



# Curriculum and Course Change System - Print Change/Delete Course Form

## XChange a Course - Abbrev & Number: BIO E-431

Corresponding Lab Course: --

Corresponding Honors course: --

..Add Honors course: --

Corresponding Graduate course: BIO E-631

..Add Graduate course: --

Course Title: MEDICAL IMAGING

### Brief Statement of Change:

Change of credit distribution and method of instruction from lecture only (3,0) to lecture/lab (2,2). This course involves a lot of hands on work with computers. Student feedback have suggested this would be more effective in a supervised lab setting than as currently done as independent homework assignments. Note that the catalog descript will not be changed as it already references "students will have the opportunity to work with real medical images", which is the primary content of the lab.

Last Term taught:1201

..Change Abbrev to:

Effective Term:01/2013

..Change Number to:

..Change Catalog Title:

..Change Transcript Title:

from:

from: MEDICAL IMAGING

to:

to:

X From: Fixed Credit: 3 (3,) To: Fixed Credit: 3 (2,2)

Change of Credit Variable Credit: -( ), (-) Variable Credit: -( ), (-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| XChange Method of Instruction | ..Change Course Modifier | ..Change General Education Designation |
|-------------------------------|--------------------------|--|
| from: to:                     | from: to:                | from: to:                              |
| XA-Lecture Only ..            | ..Pass/Fail Only ..      | ..English Composition ..               |
| ..B-Lab (w/fee) ..            | XGraded ..               | ..Oral Communication ..                |
| ..D-Seminar ..                | ..Variable Title ..      | ..Mathematics ..                       |
| ..E-Independent Study ..      | ..Creative Inquiry ..    | ..Natural Science w/Lab ..             |
| ..F-Tutorial (w/fee) ..       | ..Repeatable ..          | ..Math or Science ..                   |
| ..G-Studio ..                 | maximum credits          | ..A&H (Literature) ..                  |
| ..H-Field course ..           | from:                    | ..A&H (Non-Literature) ..              |
| ..I-Study Abroad ..           | to:                      | ..Social Science ..                    |
| ..L-Lab (no/fee) ..           |                          | ..CCA ..                               |
| ..N/B-Lecture/Lab(w/fee) X    |                          | ..STS ..                               |
| ..N/L-Lecture/Lab(no fee) ..  |                          |  |

..Change Catalog Description:

from:

to:

..Change Prerequisite(s):

from:

to:

**Learning Objectives:** • Assess, evaluate, and justify the use and application of medical imaging techniques based on the underlying physical phenomena which these methods employ  
 o Explain, and model behavior of X-ray and CT Imaging based on basic physical principles  
 o Explain MRI using the simple "top" model of spins  
 o Understand the interactions of radiation with tissue, and compare and contrast images based on safety and risk/benefit  
 • Explain the outputs of imaging modalities in terms of anatomy and physiology coupled with the physics which the modality employs  
 • Design and justify a method for analyzing medical images based on basic image processing techniques

**Topical Outline:** Lecture

Week Topic

1 Introduction

1-3 Review of Advanced Mathematics and MATLAB

3-4 Imaging Basics

4-5 X-ray Imaging

6 X-ray Computed Tomography

7-8 Nuclear Medicine

9-11 Magnetic Resonance Imaging

12-13 Ultrasound

14 Image Quality

15 Practical Applications

Lab Week Topic

1 1 Introduction to Image Processing in MATLAB

2 2-3 Image Parameters and Measurements from Images

3 4-5 Fourier Image Processing

5 6 SNR, Signal and Noise

6 7-8 CT Reconstruction

7 9-10 Ultrasound Image Acquisition and Processing

8 11-15 Term Project

**Evaluation: UNDERGRADUATE GRADING CALCULATION**

Exam I 20%

Exam II 20%

Exam III 20%

Lab Assignments 30%

Participation and Quizzes 10%

**GRADUATE GRADING CALCULATION**

Exam I 20%

Exam II 20%

Exam III 20%

Term Project 15%

Lab Assignments 25%

**GRADING SCHEMA**

A 90 - 100%

B 80 - 89%

C 70 - 79%

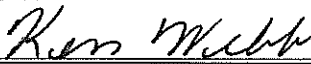
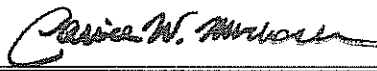

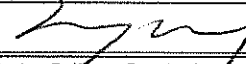

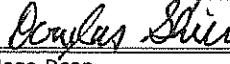
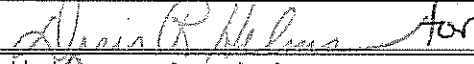
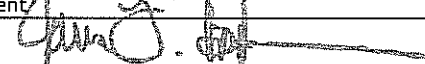
D 65 - 69%

F &lt; 65%

000072

**Add course requirements for honors and/or 600-level courses (if applicable):** To receive graduate credit in this course, students must complete a term project including analysis and processing of medical imaging data. Students will be asked to choose a project based on real world medical scenarios. The students will be encouraged to explore within their domain area, in order to bring diversity to the course material. Undergraduate students will be encouraged to help the graduate students with their efforts in order to enrich their experience.

**Form Originator:** KWEBB, Charles Webb **Date Form Created:** 11/7/2012**Form Last Updated by:** KWEBB, Charles Webb **Date Form Last Updated:** 11/7/2012**Form Number:** 5614**Approval**

|   |          |  |           |
|---|----------|--|-----------|
|    | 11/7/12  |        | 12/7/2012 |
| Chair, Department Curriculum Committee  | Date     | Chair, Undergraduate Curriculum Committee  | Date      |
|    | 11/7/12  |  |           |
| Department Chair  | Date     | Chair, Graduate Curriculum Committee   | Date      |
|   | 11/19/12 |       | 2/3/13    |
| Chair, College Curriculum Committee   | Date     | Provost  | Date      |
|  | 11/19/12 |  for | 2/3/13    |
| College Dean  | Date     | President  | Date      |
|   |          |      |           |
| Director, Calhoun Honors College  | Date     |  |           |

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# Curriculum and Course Change System - Print Change/Delete

## Course Form

**XChange a Course - Abbrev & Number: BIO E- 490**

Corresponding Lab Course: --

Corresponding Honors course: --

**..Add Honors course: --**

Corresponding Graduate course: --

**..Add Graduate course: --**

**Course Title: INTERNSHIP**

### Brief Statement of Change:

Change course modifier from graded to pass/fail only. Through this internship, students are working off-campus under nonfaculty supervision, making it difficult to accurately assess the quality of their work/experience. Therefore, we believe that pass/fail grading is much more appropriate.

Last Term taught: 1205

Effective Term: 01/2013

**..Change Abbrev to:**

**..Change Number to:**

**..Change Catalog Title:**

**..Change Transcript Title:**

from:

from: INTERNSHIP

to:

to:

.. From: Fixed Credit: (,) To: Fixed Credit: (,)

**Change of Credit** Variable Credit: 0-0 (-), (-) Variable Credit: - (-), (-)

**.. Add cross-listing with the following child course(s):**

**.. Delete cross-listing with the following child course(s):**

**.. Reverse Parent/Child relationship with:**

| <b>..Change Method of Instruction</b> | <b>XChange Course Modifier</b> | <b>..Change General Education Designation</b> |
|---------------------------------------|--------------------------------|---|
| from:                                 | from:                          | from: to:                                     |
| to:                                   | to:                            | ..English Composition ..                      |
| ..A-Lecture Only                      | .. ..Pass/Fail Only X          | ..Oral Communication ..                       |
| XB-Lab (w/fee)                        | .. XGraded ..                  | ..Mathematics ..                              |
| ..D-Seminar                           | .. ..Variable Title ..         | ..Natural Science w/Lab ..                    |
| ..E-Independent Study                 | .. ..Creative Inquiry ..       | ..Math or Science ..                          |
| ..F-Tutorial (w/fee)                  | .. XRepeatable ..              | ..A&H (Literature) ..                         |
| ..G-Studio                            | .. maximum credits             | ..A&H (Non-Literature) ..                     |
| ..H-Field course                      | .. from:                       | ..Social Science ..                           |
| ..I-Study Abroad                      | .. to:                         | ..CCA ..                                      |
| ..L-Lab (no/fee)                      | ..                             | ..STS ..                                      |
| ..N/B-Lecture/Lab(w/fee) ..           |                                |   |
| ..N/L-Lecture/Lab(no fee) ..          |                                |   |

**..Change Catalog Description:**

from:

to:

**..Change Prerequisite(s):**

from:

to:

**Learning Objectives:** This course is aimed at encouraging bioengineering students to participate in hands-on experiences that will substantially enhance their training and education. The major goal of this program is to offer a unique didactic experience where students will learn on-site the clinical requirements for effective biomedical engineering technology and for the understanding of medical device development, and will apply these principles in their state-of-

the-art research projects. Additionally, industrial internships will allow students to appreciate medical device technology from concept to market.

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This course is aimed at providing an opportunity for Bioengineering majors to earn academic credit by spending time as an observer or trainee in a clinical or an industrial setting where the practical aspects of their Bioengineering training can be cultivated. Overall the specific goals of this training program are to:

1. acquaint students with the workforce,
2. develop an appreciation of the interdisciplinary nature of bioengineering and how one uses knowledge from vastly different technologies to assemble useful biomedical devices,
3. understand the clinical needs and limitations that stimulate the medical device industry,
4. train students to adequately communicate the use of basic technical and experimental protocols commonly performed in bioengineering research in industry,
5. provide students with an appreciation of the needs for bioengineering technology,
6. increase the awareness of students about challenges and opportunities to be encountered by the device and bioengineering industry in the 21st century, and
7. prepare and motivate students to successfully transition with a graduate degree to the bioengineering profession.

**Topical Outline:** On-site assignments arranged with internship supervisor.

**Evaluation:** Attendance/participation (as reported by direct supervisor): 50%

Final report: 50%

Students with a final average of 80% overall will receive a grade of pass. Final averages below 80% will result in a grade of fail.

**Form Originator:** KWEBB, Charles Webb **Date Form Created:** 11/7/2012

**Form Last Updated by:** KWEBB, Charles Webb **Date Form Last Updated:** 11/7/2012

**Form Number:** 5617

**This form is not complete. thus approval signatures have not been printed.**

Ken No syllabus  
 PMA  
 2/13/13  
 Stephen S.

Patricia W. Mink 12/7/2012

Alexis R. Helms 2/13/13  
 Alexis R. Helms for 2/13/13  
 Camille J. Helms

CLEMSON

000075

## UNIVERSITY Curriculum and Course Change System - Print Change/Delete Course Form

XChange a Course - Abbrev &amp; Number: BIO E- 471

Corresponding Lab Course: --

Corresponding Honors course: --

..Add Honors course: --

Corresponding Graduate course: BIO E- -671

..Add Graduate course: --

Course Title: BIOPHOTONICS

## Brief Statement of Change:

Change of pre-requisite. At present, enrollment in this course is effectively restricted to bioelectrical concentration majors due to ECE 320 pre-req. The instructor admitted students from biomaterials concentration with ECE 307 and they have been successful in the course.

Last Term taught:

..Change Abbrev to:

Effective Term:01/2013

..Change Number to:

..Change Catalog Title:

..Change Transcript Title:

from:

from: BIOPHOTONICS

to:

to:

.. From: Fixed Credit: 3 (3,0) To: Fixed Credit: (,)

Change of Credit Variable Credit: - (-), (-) Variable Credit: - (-),(-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

..Change Method of Instruction

..Change Course Modifier

..Change General Education Designation

from:

to:

from:

to:

from:

to:

XA-Lecture Only

..

..Pass/Fail Only

..

..English Composition

..

..B-Lab (w/fee)

..

