: prerequisite change for Math 250

Hi Debby,

Thanks for passing this along. We will try to get you some feedback as soon as possible. At a minimum, I can say that the Psychology department has been notified of this change, which I believe meets the requirements of the FCC.

Best,

Rhonda

Rhonda Swickert, Ph.D.
Associate Chair
Department of Psychology
College of Charleston

From: Jeter, Deborah W
Sent: Sunday, January 12, 2014 8:10 AM
To: Swickert-Hittner, Rhonda
Subject: prerequisite change for Math 250

Rhonda,

I apologize for not sending this earlier but Psychology was not listed as a department that required math 250 when I asked for a catalogue search from the Registrar’s Office. At any rate, here is a copy of the original email that was sent to other departments who might be affected by our proposed change to the prerequisite for Math 250. We have already submitted the proposal to the FCC and just need any feedback from other departments as soon as possible.
The Math department proposes a change to the prerequisites for MATH 250. The current prerequisites are either Math 111, Math 120, or permission of instructor. We propose to change the prerequisites to either Math 105 with a C- or better, Math 111, Math 120, or permission of instructor. The content in Math 105 is applicable to the material that is covered in Math 250 and allowing this prerequisite change will provide access to Math 250 for other majors, such as Psychology and Business. Changing the prerequisites to include Math 105 with a C- or better will allow majors which require Math 105 but not Math 111 or Math 120, to enroll in Math 250.

The Math Department plans to submit this change to the Provost’s Office as soon as possible. It will then be forwarded to the Faculty Curriculum Committee and the Faculty Senate. Since this change could potentially affect your department we appreciate your feedback and your acknowledgement of our proposed change. Please respond to me by email and we can include your responses with our proposal.

Thanks in advance for your input and support.

Debby Jeter
Associate Chair
Department of Mathematics
College of Charleston
Charleston, SC 29424
(843) 953-8023
jeterd@cofc.edu
FACULTY CURRICULUM COMMITTEE
SIGNATURE PAGE

- In section A, list ALL of the forms covered by this signature page. If you submit a form that is not listed in A, your proposal will be held back until we receive a new, updated signature page.
- You must obtain the signature of your department chair and dean before submitting your proposal.

A. FORMS COVERED BY THIS SIGNATURE PAGE. List each form you are submitting—for instance, PSYC 383, Course Form; PSYC, Change of Major Form; PSYC, Change of Minor Form.

MATH 229 Course Form

B. APPROVAL AND SIGNATURES.

1. Signature of Department Chair or Program Director:
   [Signature]
   Date: 12/2/2013

2. Signature of Academic Dean:
   [Signature]
   Date: 12/5/2013

3. Signature of Provost:
   [Signature]
   Date: 1/5/14

4. Signature of Business Affairs (only for course fees):
   [Signature]
   Date: __________________

5. Signature of Curriculum Committee Chair:
   [Signature]
   Date: __________________

6. Signature of Budget Committee Chair (only for new programs):
   [Signature]
   Date: __________________

7. Signature of Academic Planning Committee Chair (only for new programs):
   [Signature]
   Date: __________________

8. Signature of Faculty Senate Secretary:
   [Signature]
   Date: __________________

Date Approved by Faculty Senate: ________________

☐ fee approved on __________
☐ BOT approval pending

Can a student receive credit for MATH 229 and CALC II and/or CALC III?

Appears Answer to "Yes"

[Signature] 1/5/14
FACULTY CURRICULUM COMMITTEE
COURSE FORM

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- Remember that your changes will not be implemented until the next catalog year at the earliest.
- If you have questions, start by checking the instructions on the website. Please feel free to contact the committee chairs with any remaining questions you might have.

A. CONTACT/COURSE INFORMATION.

Name: Jason Howell  Phone: 953-1016  Email: howelljs@cofc.edu

Department or Program: Mathematics  School: Science and Mathematics

Subject Acronym and Course Number: MATH 229

Catalog Year in which changes will take effect: FALL __ 2014________

B. TYPE OF REQUEST. Please check all that apply, then fill out the specified parts of the form.

☒ Add a New Course (complete parts C, D, F, G, H, I, J, K)
☐ Change Part of an Existing Course (complete parts C, D, E, F, G, I, J, K)
☐ Course Number
☐ Course Name
☐ Course Description
☐ Credit/Contact Hours
☐ Restrictions (prerequisites, co-requisites, junior/senior standing, etc.)
☐ Deactivate an Existing Course (complete parts C, D, E, G, I, J, K)
☐ Reactivate a Previously-Deactivated Course (complete parts C, D, E, G, I, J, K)

C. RATIONALE AND EXPLANATION. Please describe your request and explain why you are making it.

(Provided by the Department of Chemistry) The Department of Chemistry and Biochemistry requires a year-long sequence of Physical Chemistry for both its Chemistry and Biochemistry Majors. These courses are very mathematical and involve elements of multivariate calculus, linear algebra, and differential equations at a minimum. Currently, Chem and Biochem majors are required to take two semesters of calculus, Math 120 and Math 220, as pre-requisites for the physical chemistry sequence, though we strongly recommend in the catalog that students also take Calculus III, Math 221. Most students do not take Calculus III, however, because both of our majors are very credit hour intensive. This leaves our physical chemistry staff having to explain complex math on top of complex chemical concepts as the material arises. The “math issue” has been a frequent topic in our department for years, and over the past four years, we have monitored the number of times our graduates refer to the “physical chemistry math problem” in our required senior exit survey. Table 1 below summarizes comments from these surveys and hints at the frustration our majors feel at not being adequately prepared mathematically for this important course sequence. In conversations with the math department, we have dissected the math concepts needed to understand the math derivations of chemical principles in the physical chemistry sequence and have determined that these topics are scattered over Math 120, Math 220, Math 221, Math 203, Math 245, Math 303, Math 315, Math 323, Math 423, Math 402, and Math 445. It is no wonder that the students (and faculty) are frustrated.

In a survey of math requirements at other institutions, we are certainly not alone in only requiring a year of calculus. About half of the schools we surveyed require the same sequence of calculus for their chemistry degrees, Calc I and II. However,

This form was last updated on 06/03/13 and replaces all others.
half require more math, with about 1/5 of the schools requiring four semesters of higher math. Because of stringent requirements for American Chemical Society accreditation that require a certain distribution of courses and a minimum number of lab hours and because of the large general education requirements for students here at CoC, it is prohibitively difficult for us to require chemistry and biochemistry majors to take an additional semester of calculus. In addition, as our subject analysis indicates, taking Calculus III (in addition to Calc I and Calc II) would not adequately address some of the math deficiency. Thus, we propose to create a new 5-credit math course for chemistry and biochemistry majors that would replace the current Calc II degree requirement. The new course would blend the most essential elements of Calculus II and Calculus III with key concepts in linear algebra and differential equations in a single course that would meet daily for a semester. The majority of the topics (over 50%) actually stem from a traditional Calculus III course. The linearity of the chemistry curriculum makes it challenging to impose an additional semester of math study on these students. We feel that the students would prefer a single intense course with careful selection of topics that map onto the chemistry they will later learn. There are two alternatives to this approach. First, we could require chemistry and biochemistry majors to take Calculus III. This alternative adds 4 more credit hours and would bring the biochemistry degree from 72 credit hours to 76 credit hours. This option still leaves students unfamiliar with key concepts in linear algebra and differential equations and further delays their ability to start on the physical chemistry sequence. We could also design a new course that was meant to be taken with Calc II as a prerequisite and require it for graduation, but again, this further adds more credit hours and introduces the burden of trying to fit in more courses into an already tight 4-year graduation plan. Again, we feel the 5-credit single class approach will best meet our curricular goals without introducing undue burden on the students' graduation timing. We feel this approach also best maintains the ability of chemistry and biochemistry majors to participate in the Honors program and the ability to get minors or other majors.

The proposed new 5-credit class would be called "Vector Calculus with Chemical Applications". It would be taught in the math department each semester with an expected enrollment of 20 students each semester.