XGraded

..

..Oral Communication

..

..D-Seminar

..

..Variable Title

..

..Mathematics

..

..E-Independent Study

..

..Creative Inquiry

..

..Natural Science w/Lab

..

..F-Tutorial (w/fee)

..

..Repeatable

..

..Math or Science

..

..G-Studio

..

maximum credits

..A&amp;H (Literature)

..

..H-Field course

..

from:

..A&amp;H (Non-Literature)

..

..I-Study Abroad

..

to:

..Social Science

..

..L-Lab (no/fee)

..

..CCA

..

..N/B-Lecture/Lab(w/fee)

..

..STS

..

..N/L-Lecture/Lab(no fee)

..

..Change Catalog Description:

from:

to:

XChange Prerequisite(s):

from: MthSc 208; PHYS 221; ECE 320; or consent of instructor

to: MthSc 208; PHYS 221; ECE 307 or ECE 320; or consent of instructor

Learning Objectives:

Topical Outline:

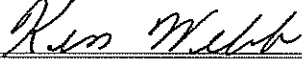


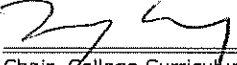
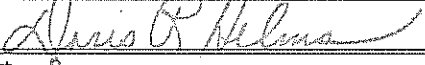
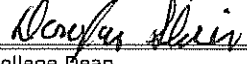


Evaluation:

Form Originator:KWEBB, Charles WebbDate Form Created: 11/16/2012

Form Last Updated by: KWEBB, Charles WebbDate Form Last Updated: 11/16/2012

Form Number: 5647

## Approval

|   |          |  |           |
|---|----------|--|-----------|
|  | 11/15/12 |  | 12/7/2012 |
| Chair, Department Curriculum Committee  | Date     | Chair, Undergraduate Curriculum Committee  | Date      |
|  | 11/16/12 |  |           |
| Department Chair  | Date     | Chair, Graduate Curriculum Committee   | Date      |
|  | 11/19/12 |  | 2/3/13    |
| Chair, College Curriculum Committee   | Date     | Provost  | Date      |
|  | 11/19/12 |  | 2/3/13    |
| College Dean  | Date     | President  | Date      |
|   |          |  |           |
| Director, Calhoun Honors College  | Date     |  |           |

000076



## Curriculum and Course Change System - Print Change/Delete Course Form

XChange a Course - Abbrev &amp; Number: BIO E- 448

Corresponding Lab Course: BIO E-L-448

Corresponding Honors course: --

..Add Honors course: --

Corresponding Graduate course: --

..Add Graduate course: --

Course Title: TISSUE ENGINEERING

## Brief Statement of Change:

Change of pre-requisite to co-enrollment in BioSci 461 rather than requiring it as a pre-req. With the current pre-reqs and curriculum structure, this course can only be taken in the final semester before graduation, unless BioSci 461 is taken in advance, which is difficult to achieve in our curriculum. Based on scheduling flexibility for students and laboratory teaching capacity, it is beneficial to allow students a choice of two semesters in which to complete this course. The instructor has been admitting students co-enrolled in BioSci 461 via COI and they have successfully completed the course.

Last Term taught: 1201

..Change Abbrev to:

Effective Term: 01/2013

..Change Number to:

..Change Catalog Title:

..Change Transcript Title:

from:

from: TISSUE ENGINEERING

to:

to:

.. From: Fixed Credit: 3 (2,3) To: Fixed Credit: (,)

Change of Credit Variable Credit: - (-), (-) Variable Credit: - (-), (-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

..Change Method of Instruction

..Change Course Modifier

..Change General Education Designation

from:

to:

from:

to:

from:

to:

..A-Lecture Only

..

..Pass/Fail Only

..

..English Composition

..

..B-Lab (w/fee)

..

XGraded

..

..Oral Communication

..

..D-Seminar

..

..Variable Title

..

..Mathematics

..

..E-Independent Study

..

..Creative Inquiry

..

..Natural Science w/Lab

..

..F-Tutorial (w/fee)

..

..Repeatable

..

..Math or Science

..

..G-Studio

..

maximum credits

..A&amp;H (Literature)

..

..H-Field course

..

from:

..A&amp;H (Non-Literature)

..

..I-Study Abroad

..

to:

..Social Science

..

..L-Lab (no/fee)

..

..CCA

..

XN/B-Lecture/Lab(w/fee)

..

..STS

..

..N/L-Lecture/Lab(no fee)

..

..Change Catalog Description:

from:

to:

XChange Prerequisite(s):

from: BioE 302; BioSci 315 and 461; or consent of instructor

to: BioE 302 and BioSci 315 and co-enrollment in BioSci 461; or consent of instructor.

Learning Objectives:

Topical Outline:

Evaluation:

Form Originator: KWEBB, Charles Webb Date Form Created: 11/16/2012

Form Last Updated by: KWEBB, Charles Webb Date Form Last Updated: 11/16/2012

Form Number: 5646

## Approval

|  |          |   |           |
|--|----------|---|-----------|
|  | 11/15/12 |   | 12/7/2012 |
| Chair, Department Curriculum Committee | Date     | Chair, Undergraduate Curriculum Committee | Date      |
|  | 11/16/12 |   |           |
| Department Chair                       | Date     | Chair, Graduate Curriculum Committee      | Date      |
|  | 11/19/12 |   | 2/3/13    |
| Chair, College Curriculum Committee    | Date     | Provost                                   | Date      |
|  | 11/19/12 |   | 2/3/13    |
| College Dean                           | Date     | President                                 | Date      |
|  |          |   |           |
| Director, Calhoun Honors College       | Date     |   |           |



## Curriculum and Course Change System - Print Major Form

Change Major Name: Chemistry

Degree: BS

Effective Catalog Year: 2012

.. Change Major Name to:

.. Change Degree to: (CHE approval required)

☒ Change Curriculum Requirements

(Submit or upload Curriculum map in catalog format. CHE approval required for &gt; 18 hours of changes)

.. Change General Education Requirements

(Must also submit a General Education Checklist)

.. Add, Change or Delete Concentration(s)

(Submit or upload Curriculum map in catalog format. CHE approval required)

.. Add, Change or Delete Emphasis Area(s)

**Explanation:** Changes to the Chemistry BS curriculum are requested to accomodate changes in chemistry department course offerings and improve overall student performance.

1) We would like to replace the BIOCH 305 requirement with CH 360 (Chemical Biology). While some students may have the necessary prereqs (BIOL 103 or 110) to take BIOCH 305, students who follow the Chemistry BS curriculum will not. The CH 360 course is designed to educate students on the chemical aspects of biological molecules while assuming some formal university-level chemistry education but no formal university-level biology education.

2) We would like to move the Advanced Synthetic Techniques lab (CH 403) to the last semester of the senior year and allow students the opportunity to take an elective in the fall semester. This change will a) Balance the credit load between the fall and spring semesters of the senior year. b) Allow students to focus on undergraduate research in the fall semester. c) Improve performance in CH 403 due to the fact that they will have completed CH 402 (inorganic chemistry) in the prior semester.

Form Originator: DOMINY, Brian Dominy Date Form Created: 11/8/2012

Form Last Updated by: , Date Form Last Updated: 11/8/2012

Form Number: 5629

## Approval

|  |  |          |                                      |           |
|--|--|----------|--------------------------------------|-----------|
|  | Chair, Department Curriculum Committee | Date     |                                      | Date      |
|  |  | 11/8/12  |                                      | 12/7/2012 |
|  | Department Chair                       | Date     | Chair, Graduate Curriculum Committee | Date      |
|  | Steve Greager                          | 11/8/12  |                                      | 2/3/13    |
|  | Chair, College Curriculum Committee    | Date     | Provost                              | Date      |
|  |  | 11/19/12 |                                      | 2/3/13    |
|  | College Dean                           | Date     | President                            | Date      |
|  | Douglas Davis                          | 12/19/12 |                                      |           |

**Department of Chemistry (REVISED)**  
**Curriculum for the Bachelor of Science Degree in Chemistry**

**FRESHMAN YEAR**

**First Semester**

4 – CH 101 General Chemistry  
 1 – CH 141 Chemistry Orientation  
 3 – Arts and Humanities Requirement<sup>1</sup> or  
     3 – Social Science Requirement<sup>1</sup>  
 3 – ENGL 103 Composition  
 4 – MTHSC 106 Calculus of One Variable I  
 Total units: 15

**Second Semester**

4 – CH 102 General Chemistry  
 4 – MTHSC 108 Calculus of One Variable II  
 3 – PHYS 122 Physics with Calculus I  
 3 – Arts and Humanities Requirement<sup>1</sup> or  
     3 – Social Science Requirement<sup>1</sup>  
 2 – CH 152 Chemistry Communication I  
 Total units: 16

**SOPHOMORE YEAR**

**First Semester**

3 – CH 223 Organic Chemistry  
 1 – CH 227 Organic Chemistry Lab  
 4 – MTHSC 206 Calculus of Sev. Var.  
 3 – PHYS 221 Physics with Calculus II  
 1 – PHYS 223 Physics Lab II  
 4 – Foreign language requirement<sup>2</sup>  
 Total units: 16

**Second Semester**

3 – CH 224 Organic Chemistry  
 1 – CH 228 Organic Chemistry Lab  
 4 – MTHSC 208 Intro. To Ord. Diff. Eqns.  
 3 – PHYS 222 Physics with Calculus II  
 1 – PHYS 224 Physics Lab II  
 3 – CH 205 Intro. to Inorganic Chemistry  
 Total units: 15

**JUNIOR YEAR**

**First Semester**

3 – CH 313 Quantitative Analysis  
 2 – CH 315 Quantitative Analysis Lab  
 3 – CH 331 Physical Chemistry  
 1 – CH 339 Physical Chemistry Lab  
~~3 – BIOCH 305 Essential Elements of Bioch.~~  
 3 – ~~CH 360 Chemical Biology~~<sup>4</sup>  
 3 – ENGL 314 Technical Writing  
 Total units: 15

**Second Semester**

3 – CH 332 Physical Chemistry  
 1 – CH 340 Physical Chemistry Lab  
 3 – CH 411 Instrumental Analysis  
 2 – CH 412 Instrumental Analysis Lab  
 3 – Arts and Humanities (Lit) requirement<sup>1</sup>  
 3 – Elective  
 Total units: 15

**SENIOR YEAR**

**First Semester**

3 – CH 402 Inorganic Chemistry  
~~2 – CH 403 Advanced Synthetic Techniques~~  
 3 – ~~Elective~~  
 3 – CH 443 Research Problems  
 3 – Chemistry Requirement<sup>3</sup>  
 3 – Arts and Humanities Requirement<sup>1</sup> or  
     3 – Social Science Requirement<sup>1</sup>  
 Total units: ~~14~~ 15

**Second Semester**

3 – Chemistry Requirement  
 3 – CH 450 Chemistry Capstone  
 1 – CH 452 Chemistry Communication II  
 3 – CH 444 Research Problems  
~~3 – Elective~~  
 2 – ~~CH 403 Advanced Synthetic Techniques~~  
 3 – Arts and Humanities Requirement<sup>1</sup> or  
     3 – Social Science Requirement<sup>1</sup>  
 Total units: ~~16~~ 15

122 Total Semester Hours

<sup>1</sup> See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>2</sup> One semester (through 102) in any modern foreign language is required.

<sup>3</sup> See advisor

<sup>4</sup> BIOCH 305 can substitute for CH 360





## Curriculum and Course Change System - Print Major Form

Change Major Name: Chemistry

Degree: BA

Effective Catalog Year: 2012/13

.. Change Major Name to:

.. Change Degree to: (CHE approval required)

☒ Change Curriculum Requirements

(Submit or upload Curriculum map in catalog format. CHE approval required for &gt; 18 hours of changes)

.. Change General Education Requirements

(Must also submit a General Education Checklist)

.. Add, Change or Delete Concentration(s)

(Submit or upload Curriculum map in catalog format. CHE approval required)

.. Add, Change or Delete Emphasis Area(s)

**Explanation:** Changes to the BA Chemistry Curriculum are requested to improve student performance in physical chemistry courses CH 331 and CH 332.

The changes involve moving CH 331 from the spring semester to the fall semester and CH 332 from the fall semester to the spring semester. In so doing, chemistry BA majors will be recommended to take these physical chemistry courses with the chemistry BS majors. By taking these courses with the majority of chemistry majors, we are anticipating an improved learning experience.

**Form Originator:** DOMINY, Brian Dominy **Date Form Created:** 11/8/2012**Form Last Updated by:** DOMINY, Brian Dominy **Date Form Last Updated:** 11/8/2012**Form Number:** 5632**Approval**

|  |          |   |           |
|--|----------|---|-----------|
|  |          | <i>Carice W. Munsen</i>                   | 12/7/2012 |
| Chair, Department Curriculum Committee | Date     | Chair, Undergraduate Curriculum Committee | Date      |
| <i>[Signature]</i>                     | 11/8/12  |   |           |
| Department Chair                       | Date     | Chair, Graduate Curriculum Committee      | Date      |
| <i>Steve Greager</i>                   | 11/8/12  | <i>Dario R. Helms</i>                     | 2/3/13    |
| Chair, College Curriculum Committee    | Date     | Provost                                   | Date      |
| <i>[Signature]</i>                     | 11/15/12 | <i>Dario R. Helms for</i>                 | 2/3/13    |
| College Dean                           | Date     | President                                 | Date      |
| <i>Douglas Shien</i>                   | 11/19/12 | <i>[Signature]</i>                        |           |

## Department of Chemistry (REVISED)

### Curriculum for the Bachelor of Arts Degree in Chemistry

#### FRESHMAN YEAR

##### First Semester

4 – CH 101 General Chemistry  
 1 – CH 141 Chemistry Orientation  
 3 – Arts and Humanities Requirement<sup>1</sup> or  
     3 – Social Science Requirement<sup>1</sup>  
 3 – ENGL 103 Composition  
 4 – MTHSC 106 Calculus of One Variable I  
 Total units: 15

##### Second Semester

4 – CH 102 General Chemistry  
 4 – MTHSC 108 Calculus of One Variable II  
 3 – PHYS 122 Physics with Calculus I  
 3 – Arts and Humanities Requirement<sup>1</sup> or  
     3 – Social Science Requirement<sup>1</sup>  
 2 – CH 152 Chemistry Communication I  
 Total units: 16

#### SOPHOMORE YEAR

##### First Semester

3 – CH 223 Organic Chemistry  
 1 – CH 227 Organic Chemistry Lab  
 4 – MTHSC 206 Calculus of Sev. Var.  
 3 – PHYS 221 Physics with Calculus II  
 4 – Foreign language requirement<sup>2</sup>  
 Total units: 15

##### Second Semester

3 – CH 224 Organic Chemistry  
 1 – CH 228 Organic Chemistry Lab  
 6 – Arts and Humanities Requirement<sup>1</sup> or  
     6 – Social Science Requirement<sup>1</sup>  
 4 – Foreign Language Requirement<sup>2</sup>  
 3 – CH 205 Intro. to Inorganic Chemistry  
 Total units: 17

Total Units in B.A. Degree: 122

<sup>1</sup> See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>2</sup> Four semesters (through 202) in any modern foreign language is required.

<sup>3</sup> See advisor

#### JUNIOR YEAR

##### First Semester

3 – CH 313 Quantitative Analysis  
 2 – CH 317 Quantitative Analysis Lab  
 3 – Minor Requirement  
 3 – Foreign Language Requirement<sup>2</sup>  
 3 – Arts and Humanities Requirement<sup>1</sup> or  
     3 – Social Science Requirement<sup>1</sup>  
~~3 – Arts and Humanities (Lit.) Requirement~~  
~~3 – CH 331 Physical Chemistry~~  
 Total units: 16

##### Second Semester

~~3 – CH 331 Physical Chemistry~~  
~~3 – Arts and Humanities (Lit.) Requirement~~  
 3 – ENGL 314 Technical Writing  
 3 – Minor Requirement  
~~3 – Arts and Humanities Requirement<sup>1</sup> or~~  
~~3 – Social Science Requirement<sup>1</sup>~~  
~~3 – CH 332 Physical Chemistry~~  
 3 – Foreign Language Requirement<sup>2</sup>  
 Total units: 15

#### SENIOR YEAR

##### First Semester

~~3 – CH 332 Physical Chemistry~~  
 3 – Arts and Humanities Requirement<sup>1</sup> or  
     3 – Social Science Requirement<sup>1</sup>  
 3 – Minor Requirement  
 3 – Chemistry Requirement  
 6 – Elective  
 Total units: 15

##### Second Semester

3 – Chemistry Requirement  
 3 – CH 450 Chemistry Capstone  
 1 – CH 452 Chemistry Communication II  
 6 – Minor Requirement  
 Total units: 13

000081



## Curriculum and Course Change System - Print Change/Delete Course Form

## XChange a Course - Abbrev &amp; Number: C E- 201

Corresponding Lab Course: --

Corresponding Honors course: C E-H-201

..Add Honors course: --

Corresponding Graduate course: --

..Add Graduate course: --

Course Title: STATICS

## Brief Statement of Change:

ENGR 141 will be added as a prerequisite or concurrent enrollment to CE 201, which will give students better exposure to engineering problem solving. We are also changing the corequisite terminology for MTHSC 206 to "concurrent enrollment".

Last Term taught: 1206

..Change Abbrev to:

Effective Term: 01/2013

..Change Number to:

..Change Catalog Title:

..Change Transcript Title:

from:

from: STATICS

to:

to:

.. From: Fixed Credit: 3 (3,0) To: Fixed Credit: (,)

Change of Credit: Variable Credit: - (-), (-) Variable Credit: - (-), (-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| ..Change Method of Instruction | ..Change Course Modifier | ..Change General Education Designation |
|--------------------------------|--------------------------|--|
|--------------------------------|--------------------------|--|

| from:                     | to: | from:              | to: | from:                   | to: |
|---------------------------|-----|--------------------|-----|-------------------------|-----|
| XA-Lecture Only           | ..  | ..Pass/Fail Only   | ..  | ..English Composition   | ..  |
| ..B-Lab (w/fee)           | ..  | XGraded            | ..  | ..Oral Communication    | ..  |
| ..D-Seminar               | ..  | ..Variable Title   | ..  | ..Mathematics           | ..  |
| ..E-Independent Study     | ..  | ..Creative Inquiry | ..  | ..Natural Science w/Lab | ..  |
| ..F-Tutorial (w/fee)      | ..  | ..Repeatable       | ..  | ..Math or Science       | ..  |
| ..G-Studio                | ..  | maximum credits    | ..  | ..A&H (Literature)      | ..  |
| ..H-Field course          | ..  | from:              | ..  | ..A&H (Non-Literature)  | ..  |
| ..I-Study Abroad          | ..  | to:                | ..  | ..Social Science        | ..  |
| ..L-Lab (no/fee)          | ..  |                    |     | ..CCA                   | ..  |
| ..N/B-Lecture/Lab(w/fee)  | ..  |                    |     | ..STS                   | ..  |
| ..N/L-Lecture/Lab(no fee) | ..  |                    |     |                         |     |

..Change Catalog Description:

from:

to:

XChange Prerequisite(s):

from: Prerequisite: PHYS 122 with C or better; Coreq - MTHSC 206.

to: Prerequisite: PHYS 122 with C or better; Preq or concurrent enrollment MTHSC 206 and ENGR 141.

Learning Objectives:

Topical Outline:

Evaluation:

Form Originator: KRISTI, Kristin Baker Date Form Created: 11/7/2012

Form Last Updated by: KRISTI, Kristin Baker Date Form Last Updated: 11/7/2012

Form Number: 5621

Approval

|  |          |   |           |
|--|----------|---|-----------|
| Chair, Department Curriculum Committee | Date     | <i>Patricia W. Anderson</i>               | 12/7/2012 |
| Department Chair                       | 11/7/12  | Chair, Undergraduate Curriculum Committee | Date      |
| <i>Thaddeus A. ...</i>                 | 11/7/12  | Chair, Graduate Curriculum Committee      | Date      |
| Chair, College Curriculum Committee    | 11/7/12  | Provost                                   | 2/3/13    |
| College Dean                           | 11/19/12 | <i>David R. Helms</i> for                 | 2/3/13    |
| <i>Deborah Shier</i>                   | 11/19/12 | President                                 | Date      |
| Director, Calhoun Honors College       | Date     | <i>David S. ...</i>                       |           |



## Curriculum and Course Change System - Print Change/Delete Course Form

000082

**XChange a Course - Abbrev & Number: C E- 206**

Corresponding Lab Course: C E-L-206

Corresponding Honors course: --

..Add Honors course: --

Corresponding Graduate course: --

..Add Graduate course: --

**Course Title: STRUCTURAL MECHANICS****Brief Statement of Change:**

Adding a prerequisite of ENGR 141 to ensure the students have exposure to engineering problem solving; it will also be useful for MATLAB experience in CE 206 Lab. MTHSC 206 will be added as a prereq. Course currently has no math prereq, however multivariable calculus is needed.

Last Term taught: 1206

..Change Abbrev to:

Effective Term: 01/2013

..Change Number to:

..Change Catalog Title:

..Change Transcript Title:

from:

from: STRUCTURAL MECHANICS

to:

to:

.. From: Fixed Credit: 4 (3,3) To: Fixed Credit: (,)

Change of Credit Variable Credit: - (-), (-) Variable Credit: - (-),(-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| ..Change Method of Instruction | ..Change Course Modifier | ..Change General Education Designation |
|--------------------------------|--------------------------|--|
| from:                          | to:                      | from: to:                              |
| ..A-Lecture Only               | ..Pass/Fail Only         | ..English Composition                  |
| ..B-Lab (w/fee)                | ..XGraded                | ..Oral Communication                   |
| ..D-Seminar                    | ..Variable Title         | ..Mathematics                          |
| ..E-Independent Study          | ..Creative Inquiry       | ..Natural Science w/Lab                |
| ..F-Tutorial (w/fee)           | ..Repeatable             | ..Math or Science                      |
| ..G-Studio                     | ..maximum credits        | ..A&H (Literature)                     |
| ..H-Field course               | from:                    | ..A&H (Non-Literature)                 |
| ..I-Study Abroad               | to:                      | ..Social Science                       |
| ..L-Lab (no/fee)               |                          | ..CCA                                  |
| XN/B-Lecture/Lab(w/fee)        |                          | ..STS                                  |
| ..N/L-Lecture/Lab(no fee)      |                          |  |

from:

to:

from:

to:

..A-Lecture Only

..

..Pass/Fail Only

..

..English Composition

..

..B-Lab (w/fee)

..

..XGraded

..

..Oral Communication

..

..D-Seminar

..

..Variable Title

..

..Mathematics

..

..E-Independent Study

..

..Creative Inquiry

..

..Natural Science w/Lab

..

..F-Tutorial (w/fee)

..

..Repeatable

..

..Math or Science

..

..G-Studio

..

..maximum credits

..

..A&amp;H (Literature)

..

..H-Field course

..

from:

..

..A&amp;H (Non-Literature)

..

..I-Study Abroad

..

to:

..

..Social Science

..

..L-Lab (no/fee)

..

..CCA

..