Table 1: Student comments from graduating seniors requesting better math preparation

| Pre-reqs (for PChem) need to be adjusted to show how math dependent the course really is |
| A stronger emphasis on math in physical chem would help the program |
| The subject matter (of physical chemistry) is extremely difficult to comprehend at times. I believe that at the least calculus 3 or a course in differential equations should be a co- or pre-requisite for these courses. |
| Physical chemistry seems like a lot more mathematics than chemistry |
| Physical chemistry is really difficult for most people, maybe a little more support for that course |
| Physical chemistry can be tough for those who do not have a strong math background, or have not taken a math course in some time |
| The only weakness that I encountered during my tenure at the College was the application of upper level mathematics. I would like to see a course offered that focuses on applications of calculus within physical chemistry. This would have made the physical chemistry courses far less daunting |
| One other course I would like to have had the option of taking is a mathematics for chemistry which would have better prepared me for P-Chem. |
| There aren’t enough math courses required to prepare for some of the math based chemistry courses |
| A stronger emphasis on the math in physical chem would help the program |
| The way physical chemistry is addressed and pre-req needs to be adjusted to show how math dependent the course actually is. Physical chemistry was extremely difficult because the concepts were not adequately introduced before we started manipulation of the math. It almost seemed as if we were supposed to have taken another course in math before physical chemistry. |
| It is hard to go to an upper level pchem class when calculus was taken freshmen/sophomore year. |
| I did not like how I was pushed to take calculus so early when I was a freshman, but I didn’t take PChem until my senior year. By then it was difficult to remember. |
| I think bringing back the old math requirement of multivariate calculus, differential equations and linear algebra would actually make much of chemistry, particularly theory and P-Chem, easier and more enjoyable for the students. The College should consider an MIT-like two semester calculus course (covering Calc 1/2/3) for chemistry/biochemistry majors |
D. IMPACT ON EXISTING PROGRAMS AND COURSES. Please briefly describe the impact of your request on your own programs and courses as well other programs and courses. If another program requires the course, you must submit their written acknowledgement with this proposal. Also, the affected program must describe any change in the number of credit hours they require. Include a list of similar courses in other departments and explain any overlap.

This course will not have an impact on any existing degree programs in Mathematics or Data Science. This course may decrease the enrollment in MATH 220 by at most 40 students per year.

This course will have an impact on the Chemistry and Biochemistry degree programs. The information below was provided by the Department of Chemistry, and a written acknowledgement is included at the end of this proposal.

The proposed course would deepen the students' understanding of core chemical concepts. The purposeful linking of math concepts to chemical applications will also make the course more appealing to these students and allow them to see immediate application of math principles. Graduating seniors in chemistry and biochemistry take an exit exam, the Majors Field Test. The test has four sections, Physical, Analytical, Inorganic, and Organic. Students who took additional math courses beyond Calc II typically score in the 90th percentile or above on the Physical Chemistry Section. We would expect to see improved scores on our MFT Physical Chemistry scores as the more focused and rigorous math class is implemented. We will have to plan the scheduling of this course such that the meeting time does not conflict with other key majors courses, as we currently do now for courses in biology. We would encourage students who know they will be applying for graduate school in chemistry to also take a traditional Calc II course. We have carefully chosen the name of the course to suggest that it is most similar to Calculus III. The name, plus the 5 credits, will indicate to graduate programs a course of more rigor, rather than less rigor. Other implications include that the students will likely not be able to replicate this course off campus. For transfer students who have already completed a year of calculus, we would allow them to take the course as a co-requisite with Physical Chemistry, rather than as a pre-requisite.

The new math class would replace the current degree requirement of Math 220 for the Chemistry and Biochemistry major. The proposed change increases the number of credit hours for a BS in Biochemistry from 72 credit hours to 73 credit hours. The proposed change increases the number of credit hours for the BS in Chemistry from 60 to 61. The proposed change increases the number of credit hours for the BA in Chemistry from 40 to 41.

This course is a collaborative effort between the Math Department and the Chemistry Department. It has been developed at the request of the Chemistry Department and numerous math faculty members have expressed an interest in teaching it.

This form was last updated on 06/03/13 and replaces all others.
E. EXISTING COURSE INFORMATION. If you are proposing a new course, just leave this blank. Otherwise, please fill out all fields.

Department: 
School: 
Subject Acronym: 
Course Number: 

Credit hours: __ lecture __ lab __ seminar __ independent study
Contact hours: __ lecture __ lab __ seminar __ independent study

Course title:

Course description (maximum 50 words, exactly as it appears in the catalog):

Restrictions (pre-requisites, co-requisites, majors only, etc.):

Cross-listing, if any:

Is this course repeatable? □ yes □ no If yes, how many total credit hours may the student earn? ___

F. NEW COURSE INFORMATION. If you are deactivating a course, leave this blank. Otherwise, please fill out all fields. For changed courses, use **boldface** for the information that is changing.

Department: Mathematics 
School: Science and Mathematics
Subject Acronym: MATH 
Course Number: 229

Credit hours: ___5__ lecture ___ lab ___ seminar ___ independent study
Contact hours: ___5__ lecture ___ lab ___ seminar ___ independent study

Course title: Vector Calculus with Chemical Applications

Course description (maximum 50 words, exactly as it appears in the catalog): Multidimensional coordinate systems, vectors, matrices, matrix and vector operations, eigenvalues and eigenvectors, matrix groups and commutators, vector-valued functions, partial derivatives, directional derivatives, multiple integrals, line and surface integrals, vector calculus, Taylor series, Fourier series and transforms, a survey of ordinary and partial differential equations motivated by applications in chemistry.

Restrictions (pre-requisites, co-requisites, majors only, etc.):
Pre-requisites: Placement or C- or better in MATH 120/HONS 115.

If this is a newly-created course, is it intended to be the equivalent of an existing course and replace it? □ yes □ no
If so, which course? ____________
*Note: You must deactivate that course by submitting an additional Course Form.*

Cross-listing, if any (submit approval from relevant department): None
*Note: Cross-listed courses are equivalent.*

Is this course repeatable? □ yes □ no If yes, how many total credit hours may the student earn? ____

This form was last updated on 06/03/13 and replaces all others.
Is there an activity, lab, or other fee associated with this course? □ yes □ no What is the fee? $____

Note: The Senate cannot approve new fees; Business Affairs will submit any such request to the Board of Trustees. The course can still be created, but the fee will not be attached until the Board has approved it.

G. COSTS. List all of the new costs or cost savings (including new faculty/staff requests, library, equipment, etc.) associated with your request.

No new costs will be associated with this course.

H. STUDENT LEARNING OUTCOMES AND ASSESSMENT.

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
<th>Assessment Method and Performance Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>What will students know and be able to do when they complete the course?</td>
<td>How will each outcome be measured? Who will be assessed, when, and how often? How well should students be able to do on the assessment?</td>
</tr>
<tr>
<td>1. Acquire a working knowledge of the major concepts of vector calculus relevant to chemistry.</td>
<td>This learning outcome will be assessed with signature questions on the course final exam. 70% of students should &quot;meet expectations&quot; or &quot;exceed expectations&quot; based on the rubric designed to assess the signature questions.</td>
</tr>
<tr>
<td>2. Demonstrate proficiency using mathematical models to solve applied problems in quantum chemistry, chemical kinetics, and thermodynamics.</td>
<td>This learning outcome will be assessed with signature questions on the course final exam. 70% of students should &quot;meet expectations&quot; or &quot;exceed expectations&quot; based on the rubric designed to assess the signature questions.</td>
</tr>
<tr>
<td>3. Be able to identify and apply the appropriate models to describe elementary physicochemical phenomena in mathematical terms.</td>
<td>This learning outcome will be assessed with signature questions on the course final exam. 70% of students should &quot;meet expectations&quot; or &quot;exceed expectations&quot; based on the rubric designed to assess the signature questions.</td>
</tr>
<tr>
<td>4. Demonstrate general knowledge of the fundamentals of vector calculus and the core mathematical theory apart from any particular application.</td>
<td>This learning outcome will be assessed with signature questions on the course final exam. 70% of students should &quot;meet expectations&quot; or &quot;exceed expectations&quot; based on the rubric designed to assess the signature questions.</td>
</tr>
</tbody>
</table>

How does this course align with the student learning outcomes articulated for the major, program, or general education? What program-level outcome or outcomes does it support? Is the content or skill introduced, reinforced, or demonstrated in this course?