XN/B-Lecture/Lab(w/fee)

..

..STS

..

..N/L-Lecture/Lab(no fee)

..

..Change Catalog Description:

from:

to:

**XChange Prerequisite(s):**

from: Prereq: CE 201.

to: Prereq: CE 201, MTHSC 206, and ENGR 141.

**Learning Objectives:****Topical Outline:****Evaluation:****Form Originator:**KRISTI, Kristin Baker**Date Form Created:** 11/7/2012**Form Last Updated by:**KRISTI, Kristin Baker**Date Form Last Updated:** 11/7/2012**Form Number:** 5623**Approval**

|   |      |                              |           |
|---|------|------------------------------|-----------|
| Chair, Department Curriculum Committee    | Date | <i>Christine W. Anderson</i> | 12/7/2012 |
| Chair, Undergraduate Curriculum Committee | Date |                              |           |
| Department Chair                          | Date |                              |           |
| Chair, Graduate Curriculum Committee      | Date |                              |           |
| Chair, College Curriculum Committee       | Date | <i>David R. Helms</i>        | 2/3/13    |
| Provost                                   | Date |                              |           |
| College Dean                              | Date | <i>David R. Helms for</i>    | 2/3/13    |
| President                                 | Date | <i>John O. Holt</i>          |           |
| Director, Calhoun Honors College          | Date |                              |           |



## Curriculum and Course Change System - Print Change/Delete Course Form

000083

## XChange a Course - Abbrev &amp; Number: C E- 208

Corresponding Lab Course: --

Corresponding Honors course: --

..Add Honors course: --

Corresponding Graduate course: --

..Add Graduate course: --

Course Title: DYNAMICS

## Brief Statement of Change:

We are adding ENGR 141 as a prerequisite to ensure the students have exposure to engineering problem solving skills. We are also removing PHYS 122 as a prerequisite because it is already a prereq for a previous course. MTHSC 206 is being changed from a corequisite to a prerequisite.

Last Term taught: 1205

..Change Abbrev to:

Effective Term: 01/2013

..Change Number to:

..Change Catalog Title:

..Change Transcript Title:

from:

from: DYNAMICS

to:

to:

.. From: Fixed Credit: 2 (2,) To: Fixed Credit: (,)

Change of Credit Variable Credit: - (-), (-) Variable Credit: - (-), (-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| ..Change Method of Instruction | ..Change Course Modifier | ..Change General Education Designation |
|--------------------------------|--------------------------|--|
| from:                          | to:                      | from: to:                              |
| XA-Lecture Only                | .. Pass/Fail Only        | .. English Composition                 |
| ..B-Lab (w/fee)                | .. XGraded               | .. Oral Communication                  |
| ..D-Seminar                    | .. Variable Title        | .. Mathematics                         |
| ..E-Independent Study          | .. Creative Inquiry      | .. Natural Science w/Lab               |
| ..F-Tutorial (w/fee)           | .. Repeatable            | .. Math or Science                     |
| ..G-Studio                     | .. maximum credits       | .. A&H (Literature)                    |
| ..H-Field course               | from:                    | .. A&H (Non-Literature)                |
| ..I-Study Abroad               | to:                      | .. Social Science                      |
| ..L-Lab (no/fee)               |                          | .. CCA                                 |
| ..N/B-Lecture/Lab(w/fee)       |                          | .. STS                                 |
| ..N/L-Lecture/Lab(no fee)      |                          |  |

..Change Catalog Description:

from:

to:

XChange Prerequisite(s):

from: Prereq: CE 201 and PHYS 122 with C or better. Coreq: MTHSC 206.

to: Prereq: CE 201 and MTHSC 206. both with C or better

Learning Objectives:

Topical Outline:

Evaluation:

Form Originator: KRISTI, Kristin Baker Date Form Created: 11/7/2012

Form Last Updated by: , Date Form Last Updated: 11/14/2012

Form Number: 5622

Approval

|                                  |          |   |      |
|----------------------------------|----------|---|------|
|                                  | Date     | Chair, Undergraduate Curriculum Committee | Date |
|                                  | 11/14/12 |   |      |
|                                  | Date     | Chair, Graduate Curriculum Committee      | Date |
|                                  | 11/14/12 |   |      |
|                                  | Date     | Provost                                   | Date |
|                                  | 11/19/12 |   |      |
|                                  | Date     | President                                 | Date |
|                                  | 11/19/12 |   |      |
| Director, Calhoun Honors College | Date     |   |      |



000084

## Curriculum and Course Change System - Print Change/Delete Course Form

**XChange a Course - Abbrev & Number: C E- 321**

Corresponding Lab Course: C E-L-321

Corresponding Honors course: --

..Add Honors course: --

Corresponding Graduate course: --

..Add Graduate course: --

**Course Title: GEOTECHNICAL ENGR****Brief Statement of Change:**

Last month, we submitted the following change: Recently, the faculty voted to replace ENGR 130 with ENGR 141. ENGR 130 is a prerequisite for CE 321. We are changing the prerequisite to include ENGR 141. We have since added ENGR 141 as a prereq for CE 206, which is a prereq for CE 321. We are also adding GEOL 101/103 as a prereq because the Geotech faculty said it would be useful.

Last Term taught:1206

..Change Abbrev to:

Effective Term:01/2013

..Change Number to:

..Change Catalog Title:

..Change Transcript Title:

from:

from: GEOTECHNICAL ENGR

to:

to:

.. From: Fixed Credit: 4 (3,3) To: Fixed Credit: (,)

Change of Credit Variable Credit: - (-), (-) Variable Credit: - (-),(-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

..Change Method of Instruction

..Change Course Modifier

..Change General Education Designation

from:

to:

from:

to:

from:

to:

..A-Lecture Only

..

..Pass/Fail Only

..

..English Composition

..

..B-Lab (w/fee)

..

..XGraded

..

..Oral Communication

..

..D-Seminar

..

..Variable Title

..

..Mathematics

..

..E-Independent Study

..

..Creative Inquiry

..

..Natural Science w/Lab

..

..F-Tutorial (w/fee)

..

..Repeatable

..

..Math or Science

..

..G-Studio

..

..maximum credits

..

..A&amp;H (Literature)

..

..H-Field course

..

from:

..A&amp;H (Non-Literature)

..

..I-Study Abroad

..

to:

..Social Science

..

..L-Lab (no/fee)

..

..CCA

..

XN/B-Lecture/Lab(w/fee)

..

..STS

..

..N/L-Lecture/Lab(no fee)

..

..Change Catalog Description:

from:

to:

**XChange Prerequisite(s):**

from: Prerequisite: CE 206 and ENGR 141 (changed from 130 in 10/12)

to: Prerequisite: CE 206 and GEOL 101/103.

**Learning Objectives:****Topical Outline:****Evaluation:****Form Originator:**KRISTI, Kristin Baker**Date Form Created:** 11/7/2012**Form Last Updated by:** KRISTI, Kristin Baker**Date Form Last Updated:** 11/7/2012**Form Number:** 5624**Approval**

Chair, Department Curriculum Committee

Date

Chair, Undergraduate Curriculum Committee

Date

Department Chair

Date

Chair, Graduate Curriculum Committee

Date

Chair, College Curriculum Committee

Date

Provost

Date

College Dean

Date

President

Date

Director, Calhoun Honors College

Date



000085

## Curriculum and Course Change System - Print Change/Delete Course Form

**XChange a Course - Abbrev & Number: C E- 404**

Corresponding Lab Course: --

Corresponding Honors course: --

..Add Honors course: --

Corresponding Graduate course: C E- -604

..Add Graduate course: --

**Course Title: MASONRY STRUCT DES****Brief Statement of Change:**

Change course prerequisite to remove CE 402 and add CE 301. CE 404 will be offered as a stand-alone course by covering some of the topics common to CE 402. This will allow a higher number of students to enroll in the class.

Last Term taught: 1105

..Change Abbrev to:

Effective Term: 01/2013

..Change Number to:

..Change Catalog Title:

..Change Transcript Title:

from:

from: MASONRY STRUCT DES

to:

to:

.. From: Fixed Credit: 3 (3,) To: Fixed Credit: (,)

Change of Credit: Variable Credit: - (-), (-) Variable Credit: - (-), (-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| ..Change Method of Instruction | ..Change Course Modifier | ..Change General Education Designation |
|--------------------------------|--------------------------|--|
| from: to:                      | from: to:                | from: to:                              |
| XA-Lecture Only                | ..Pass/Fail Only         | ..English Composition                  |
| ..B-Lab (w/fee)                | ..XGraded                | ..Oral Communication                   |
| ..D-Seminar                    | ..Variable Title         | ..Mathematics                          |
| ..E-Independent Study          | ..Creative Inquiry       | ..Natural Science w/Lab                |
| ..F-Tutorial (w/fee)           | ..Repeatable             | ..Math or Science                      |
| ..G-Studio                     | ..maximum credits        | ..A&H (Literature)                     |
| ..H-Field course               | from:                    | ..A&H (Non-Literature)                 |
| ..I-Study Abroad               | to:                      | ..Social Science                       |
| ..L-Lab (no/fee)               |                          | ..CCA                                  |
| ..N/B-Lecture/Lab(w/fee)       |                          | ..STS                                  |
| ..N/L-Lecture/Lab(no fee)      |                          |  |

..Change Catalog Description:

from:

to:

XChange Prerequisite(s):

from: Prereq: CE 402 or consent of instructor.

to: CE 404: Prereq - CE 301. CE 604: Prereq - CE 301 or consent of instructor.

Learning Objectives:

Topical Outline:

Evaluation:

Form Originator: KRISTI, Kristin Baker Date Form Created: 11/7/2012

Form Last Updated by: , Date Form Last Updated: 11/8/2012

Form Number: 5618

**Approval**

|   |      |                             |           |
|---|------|-----------------------------|-----------|
| Chair, Department Curriculum Committee    | Date | <i>Cristina W. Anderson</i> | 12/7/2012 |
| Chair, Undergraduate Curriculum Committee | Date |                             |           |
| Department Chair                          | Date |                             |           |
| Chair, College Curriculum Committee       | Date | <i>David R. Helms</i>       | 2/3/13    |
| Provost                                   | Date | <i>David R. Helms for</i>   | 2/3/13    |
| College Dean                              | Date | <i>David J. Helms</i>       |           |
| Director, Calhoun Honors College          | Date |                             |           |



000086

## Curriculum and Course Change System - Print Change/Delete Course Form

XChange a Course - Abbrev &amp; Number: C E- 407

Corresponding Lab Course: --

Corresponding Honors course: --

..Add Honors course: --

Corresponding Graduate course: C E- -607

..Add Graduate course: --

Course Title: WOOD DESIGN

## Brief Statement of Change:

Change course prerequisite to remove CE 402 or CE 406, and add CE 301. CE 407 is a stand-alone class. This change will allow more students to enroll in the course.

Last Term taught: 1201

..Change Abbrev to:

Effective Term: 01/2013

..Change Number to:

..Change Catalog Title:

..Change Transcript Title:

from:

from: WOOD DESIGN

to:

to:

.. From: Fixed Credit: 3 (3,) To: Fixed Credit: (,)

Change of Credit: Variable Credit: - (-), (-) Variable Credit: - (-), (-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

..Change Method of Instruction

..Change Course Modifier

..Change General Education Designation

from:

to:

from:

to:

from:

to:

XA-Lecture Only

..Pass/Fail Only

..English Composition

..B-Lab (w/fee)

..XGraded

..Oral Communication

..D-Seminar

..Variable Title

..Mathematics

..E-Independent Study

..Creative Inquiry

..Natural Science w/Lab

..F-Tutorial (w/fee)

..Repeatable

..Math or Science

..G-Studio

..maximum credits

..A&amp;H (Literature)

..H-Field course

from:

..A&amp;H (Non-Literature)

..I-Study Abroad

to:

..Social Science

..L-Lab (no/fee)

..

..CCA

..N/B-Lecture/Lab(w/fee)

..

..STS

..N/L-Lecture/Lab(no fee)

..

..Change Catalog Description:

from:

to:

XChange Prerequisite(s):

from: Prereq: CE 402 or CE 406, or consent of Instructor

to: CE 407: Prereq - CE 301. CE 607: Prereq - CE 301 or consent of Instructor.

Learning Objectives:

Topical Outline:

Evaluation:

Form Originator: KRISTI, Kristin Baker Date Form Created: 11/7/2012

Form Last Updated by: , Date Form Last Updated: 11/8/2012

Form Number: 5619

Approval

|  |           |   |           |
|--|-----------|---|-----------|
|  | Date      |   | Date      |
| Chair, Department Curriculum Committee | 11/7/12   | Chair, Undergraduate Curriculum Committee | 12/7/2012 |
|  | Date      |   | Date      |
| Department Chair                       | 11/8/2012 | Chair, Graduate Curriculum Committee      | 2/3/13    |
|  | Date      |   | Date      |
| Chair, College Curriculum Committee    | 11/19/12  | Provost                                   | 2/3/13    |
|  | Date      |   | Date      |
| College Dean                           | 11/19/12  | President                                 |           |
|  | Date      |   |           |
| Director, Calhoun Honors College       |           |   |           |





## Curriculum and Course Change System - Print Change/Delete Course Form

000057

## XChange a Course - Abbrev &amp; Number: C E- 408

Corresponding Lab Course: --

Corresponding Honors course: --

..Add Honors course: --

Corresponding Graduate course: C E- -608

..Add Graduate course: --

Course Title: STRUCT LOADS &amp; SYS

## Brief Statement of Change:

Remove CE 321 as a prerequisite; it was added by mistake.

Last Term taught: 1206

..Change Abbrev to:

Effective Term: 01/2013

..Change Number to:

..Change Catalog Title: ..Change Transcript Title:

from:

from: STRUCT LOADS &amp; SYS

to:

to:

.. From: Fixed Credit: 3 (3,) To: Fixed Credit: (,)

Change of Credit: Variable Credit: - (-), (-) Variable Credit: - (-), (-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| ..Change Method of Instruction | ..Change Course Modifier | ..Change General Education Designation |
|--------------------------------|--------------------------|--|
| from:                          | to:                      | from: to:                              |

|                           |    |                    |    |                         |    |
|---------------------------|----|--------------------|----|-------------------------|----|
| XA-Lecture Only           | .. | ..Pass/Fail Only   | .. | ..English Composition   | .. |
| ..B-Lab (w/fee)           | .. | ..XGraded          | .. | ..Oral Communication    | .. |
| ..D-Seminar               | .. | ..Variable Title   | .. | ..Mathematics           | .. |
| ..E-Independent Study     | .. | ..Creative Inquiry | .. | ..Natural Science w/Lab | .. |
| ..F-Tutorial (w/fee)      | .. | ..Repeatable       | .. | ..Math or Science       | .. |
| ..G-Studio                | .. | maximum credits    | .. | ..A&H (Literature)      | .. |
| ..H-Field course          | .. | from:              | .. | ..A&H (Non-Literature)  | .. |
| ..I-Study Abroad          | .. | to:                | .. | ..Social Science        | .. |
| ..L-Lab (no/fee)          | .. |                    | .. | ..CCA                   | .. |
| ..N/B-Lecture/Lab(w/fee)  | .. |                    | .. | ..STS                   | .. |
| ..N/L-Lecture/Lab(no fee) | .. |                    | .. |                         | .. |

..Change Catalog Description:

from:

to:

XChange Prerequisite(s):

from: Prereq: CE 321 and CE 301, or consent of instructor.

to: CE 408 Prereq - CE 301 CE 608: Prereq - CE 301 or consent of instructor.

Learning Objectives:

Topical Outline:

Evaluation:

Form Originator: KRISTI, Kristin Baker Date Form Created: 11/7/2012

Form Last Updated by: , Date Form Last Updated: 11/8/2012

Form Number: 5625

Approval

|  |          |   |           |
|--|----------|---|-----------|
| Chair, Department Curriculum Committee | Date     | <i>Patricia W. Anderson</i>               | 12/7/2012 |
| <i>[Signature]</i>                     | 11/7/12  | Chair, Undergraduate Curriculum Committee | Date      |
| Department Chair                       | Date     | Chair, Graduate Curriculum Committee      | Date      |
| <i>[Signature]</i>                     | 11/8/12  | <i>[Signature]</i>                        | 2/3/13    |
| Chair, College Curriculum Committee    | Date     | Provost                                   | Date      |
| <i>[Signature]</i>                     | 11/19/12 | <i>[Signature]</i> for                    | 2/3/13    |
| College Dean                           | Date     | President                                 | Date      |
| <i>[Signature]</i>                     | 11/19/12 | <i>[Signature]</i>                        |           |
| Director, Calhoun Honors College       | Date     |   |           |

### General Engineering Catalog Changes – November 2012

With the elimination of ENGR 130 from the curriculum, General Engineering would like to propose to change the catalog [current 2012 – 2013 page 87] to the following:

#### **Freshman Curriculum**

##### **First Semester**

- 2 - ~~ENGR 102~~ Engineering Disciplines and Skills
  - 4 - CH 101 General Chemistry
  - 3 - ENGL 103 Accelerated Composition
  - 4 - MTHSC 106 Calculus of One Variable I
  - 3 - General Education Requirement<sup>1</sup>
- 16

##### **Second Semester**

- 4 - MTHSC 108 Calculus of One Variable II
  - 3 - PHYS 122 Physics with Calculus I
  - 3 - ~~ENGR 141~~ Programming and Problem Solving<sup>2</sup>
  - 3-4 - Departmental Science Requirement<sup>3</sup>
  - 3 - General Education Requirement<sup>1</sup>
- 16-17

<sup>1</sup>See Policy on General Education Requirements for Engineering Curricula below.

<sup>2</sup>See advisor for Chemical Engineering Requirement

#### **Admission into Engineering Degree Programs**

To transfer into an engineering degree program, a student must have completed the following courses in the freshman engineering curriculum with a grade of C or better:

- 2 - ENGR 102 Engineering Disciplines and Skills
- 4 - CH 101 General Chemistry
- 3 - ENGL 103 Accelerated Composition
- 4 - MTHSC 106 Calculus of One Variable I
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - PHYS 122 Physics with Calculus I
- 3 - ~~ENGR 141~~ Programming and Problem Solving<sup>2</sup>

<sup>2</sup>For Chemical Engineering, CHE 130 is required.

E. Stuber

11/19/12

Charles Ben, 12/19/12



## Curriculum and Course Change System - Print Change/Delete Course Form

000089

**X Change a Course - Abbrev & Number: ENGR- 141**

Corresponding Lab Course: ENGR-L-141

Corresponding Honors course: ENGR-H-141

.. **Add Honors course:** --

Corresponding Graduate course: --

.. **Add Graduate course:** --**Course Title: PROG/PROB SOLV****Brief Statement of Change:**

Currently students are not allowed to change to any ENGR major without a grade of C or better in CES 102. This change will prevent enrollment in ENGR 141 without a grade of C in CES 102.

Last Term taught: 1206

.. **Change Abbrev to:**

Effective Term: 01/2013

.. **Change Number to:**.. **Change Catalog Title:**.. **Change Transcript Title:**

from:

from: PROG/PROB SOLV

to:

to:

.. From: Fixed Credit: 3 (2,2) To: Fixed Credit: (,)

.. **Change of Credit** Variable Credit: - (-), (-) Variable Credit: - (-),(-).. **Add cross-listing with the following child course(s):**.. **Delete cross-listing with the following child course(s):**.. **Reverse Parent/Child relationship with:****.. Change Method of Instruction****.. Change Course Modifier****.. Change General Education Designation**

from:

to:

.. A-Lecture Only

.. Pass/Fail Only

.. B-Lab (w/fee)

.. X Graded

.. D-Seminar

.. Variable Title

.. E-Independent Study

.. Creative Inquiry

.. F-Tutorial (w/fee)

.. Repeatable

.. G-Studio

.. maximum credits

.. H-Field course

.. from:

.. I-Study Abroad

.. to:

.. L-Lab (no/fee)

X N/B-Lecture/Lab(w/fee)

.. N/L-Lecture/Lab(no fee)

.. **Change Catalog Description:**

from:

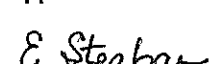

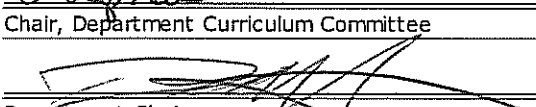

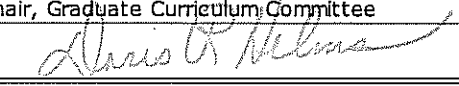
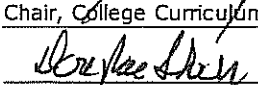
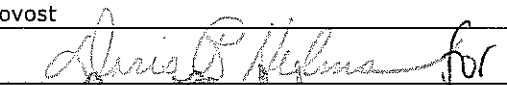
to:

**X Change Prerequisite(s):**

from: Prereq: CES 102; Coreq: MTHSC 106 or 107.Honors Coreq: MTHSC 108

to: Prereq: CES 102 with a C or better; Prereq or concurrent enrollment: MTHSC 106 or 107.Honors: Membership in Calhoun Honors College; Prereq or concurrent enrollment: MTHSC 108

**Learning Objectives:****Topical Outline:****Evaluation:****Form Originator:** BETHSTE, Elizabeth Stephan **Date Form Created:** 11/7/2012**Form Last Updated by:** BETHSTE, Elizabeth Stephan **Date Form Last Updated:** 11/7/2012**Form Number:** 5620**Approval**

|  |          |  |           |
|--|----------|--|-----------|
|  | 11/7/12  |  | 12/7/2012 |
| Chair, Department Curriculum Committee   | Date     | Chair, Undergraduate Curriculum Committee  | Date      |
|  |          |  |           |
| Department Chair   | Date     | Chair, Graduate Curriculum Committee   | Date      |
|  | 11/19/12 |  | 2/3/13    |
| Chair, College Curriculum Committee  | Date     | Provost  | Date      |
|  | 11/19/12 |  | 2/3/13    |
| College Dean   | Date     | President  | Date      |



## Curriculum and Course Change System - Print Change/Delete Course Form

000099

**X Change a Course - Abbrev & Number: EE&S- 201**

Corresponding Lab Course: --

Corresponding Honors course: --

.. Add Honors course: --

Corresponding Graduate course: --

.. Add Graduate course: --

**Course Title: ENVIRON ENG FUND I****Brief Statement of Change:**

We are including prerequisites or CES (ENGR) 102 with a grade of C or better and a concurrent prerequisite of (ENGR 130, ENGR 141, or CHE 130) to select students making sufficient progress in General Engineering.