Math 229 is being developed to facilitate delivery of the Chemistry and Biochemistry curriculum. Math 229 will support the development of critical thinking skills for Chemistry and Biochemistry majors by providing the advanced, foundational math skills required for deep understanding of chemical principles. Two SLO and departmental program goals will be facilitated by the addition of the new course: 1) Chemistry and Biochemistry majors will demonstrate proficiency in one or more of the more narrowly defined sub-disciplines of Chemistry, which include Analytical, Biochemistry, Inorganic, Organic, or Physical chemistry and 2) Chemistry and Biochemistry majors will demonstrate a positive appreciation for the educational experiences received within our department. By directly addressing graduate complaints about the math deficiencies through the joint development of this course, we expect our graduates to better appreciate their educational experience. By providing a solid math foundation prior to delivering complex, mathematical derivations of chemical principles in the Physical Chemistry sequence, our students are more likely to excel and master proficiency in the Physical Chemistry sub-discipline. The content of the course will introduce the needed math skills and students will be expected to demonstrate mastery of these skills at the end of the Math course. In addition, the reinforcement of the skills and demonstration of these skills will occur again over the two-semester sequence of Physical Chemistry.
I. PROGRAM CHANGES. Will this course be added to the existing degree requirements or list of approved electives of a major, minor, or concentration?  ☒ yes ☐ no

If yes, please attach a Change Minor and/or Change Major/Program Form as appropriate.

A complete list of the program changes for the Chemistry and Biochemistry degree programs will be submitted under separate cover by the Department of Chemistry.

J. CHECKLIST.

☒ I have completed all relevant parts of the form.

☒ I have attached a cover letter that describes my request and lists all the documents I am submitting.

☒ (For new courses only) I have attached a syllabus.

☒ (For courses used in any way by other departments, including cross-listing) I have attached an acknowledgement from the relevant department.

☒ (For courses intended to fulfill a Gen Ed requirement) I have submitted the proposal to the Gen Ed committee.

☒ I have submitted one Signature Form that lists all of the different forms I am submitting.
MATH 229: Vector Calculus with Chemical Applications  
College of Charleston Department of Mathematics  
Course Syllabus

Instructor: Instructor Name, Email: email@cofc.edu, Phone: (843) 953-xxxx  
Office: Robert Scott Small Building 3xx, Office Hours: TBD, and by appointment.

• Disclaimer: The information presented in this course syllabus is subject to change (with notification) at the discretion of the Instructor.

• Lecture Meetings: 9:00 am - 9:50 am MWF; 9:25 am - 10:40 am TR, all in Maybank Hall 2XX.

• Course Website: Course materials, assignments, and announcements will be available at the course OAKS website. Students are responsible for checking the site regularly for any information relevant to the class.


• Prerequisites: Placement or C- or better in MATH 120/HONS 115.

• Course Description: (5 Credit Hours) Multidimensional coordinate systems, vectors, matrices, matrix and vector operations, eigenvalues and eigenvectors, matrix groups and commutators, vector-valued functions, partial derivatives, directional derivatives, multiple integrals, line and surface integrals, vector calculus, Taylor series, Fourier series and transforms, a survey of ordinary and partial differential equations motivated by applications in chemistry.

• Student Learning Outcomes: Students are expected to display a thorough understanding of the topics covered.

   1. Acquire a working knowledge of the major concepts of vector calculus relevant to chemistry.
   2. Demonstrate proficiency using mathematical models to solve applied problems in quantum chemistry, chemical kinetics, and thermodynamics.
   3. Be able to identify and apply the appropriate models to describe elementary physiochemical phenomena in mathematical terms.
   4. Demonstrate general knowledge of the fundamentals of vector calculus and the core mathematical theory apart from any particular application.

These outcomes will be assessed on the final exam. The student will accomplish the above outcomes through attending lectures, taking quizzes and exams, completing several homework assignments, and completing a final exam. Students should expect to spend at least 10 (TEN) hours per week on reading, homework, and studying, in addition to the five class meetings per week.

• Attendance: Attendance to all lectures is expected, and students are responsible for materials covered in classes that are missed. The instructor will make every attempt to be helpful to students who miss class meetings due to illness or other unavoidable circumstances. Students who are absent excessively from class (more than 8 absences) will be dropped at the WA (Withdrawal for Excessive Absences) date, which is October XX.

• Homework: Homework assignments will be given to students on a regular basis (about once a week). Individual assignments may have different point totals, and the homework assignment average will be computed by taking the total number of points earned and dividing by the total number of possible points.

   − All homework should be written or typeset (if the student’s handwriting is poor or if the student prefers to type) clearly and concisely, on the front sides (only) of stapled pages. Information on the \TeX typesetting system will be made available on the OAKS course.

   − All problem statements should be reproduced when feasible, and solutions should be explicitly delimited from the problem statements and/or other comments.
- Homework assignments will be made available on OAKS, and the due date and time for assignments will be given with each particular assignment. All homework is due when stated and will not be accepted late. Exceptions may be made at the discretion of the instructor in exceptional circumstances.
- Since the purpose of homework is to help you learn, you may discuss homework problems with others (if you do so, acknowledge that on your homework). However, you must work out and write up your own solutions—you may not look at the homework of someone else (or at a common source) or show anyone your homework. Copying is cheating (see below).
- Copying and cheating is strictly prohibited. Offenses will be pursued in accordance with the College's policy on cheating (see Academic Integrity).

- **Quizzes:** Periodically, short quizzes will be given in class. The content of the quizzes will be based on lectures, reading assignments, and homework problems. At the end of the semester, around 10% of your lowest quizzes will be dropped and your quiz average will be computed using the remaining quiz grades.
- **Exams:** There will be four (midterm) exams administered throughout the semester. The dates for the four exams are:
  - September 11th (Thursday)
  - October 2nd (Thursday)
  - October 28th (Thursday)
  - November 20th (Thursday)

**Missed Midterm Exams:** No missed midterm exams will be made up. If a student misses an exam without a valid excuse, the grade will be zero. If a student misses an exam with a valid excuse, then the average of the other two exams will be used for the missed exam grade. A valid excuse means that the student has a valid Absence Memo from the Office of Student Affairs or some other documentation from a valid campus office stating that the student is traveling for an extracurricular activity (with documentation), etc. In these cases the student should notify the instructor ASAP (before the exam if at all possible) that they will be missing the exam.

- **Final Exam:** The final exam is cumulative and is scheduled for 8:00am-11:00am on Monday, December 8th. It is very important to note that you will not be allowed to take the final exam early and you should not make plans to leave campus for good prior to that date and time.

- **Grading Policy:**

<table>
<thead>
<tr>
<th>Midterm Grade</th>
<th>Final Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quizzes 15%</td>
<td>15%</td>
</tr>
<tr>
<td>Homework 10%</td>
<td>10%</td>
</tr>
<tr>
<td>First Two Exams 75%</td>
<td></td>
</tr>
</tbody>
</table>

- **Grading Scale:**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>93-100</td>
</tr>
<tr>
<td>A-</td>
<td>90-92</td>
</tr>
<tr>
<td>B+</td>
<td>87-89</td>
</tr>
<tr>
<td>B</td>
<td>83-86</td>
</tr>
<tr>
<td>B-</td>
<td>80-82</td>
</tr>
<tr>
<td>C+</td>
<td>77-79</td>
</tr>
<tr>
<td>C</td>
<td>73-76</td>
</tr>
<tr>
<td>C-</td>
<td>70-72</td>
</tr>
<tr>
<td>D+</td>
<td>67-69</td>
</tr>
<tr>
<td>D</td>
<td>63-66</td>
</tr>
<tr>
<td>D-</td>
<td>60-62</td>
</tr>
<tr>
<td>F</td>
<td>0-59</td>
</tr>
</tbody>
</table>

- **Extra Credit:** There will be no opportunities for extra credit in this course. Your grade will be calculated using the structure given above.