Last Term taught: 1108

Effective Term: 08/2013

.. Change Abbrev to:

.. Change Number to:

.. Change Catalog Title:

from:

to:

.. Change Transcript Title:

from: ENVIRON ENG FUND I

to:

.. Change of Credit From: Fixed Credit: 3 (3,) To: Fixed Credit: (,) Variable Credit: - (-), (-) Variable Credit: - (-), (-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| .. Change Method of Instruction | .. Change Course Modifier | .. Change General Education Designation |
|---------------------------------|---------------------------|---|
| from: to:                       | from: to:                 | from: to:                               |
| X A-Lecture Only                | .. Pass/Fail Only         | English                                 |
| .. B-Lab (w/fee)                | X Graded                  | .. Composition                          |
| .. D-Seminar                    | .. Variable Title         | Oral                                    |
| E-Independent                   | .. Creative Inquiry       | .. Communication                        |
| .. Study                        | .. Repeatable             | .. Mathematics                          |
| .. F-Tutorial (w/fee)           | maximum credits           | Natural Science                         |
| .. G-Studio                     | from:                     | .. w/Lab                                |
| .. H-Field course               | to:                       | .. Math or Science                      |
| .. I-Study Abroad               |                           | .. A&H (Literature)                     |
| .. L-Lab (no/fee)               |                           | A&H (Non-                               |
| N/B-Lecture/Lab                 |                           | .. Literature)                          |
| .. (w/fee)                      |                           | .. Social Science                       |
| N/L-Lecture/Lab(no              |                           | ..CCA                                   |
| fee)                            |                           | .. STS                                  |

**.. Change Catalog Description:**

from:

to:

**X Change Prerequisite(s):**

from: MTHSC 108; CH 101

to: MTHSC 108; CH 101; ENGR (CES) 102 with a grade of C or better; *Concurrent or prereq* ~~Corequisite:~~ (ENGR 130, ENGR 141, or CHE 130)**Learning Objectives:****Topical Outline:****Evaluation:****Form Originator:** TJVRC, Thomas Overcamp **Date Form Created:** 10/29/2012**Form Last Updated by:** TJVRC, Thomas Overcamp **Date Form Last Updated:** 10/31/2012**Form Number:** 5575**Approval**

|  |            |   |           |
|--|------------|---|-----------|
| <i>Thomas J. Overcamp</i>              | 5 Nov 2012 | <i>Carrie W. Mendenhall</i>               | 12/7/2012 |
| Chair, Department Curriculum Committee | Date       | Chair, Undergraduate Curriculum Committee | Date      |
| <i>RW Fatta</i>                        | 11/6/12    |   |           |
| Department Chair                       | Date       | Chair, Graduate Curriculum Committee      | Date      |
| <i>[Signature]</i>                     | 11/19/12   | <i>David R. Nelson</i>                    | 2/3/13    |
| Chair, College Curriculum Committee    | Date       | Provost                                   | Date      |
| <i>Walter Blair</i>                    | 11/19/12   | <i>David R. Nelson for</i>                | 2/3/13    |
| College Dean                           | Date       | President                                 | Date      |
|  |            | <i>[Signature]</i>                        |           |
| Director, Calhoun Honors College       | Date       |   |           |

000091

CLEMSON  
UNIVERSITY

## Curriculum and Course Change System - Print Change/Delete Course Form

## X Change a Course - Abbrev &amp; Number: EE&amp;S- 202

Corresponding Lab Course: EE&amp;S-L-202

Corresponding Honors course: --

.. Add Honors course: --

Corresponding Graduate course: --

.. Add Graduate course: --

Course Title: ENVIRON ENG FUND II

## Brief Statement of Change:

We are including a prerequisite of (ENGR 130, ENGR 141, or CHE 130) with a grade of C or better to select students making sufficient progress in General Engineering.

Last Term taught: 1201

Effective Term: 08/2013

.. Change Abbrev to:

.. Change Number to:

.. Change Catalog Title:

from:

to:

.. Change Transcript Title:

from: ENVIRON ENG FUND II

to:

.. Change of Credit: From: Fixed Credit: 4 (3,3) To: Fixed Credit: (,) Variable Credit: - (-), (-) Variable Credit: - (-), (-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| .. Change Method of Instruction |     | .. Change Course Modifier |     | .. Change General Education Designation |     |
|---------------------------------|-----|---------------------------|-----|---|-----|
| from:                           | to: | from:                     | to: | from:                                   | to: |
| .. A-Lecture Only               | ..  | .. Pass/Fail Only         | ..  | .. English                              | ..  |
| .. B-Lab (w/fee)                | ..  | .. X Graded               | ..  | .. Composition                          | ..  |
| .. D-Seminar                    | ..  | .. Variable Title         | ..  | .. Oral                                 | ..  |
| .. E-Independent                | ..  | .. Creative Inquiry       | ..  | .. Communication                        | ..  |
| .. Study                        | ..  | .. Repeatable             | ..  | .. Mathematics                          | ..  |
| .. F-Tutorial (w/fee)           | ..  | .. maximum credits        | ..  | .. Natural Science                      | ..  |
| .. G-Studio                     | ..  | from:                     | ..  | .. w/Lab                                | ..  |
| .. H-Field course               | ..  | to:                       | ..  | .. Math or Science                      | ..  |
| .. I-Study Abroad               | ..  |                           | ..  | .. A&H (Literature)                     | ..  |
| .. L-Lab (no/fee)               | ..  |                           | ..  | .. A&H (Non-                            | ..  |
| .. N/B-Lecture/Lab              | ..  |                           | ..  | .. Literature)                          | ..  |
| X (w/fee)                       | ..  |                           | ..  | .. Social Science                       | ..  |
| .. N/L-Lecture/Lab(no           | ..  |                           | ..  | .. CCA                                  | ..  |
| .. fee)                         | ..  |                           | ..  | .. STS                                  | ..  |

## .. Change Catalog Description:

from:

to:

## X Change Prerequisite(s):

from: EE&amp;S 201; CH 102;

to: EE&amp;S 201; CH 102; (ENGR 130, ENGR 141, or CHE 130) with a grade of C or better

## Learning Objectives:

## Topical Outline:


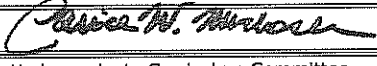
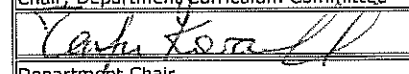
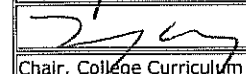
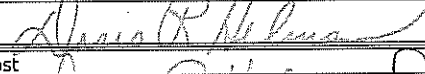
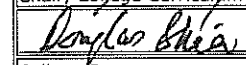

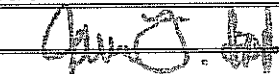
## Evaluation:

Form Originator: TJVRC, Thomas Overcamp Date Form Created: 10/29/2012

Form Last Updated by: , Date Form Last Updated: 10/31/2012

Form Number: 5576

## Approval

|   |           |  |           |
|---|-----------|--|-----------|
|  | 11/2/2012 |  | 12/7/2012 |
| Chair, Department Curriculum Committee  | Date      | Chair, Undergraduate Curriculum Committee  | Date      |
|  | 11/2/12   |  |           |
| Department Chair  | Date      | Chair, Graduate Curriculum Committee   | Date      |
|  | 11/19/12  |  | 2/3/13    |
| Chair, College Curriculum Committee   | Date      | Provost  | Date      |
|  | 11/19/12  |  | 2/3/13    |
| College Dean  | Date      | President  | Date      |
|   |           |  |           |
| Director, Calhoun Honors College  | Date      |  |           |



## Curriculum and Course Change System - Print Change/Delete Course Form

000092

X Change a Course - Abbrev & Number: EE&S- 410  
 Corresponding Lab Course: --  
 Corresponding Honors course: --  
 .. Add Honors course: --  
 Corresponding Graduate course: EE&S- -610  
 .. Add Graduate course: --  
 Course Title: ENV RADIATION PROTEC

## Brief Statement of Change:

We are changing the prerequisite for EE&S 410 from consent of instructor to PHYS 221 with a grade of C or better. We are deleting prerequisites for EE&S 610. This should ensure minimum competency for the course.

Last Term taught: 1108 .. Change Abbrev to:  
 Effective Term: 08/2013 .. Change Number to:  
 .. Change Catalog Title: .. Change Transcript Title:  
 from: from: ENV RADIATION PROTEC  
 to: to:

.. From: Fixed Credit: 3 (3,) To: Fixed Credit: (,) ..  
 Change of Credit: Variable Credit: - (-), (-) Variable Credit: - (-),(-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| .. Change Method of Instruction | .. Change Course Modifier | .. Change General Education Designation |
|---------------------------------|---------------------------|---|
| from: to:                       | from: to:                 | from: to:                               |
| X A-Lecture Only ..             | .. Pass/Fail Only ..      | .. English ..                           |
| .. B-Lab (w/fee) ..             | X Graded ..               | .. Composition ..                       |
| .. D-Seminar ..                 | .. Variable Title ..      | .. Oral ..                              |
| E-Independent ..                | .. Creative Inquiry ..    | .. Communication ..                     |
| .. Study ..                     | .. Repeatable ..          | .. Mathematics ..                       |
| .. F-Tutorial (w/fee) ..        | maximum credits ..        | .. Natural Science ..                   |
| .. G-Studio ..                  | from: ..                  | .. w/Lab ..                             |
| .. H-Field course ..            | to: ..                    | .. Math or Science ..                   |
| .. I-Study Abroad ..            | ..                        | .. A&H (Literature) ..                  |
| .. L-Lab (no/fee) ..            | ..                        | .. A&H (Non- ..                         |
| N/B-Lecture/Lab ..              | ..                        | .. Literature) ..                       |
| .. (w/fee) ..                   | ..                        | .. Social Science ..                    |
| N/L-Lecture/Lab(no ..           | ..                        | .. CCA ..                               |
| .. fee) ..                      | ..                        | .. STS ..                               |

## .. Change Catalog Description:

from:  
to:

## X Change Prerequisite(s):

from: Consent of Instructor.

to: EE&S 410: PHYS 221 with a grade of C or better; EE&S 610: -

## Learning Objectives:

## Topical Outline:

## Evaluation:

Form Originator: TJVRC, Thomas Overcamp Date Form Created: 10/29/2012

Form Last Updated by: TJVRC, Thomas Overcamp Date Form Last Updated: 10/31/2012

Form Number: 5577

## Approval

|  |           |   |           |
|--|-----------|---|-----------|
| Thomas J. Overcamp                     | 11/2/2012 | Patricia W. Mendenhall                    | 12/7/2012 |
| Chair, Department Curriculum Committee | Date      | Chair, Undergraduate Curriculum Committee | Date      |
| Carla Karal                            | 11/2/12   |   |           |
| Department Chair                       | Date      | Chair, Graduate Curriculum Committee      | Date      |
| 255                                    | 11/19/12  | Alvin R. Helms                            | 2/3/13    |
| Chair, College Curriculum Committee    | Date      | Provost                                   | Date      |
| Debra J. Shivers                       | 11/19/12  | Alvin R. Helms for                        | 2/3/13    |
| College Dean                           | Date      | President                                 | Date      |
|  |           | Alvin R. Helms                            |           |
| Director, Calhoun Honors College       | Date      |   |           |



## Curriculum and Course Change System - Print Change/Delete Course Form

000093

X Change a Course - Abbrev &amp; Number: EE&amp;S- 450

Corresponding Lab Course: --

Corresponding Honors course: --

.. Add Honors course: --

Corresponding Graduate course: --

.. Add Graduate course: --

Course Title: PROFESSIONAL SEMINAR

## Brief Statement of Change:

These prerequisite changes are in conjunction with those for EE&S 475. To ensure the students taking EE&S 475 have the prerequisites, we are instituting concurrent prerequisites of EE&S 402, EE&S 403, and EE&S 430.