- **Accommodations:** The College will make reasonable accommodations for persons with documented disabilities. Students should apply at the Center for Disability Services/SNAP, located on the first floor of the Lightsey Center, Suite 104. Students approved for accommodations are responsible for notifying the Instructor as soon as possible and for contacting the Instructor at least one week before any accommodation is needed.
• **Academic Integrity:** All College of Charleston academic integrity policies, including the Honor Code and the Code of Conduct, apply to this course. Violations of the honor code will be dealt with immediately and referred to the Office of the Dean of Students. Penalties for violating the honor code may include receiving a grade of XF and/or suspension/expulsion from the College. Refer to http://studentaffairs.cofc.edu/honor-system/studenthandbook/index.php and http://deanofstudents.cofc.edu/policies-and-procedures/honor-system.php and feel free to ask the instructor for help if you have any questions.

• **Classroom Disruption:** Students are expected to behave in a manner consistent with a positive collegiate learning environment. Any student who disrupts the class to the point where the ability of the instructor to teach or the ability of the students to learn is impaired will be asked to leave and will be referred to the Office of the Dean of Students for further action. Please see http://deanofstudents.cofc.edu/policies-and-procedures/classroom-disruption.php for the College's policy on classroom disruption.

**Schedule of Topics**

• **Week 1:** Diagnostic quiz, Cartesian, polar, cylindrical, and spherical coordinate systems, review of complex numbers, vectors and vector operations, orthogonality, equations of lines and planes, systems of linear equations, matrices.

• **Week 2:** Row reduction and echelon forms, solution sets, linear independence and dimension, matrix operations, partitioned matrices, inverses.

• **Week 3:** Determinants, rank, vector spaces and subspaces, basis, null and column space, eigenvalues and eigenvectors.

• **Week 4:** Linear operators (transformations), symmetry operators, operator algebras and the commutator, matrix groups.

• **Week 5:** Review of limits and derivatives, vector-valued functions and parametric curves, derivatives of vector functions, arc length and curvature, functions of several variables, vector fields.

• **Week 6:** Partial derivatives, the chain rule and the total differential, implicit differentiation and Euler's cyclical rule, directional derivatives and the gradient, maximum and minimum values.

• **Week 7:** Derivatives in cylindrical and spherical coordinates, curl and divergence, review of integration including substitution, integration by parts, improper integrals, multiple integrals over rectangles.

• **Week 8:** Change of variables in multiple integrals, multiple integrals over general regions, integrals in polar, cylindrical, and spherical coordinates, line integrals.

• **Week 9:** Green's Theorem, parametric surfaces and surface integrals, Stokes' Theorem, the Divergence Theorem.

• **Week 10:** Tangent lines and planes, linear approximation, power series, Taylor and Maclaurin series.

• **Week 11:** Fourier series, operations on series, Fourier transform, Laplace transform.

• **Week 12:** Ordinary differential equations, separable equations, exact equations, integrating factors.

• **Week 13:** Harmonic oscillators, Legendre polynomials, Hermite polynomials.

• **Week 14:** Partial differential equations, heat equation, wave equation, partial differential equations in cylindrical and spherical coordinates.
November 23, 2013

To: Jason Howell  
From: Pamela Riggs-Gelasco  
RE: Development of new math course

Dear Jason,

Thank you for your assistance in designing and proposing a new math course “Vector Calculus with Chemical Applications”. Using this course to replace our current Calculus II requirement for our majors will better serve our students by giving them the mathematical skillset needed to comprehend material in the Chemistry 341-342 year-long sequence of Physical Chemistry. A committee of 6 mathematicians and 4 chemists outlined the math required for Physical Chemistry and discussed multiple delivery options, including an elective course, an additional course taken after Calc II, or a simple addition of Calc III to our requirements. In subsequent discussions at Chemistry faculty meetings, we determined that an additional course on top of calculus II would be prohibitively difficult for our students and would likely affect the number of majors in our program. An elective course would not be taken by enough students to justify the workload and would further amplify differences in math skill sets. The elective course option would not allow us to fundamentally change the current method of content delivery in Physical Chemistry. Thus, we decided on a single, intense 5-credit experience that would allow both a redistribution of calculus topics presented to the students (with the bulk of these topics coming from traditional Calc III content) and the introduction of basic differential equations and linear algebra skills. We greatly appreciate the math department’s enthusiasm for both developing and teaching this course for our students.

Many thanks,

Pamela Riggs-Gelasco

Pamela Riggs-Gelasco