Last Term taught:

Effective Term: 08/2013

.. Change Abbrev to:

.. Change Number to:

.. Change Catalog Title:

from:

to:

.. Change Transcript Title:

from: PROFESSIONAL SEMINAR

to:

.. Change of Credit: From: Fixed Credit: 1 (1,) To: Fixed Credit: (,) Variable Credit: - (-), (-) Variable Credit: - (-), (-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| .. Change Method of Instruction | .. Change Course Modifier | .. Change General Education Designation |
|---------------------------------|---------------------------|---|
| from: to:                       | from: to:                 | from: to:                               |
| .. A-Lecture Only               | .. X Pass/Fail Only       | .. English                              |
| .. B-Lab (w/fee)                | .. .. Graded              | .. Composition                          |
| X D-Seminar                     | .. .. Variable Title      | .. Oral                                 |
| .. E-Independent                | .. .. Creative Inquiry    | .. Communication                        |
| .. Study                        | .. .. Repeatable          | .. Mathematics                          |
| .. F-Tutorial (w/fee)           | .. maximum credits        | .. Natural Science                      |
| .. G-Studio                     | from:                     | .. w/Lab                                |
| .. H-Field course               | to:                       | .. Math or Science                      |
| .. I-Study Abroad               |                           | .. A&H (Literature)                     |
| .. L-Lab (no/fee)               |                           | .. A&H (Non-                            |
| .. N/B-Lecture/Lab              |                           | .. Literature)                          |
| .. (w/fee)                      |                           | .. Social Science                       |
| .. N/L-Lecture/Lab(no           |                           | .. CCA                                  |
| .. fee)                         |                           | .. STS                                  |

.. Change Catalog Description:

from:

to:

X Change Prerequisite(s):

from: Senior standing

to: Concurrent: EE&amp;S 402, EE&amp;S 403, and EE&amp;S 430

Learning Objectives:

Topical Outline:

Evaluation:

Form Originator: TJVRC, Thomas Overcamp Date Form Created: 10/29/2012

Form Last Updated by: , Date Form Last Updated: 10/31/2012

Form Number: 5578

## Approval

|  |           |   |           |
|--|-----------|---|-----------|
| <i>Thomas Overcamp</i>                 | 11/2/2012 | <i>Cassie W. Mulhose</i>                  | 12/7/2012 |
| Chair, Department Curriculum Committee | Date      | Chair, Undergraduate Curriculum Committee | Date      |
| <i>Yoko Kozall</i>                     | 11/2/12   |   |           |
| Department Chair                       | Date      | Chair, Graduate Curriculum Committee      | Date      |
| <i>[Signature]</i>                     | 11/19/12  | <i>[Signature]</i>                        | 2/3/13    |
| Chair, College Curriculum Committee    | Date      | Provost                                   | Date      |
| <i>[Signature]</i>                     | 11/19/12  | <i>[Signature]</i>                        | 2/3/13    |
| College Dean                           | Date      | President                                 | Date      |
|  |           | <i>[Signature]</i>                        |           |
| Director, Calhoun Honors College       | Date      |   |           |



## Curriculum and Course Change System - Print Change/Delete Course Form

000094

**X Change a Course - Abbrev & Number: EE&S- 475**

Corresponding Lab Course: EE&amp;S-L-475

Corresponding Honors course: --

.. Add Honors course: --

Corresponding Graduate course: --

.. Add Graduate course: --

**Course Title: CAPSTONE DESIGN PROJ****Brief Statement of Change:**

When we initiated our capstone design course, we set senior standing as the prerequisite. Subsequently, we have realized that there are a minimum of courses that need to be taken prior to this course: CE 341, EE&S 402, EE&S 403, and EE&S 430. These courses are essential engineering science and design courses.

Last Term taught:

Effective Term: 08/2013

.. Change Abbrev to:

.. Change Number to:

.. Change Catalog Title:

from:

to:

.. Change Transcript Title:

from: CAPSTONE DESIGN PROJ

to:

.. Change of Credit

From: Fixed Credit: 3 (1,6)

Variable Credit: - (-), (-)

To: Fixed Credit: (,)

Variable Credit: - (-), (-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| .. Change Method of Instruction | .. Change Course Modifier | .. Change General Education Designation |
|---------------------------------|---------------------------|---|
| from: to:                       | from: to:                 | from: to:                               |
| .. A-Lecture Only               | .. Pass/Fail Only         | English                                 |
| .. B-Lab (w/fee)                | .. X Graded               | .. Composition                          |
| .. D-Seminar                    | .. Variable Title         | Oral                                    |
| .. E-Independent                | .. Creative Inquiry       | .. Communication                        |
| .. Study                        | .. Repeatable             | .. Mathematics                          |
| .. F-Tutorial (w/fee)           | .. maximum credits        | .. Natural Science                      |
| .. G-Studio                     | from:                     | .. w/Lab                                |
| .. H-Field course               | to:                       | .. Math or Science                      |
| .. I-Study Abroad               |                           | .. A&H (Literature)                     |
| .. L-Lab (no/fee)               |                           | .. A&H (Non-                            |
| .. N/B-Lecture/Lab              |                           | .. Literature)                          |
| X (w/fee)                       |                           | .. Social Science                       |
| .. N/L-Lecture/Lab(no           |                           | .. CCA                                  |
| .. fee)                         |                           | .. STS                                  |

**.. Change Catalog Description:**

from:

to:

**X Change Prerequisite(s):**

from: Senior standing

to: CE 341, EE&amp;S 402, EE&amp;S 403, and EE&amp;S 430

**Learning Objectives:****Topical Outline:****Evaluation:****Form Originator:** TJVRC, Thomas Overcamp **Date Form Created:** 10/29/2012**Form Last Updated by:** , **Date Form Last Updated:** 10/31/2012**Form Number:** 5579**Approval**

|  |          |   |           |
|--|----------|---|-----------|
| <i>Thomas Overcamp</i>                 | 11/2/12  | <i>Carissa W. Murrell</i>                 | 12/7/2012 |
| Chair, Department Curriculum Committee | Date     | Chair, Undergraduate Curriculum Committee | Date      |
| <i>Carla Kervell</i>                   | 11/2/12  |   |           |
| Department Chair                       | Date     | Chair, Graduate Curriculum Committee      | Date      |
| <i>[Signature]</i>                     | 11/5/12  | <i>David R. Helms</i>                     | 2/3/13    |
| Chair, College Curriculum Committee    | Date     | Provost                                   | Date      |
| <i>Doreen Allen</i>                    | 11/19/12 | <i>[Signature] for</i>                    | 2/5/13    |



|                                  |      |           |      |
|----------------------------------|------|-----------|------|
| College Dean                     | Date | President | Date |
|                                  |      |           |      |
| Director, Calhoun Honors College | Date |           |      |

000095



## Curriculum and Course Change System - Print Change/Delete Course Form

000096

X Change a Course - Abbrev & Number: EE&S- 480  
 Corresponding Lab Course: --  
 Corresponding Honors course: --  
 .. Add Honors course: --  
 Corresponding Graduate course: EE&S- -680  
 .. Add Graduate course: --  
 Course Title: ENV RISK ASSESSMENT

## Brief Statement of Change:

In teaching the course for the first time at the undergraduate level, two students who did not have MTHSC 208 dropped the class. We have learned that we need this level of mathematics competency. We deleted the prerequisites on the graduate-level class

Last Term taught: .. Change Abbrev to:  
 Effective Term: 08/2013 .. Change Number to:  
 .. Change Catalog Title: .. Change Transcript Title:  
 from: from: ENV RISK ASSESSMENT  
 to: to:

.. Change of Credit From: Fixed Credit: 3 (3,) To: Fixed Credit: (,) Variable Credit: - (-), (-) Variable Credit: - (-),(-)

.. Add cross-listing with the following child course(s):  
 .. Delete cross-listing with the following child course(s):  
 .. Reverse Parent/Child relationship with:

| .. Change Method of Instruction | .. Change Course Modifier | .. Change General Education Designation |
|---------------------------------|---------------------------|---|
| from: to:                       | from: to:                 | from: to:                               |
| X A-Lecture Only                | .. Pass/Fail Only         | .. English                              |
| .. B-Lab (w/fee)                | X Graded                  | .. Composition                          |
| .. D-Seminar                    | .. Variable Title         | .. Oral                                 |
| E-Independent                   | .. Creative Inquiry       | .. Communication                        |
| .. Study                        | .. Repeatable             | .. Mathematics                          |
| .. F-Tutorial (w/fee)           | maximum credits           | .. Natural Science                      |
| .. G-Studio                     | from:                     | .. w/Lab                                |
| .. H-Field course               | to:                       | .. Math or Science                      |
| .. I-Study Abroad               |                           | .. A&H (Literature)                     |
| .. L-Lab (no/fee)               |                           | .. A&H (Non-                            |
| N/B-Lecture/Lab                 |                           | .. Literature)                          |
| .. (w/fee)                      |                           | .. Social Science                       |
| N/L-Lecture/Lab(no              |                           | .. CCA                                  |
| .. fee)                         |                           | .. STS                                  |

## .. Change Catalog Description:

from:  
 to:

## X Change Prerequisite(s):

from: EE&S 202 or EE&S 401;  
 to: EE&S 480: EE&S 202 or EE&S 401; MTHSC 208 with a grade of C or better; EE&S 610: -

## Learning Objectives:

## Topical Outline:

## Evaluation:

Form Originator: TJVRC, Thomas Overcamp Date Form Created: 10/29/2012

Form Last Updated by: TJVRC, Thomas Overcamp Date Form Last Updated: 10/31/2012

Form Number: 5580

## Approval

|  |           |   |           |
|--|-----------|---|-----------|
| <i>Thomas J. Overcamp</i>              | 11/2/2012 | <i>Charles W. Nicholas</i>                | 12/7/2012 |
| Chair, Department Curriculum Committee | Date      | Chair, Undergraduate Curriculum Committee | Date      |
| <i>Taylor Carroll</i>                  | 11/2/12   |   |           |
| Department Chair                       | Date      | Chair, Graduate Curriculum Committee      | Date      |
| <i>[Signature]</i>                     | 11/19/12  | <i>Alvin R. Helms</i>                     | 2/3/13    |
| Chair, College Curriculum Committee    | Date      | Provost                                   | Date      |
| <i>Douglas Stein</i>                   | 11/19/12  | <i>Alvin R. Helms for</i>                 | 2/3/13    |
| College Dean                           | Date      | President                                 | Date      |
|  |           | <i>[Signature]</i>                        |           |
| Director, Calhoun Honors College       | Date      |   |           |

CLEMSON  
UNIVERSITY

## Curriculum and Course Change System - Print Change/Delete Course Form

000097

X Change a Course - Abbrev &amp; Number: EE&amp;S- 485

Corresponding Lab Course: --

Corresponding Honors course: --

.. Add Honors course: --

Corresponding Graduate course: EE&amp;S- -685

.. Add Graduate course: --

Course Title: HAZARD WASTE MGT

## Brief Statement of Change:

We are changing the prerequisites to include one semester of organic chemistry, (CH 201 or CH 223). Knowledge of organic chemistry is essential knowledge for this course. We are dropping prerequisites for EE&S 685.

Last Term taught: 1201

Effective Term: 08/2013

.. Change Abbrev to:

.. Change Number to:

.. Change Catalog Title:

from:

to:

.. Change Transcript Title:

from: HAZARD WASTE MGT

to:

.. Change of Credit From: Fixed Credit: 3 (3,) To: Fixed Credit: (,) Variable Credit: - (-), (-) Variable Credit: - (-),(-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| .. Change Method of Instruction | .. Change Course Modifier | .. Change General Education Designation |
|---------------------------------|---------------------------|---|
| from: to:                       | from: to:                 | from: to:                               |
| X A-Lecture Only                | .. Pass/Fail Only         | .. English                              |
| .. B-Lab (w/fee)                | X Graded                  | .. Composition                          |
| .. D-Seminar                    | .. Variable Title         | .. Oral                                 |
| E-Independent                   | .. Creative Inquiry       | .. Communication                        |
| .. Study                        | .. Repeatable             | .. Mathematics                          |
| .. F-Tutorial (w/fee)           | maximum credits           | .. Natural Science                      |
| .. G-Studio                     | from:                     | .. w/Lab                                |
| .. H-Field course               | to:                       | .. Math or Science                      |
| .. I-Study Abroad               |                           | .. A&H (Literature)                     |
| .. L-Lab (no/fee)               |                           | .. A&H (Non-                            |
| N/B-Lecture/Lab                 |                           | .. Literature)                          |
| .. (w/fee)                      |                           | .. Social Science                       |
| N/L-Lecture/Lab(no              |                           | .. CCA                                  |
| .. fee)                         |                           | .. STS                                  |

## .. Change Catalog Description:

from:

to:

## X Change Prerequisite(s):

from: EE&amp;S 202 or 401 or consent of instructor; one semester of general chemistry.

to: EE&amp;S 485: (EE&amp;S 202 or EE&amp;S 401); (CH 201 or CH 223); EE&amp;S 685: -

## Learning Objectives:

## Topical Outline:

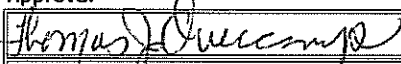
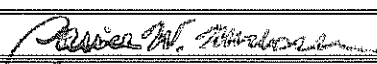



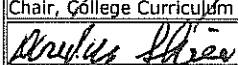


## Evaluation:

Form Originator: TJVRC, Thomas Overcamp Date Form Created: 10/29/2012

Form Last Updated by: TJVRC, Thomas Overcamp Date Form Last Updated: 10/31/2012

Form Number: 5581

## Approval

|   |           |  |           |
|---|-----------|--|-----------|
|  | 11/2/2012 |  | 12/7/2012 |
| Chair, Department Curriculum Committee  | Date      | Chair, Undergraduate Curriculum Committee  | Date      |
|  | 11/2/12   |  |           |
| Department Chair  | Date      | Chair, Graduate Curriculum Committee   | Date      |
|  | 11/19/12  |  | 2/3/13    |
| Chair, College Curriculum Committee   | Date      | Provost  | Date      |
|  | 11/19/12  |  | 2/3/13    |
| College Dean  | Date      | President  | Date      |
|   |           |  |           |
| Director, Calhoun Honors College  | Date      |  |           |



## Curriculum and Course Change System - Print Change/Delete Course Form

000098

**X Change a Course - Abbrev & Number: GEOL- 205**

Corresponding Lab Course: --

Corresponding Honors course: --

.. **Add Honors course:** --

Corresponding Graduate course: --

.. **Add Graduate course:** --**Course Title: MINERAL & INTRO PET****Brief Statement of Change:**

Clarifies that GEOL 205 (lecture) and GEOL 207 (lab) must be taken together at same time; Adds concurrent requirement of CH 101

Last Term taught: 1108

Effective Term: 01/2013

.. **Change Abbrev to:**.. **Change Number to:**.. **Change Catalog Title:**

from:

to:

.. **Change Transcript Title:**

from: MINERAL &amp; INTRO PET

to:

.. **Change of Credit** From: Fixed Credit: 3 (3,) To: Fixed Credit: (,) Variable Credit: - (-), (-) Variable Credit: - (-),(-)

.. **Add cross-listing with the following child course(s):**.. **Delete cross-listing with the following child course(s):**.. **Reverse Parent/Child relationship with:**

| .. <b>Change Method of Instruction</b> |     | .. <b>Change Course Modifier</b> |     | .. <b>Change General Education Designation</b> |     |
|--|-----|----------------------------------|-----|--|-----|
| from:                                  | to: | from:                            | to: | from:  | to: |
| X A-Lecture Only                       | ..  | .. Pass/Fail Only                | ..  | English  | ..  |
| .. B-Lab (w/fee)                       | ..  | X Graded                         | ..  | .. Composition                                 | ..  |
| .. D-Seminar                           | ..  | .. Variable Title                | ..  | Oral   | ..  |
| E-Independent                          | ..  | .. Creative Inquiry              | ..  | .. Communication                               | ..  |
| .. Study                               | ..  | .. Repeatable                    | ..  | .. Mathematics                                 | ..  |
| .. F-Tutorial (w/fee)                  | ..  | maximum credits                  | ..  | Natural Science                                | ..  |
| .. G-Studio                            | ..  | from:                            | ..  | .. w/Lab                                       | ..  |
| .. H-Field course                      | ..  | to:                              | ..  | .. Math or Science                             | ..  |
| .. I-Study Abroad                      | ..  |                                  | ..  | .. A&H (Literature)                            | ..  |
| .. L-Lab (no/fee)                      | ..  |                                  | ..  | A&H (Non-                                      | ..  |
| N/B-Lecture/Lab                        | ..  |                                  | ..  | .. Literature)                                 | ..  |
| .. (w/fee)                             | ..  |                                  | ..  | .. Social Science                              | ..  |
| N/L-Lecture/Lab(no                     | ..  |                                  | ..  | .. CCA   | ..  |
| .. fee)                                | ..  |                                  | ..  | .. STS   | ..  |

.. **Change Catalog Description:**

from:

to:

**X Change Prerequisite(s):**

from: GEOL 101, 103, or consent of instructor

to: GEOL 101 and GEOL 103; Coreq: GEOL 207; Concurrent: CH 101

**Learning Objectives:****Topical Outline:****Evaluation:**

Form Originator: MSCHLAU, Mark Schlautman Date Form Created: 10/27/2012

Form Last Updated by: MSCHLAU, Mark Schlautman Date Form Last Updated: 10/27/2012

Form Number: 5557

**Approval**

|  |          |   |         |
|--|----------|---|---------|
|  | 11/2/12  |   | 12/7/12 |
| Chair, Department Curriculum Committee | Date     | Chair, Undergraduate Curriculum Committee | Date    |
|  | 11/2/12  |   |         |
| Department Chair                       | Date     | Chair, Graduate Curriculum Committee      | Date    |
|  | 11/19/12 |   | 2/13/13 |
| Chair, College Curriculum Committee    | Date     | Provost                                   | Date    |
|  | 11/19/12 |   | 2/13/13 |
| College Dean                           | Date     | President                                 | Date    |
|  |          |   |         |
| Director, Calhoun Honors College       | Date     |   |         |



## Curriculum and Course Change System - Print Change/Delete Course Form

**X Change a Course - Abbrev & Number: GEOL- 313**  
 Corresponding Lab Course: GEOL-L-313  
 Corresponding Honors course: --  
 .. Add Honors course: --  
 Corresponding Graduate course: --  
 .. Add Graduate course: --  
**Course Title: SED & STRATIGRAPHY**

000099

**Brief Statement of Change:**

Fixes error - GEOL 206 no longer in catalog

Last Term taught: 1201  
 Effective Term: 01/2013

.. Change Abbrev to:  
 .. Change Number to:

.. Change Catalog Title:  
 from:  
 to:

.. Change Transcript Title:  
 from: SED & STRATIGRAPHY  
 to:

.. Change of Credit  
 From: Fixed Credit: 4 (3,3) To: Fixed Credit: (,)  
 Variable Credit: - (-), (-) Variable Credit: - (-),(-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| .. Change Method of Instruction | .. Change Course Modifier | .. Change General Education Designation |
|---------------------------------|---------------------------|---|
| from: to:                       | from: to:                 | from: to:                               |
| .. A-Lecture Only               | .. Pass/Fail Only         | .. English                              |
| .. B-Lab (w/fee)                | X Graded                  | .. Composition                          |
| .. D-Seminar                    | .. Variable Title         | .. Oral                                 |
| .. E-Independent                | .. Creative Inquiry       | .. Communication                        |
| .. Study                        | .. Repeatable             | .. Mathematics                          |
| .. F-Tutorial (w/fee)           | .. maximum credits        | .. Natural Science                      |
| .. G-Studio                     | from:                     | .. w/Lab                                |
| .. H-Field course               | to:                       | .. Math or Science                      |
| .. I-Study Abroad               |                           | .. A&H (Literature)                     |
| .. L-Lab (no/fee)               |                           | .. A&H (Non-                            |
| .. N/B-Lecture/Lab              |                           | .. Literature)                          |
| X (w/fee)                       |                           | .. Social Science                       |
| .. N/L-Lecture/Lab(no           |                           | .. CCA                                  |
| .. fee)                         |                           | .. STS                                  |

## .. Change Catalog Description:

from:

to:

## X Change Prerequisite(s):

from: GEOL 206 or consent of instructor

to: GEOL 205

## Learning Objectives:

## Topical Outline:

## Evaluation:

Form Originator: MSCHLAU, Mark Schlautman Date Form Created: 10/27/2012

Form Last Updated by: MSCHLAU, Mark Schlautman Date Form Last Updated: 10/27/2012

Form Number: 5558

## Approval

|  |           |   |           |
|--|-----------|---|-----------|
| <i>Thomas J. Overcamp</i>              | 11/2/2012 | <i>Carrie W. Mendenhall</i>               | 12/7/2012 |
| Chair, Department Curriculum Committee | Date      | Chair, Undergraduate Curriculum Committee | Date      |
| <i>Cathy Koral</i>                     | 11/2/12   |   |           |
| Department Chair                       | Date      | Chair, Graduate Curriculum Committee      | Date      |
| <i>[Signature]</i>                     | 11/19/12  | <i>Thomas J. Overcamp</i>                 | 2/13/13   |
| Chair, College Curriculum Committee    | Date      | Provost                                   | Date      |
| <i>[Signature]</i>                     | 11/19/12  | <i>Thomas J. Overcamp</i>                 | 2/13/13   |
| College Dean                           | Date      | President                                 | Date      |
|  |           | <i>[Signature]</i>                        |           |
| Director, Calhoun Honors College       | Date      |   |           |

CLEMSON

UNIVERSITY Curriculum and Course Change System - Print Change/Delete Course Form

000100

**X Change a Course - Abbrev & Number: GEOL- 314**  
 Corresponding Lab Course: GEOL-L-314  
 Corresponding Honors course: GEOL-H-314  
**.. Add Honors course: --**  
 Corresponding Graduate course: --  
**.. Add Graduate course: --**  
**Course Title: SED PETROLOGY**

**Brief Statement of Change:**

Fixes error - GEOL 206 no longer in catalog

Last Term taught: 0601  
 Effective Term: 01/2013

**.. Change Abbrev to:**  
**.. Change Number to:**

**.. Change Catalog Title:**  
 from:  
 to:

**.. Change Transcript Title:**  
 from: SED PETROLOGY  
 to:

**.. Change of Credit** From: Fixed Credit: 3 (2,3) To: Fixed Credit: (,) Variable Credit: - (-), (-) Variable Credit: - (-),(-)

**.. Add cross-listing with the following child course(s):****.. Delete cross-listing with the following child course(s):****.. Reverse Parent/Child relationship with:**

| .. Change Method of Instruction |     | .. Change Course Modifier |     | .. Change General Education Designation |     |
|---------------------------------|-----|---------------------------|-----|---|-----|
| from:                           | to: | from:                     | to: | from:                                   | to: |
| .. A-Lecture Only               | ..  | .. Pass/Fail Only         | ..  | English                                 |     |
| .. B-Lab (w/fee)                | ..  | X Graded                  | ..  | .. Composition                          | ..  |
| .. D-Seminar                    | ..  | .. Variable Title         | ..  | Oral                                    |     |
| E-Independent                   | ..  | .. Creative Inquiry       | ..  | .. Communication                        | ..  |
| .. Study                        | ..  | .. Repeatable             | ..  | .. Mathematics                          | ..  |
| .. F-Tutorial (w/fee)           | ..  | maximum credits           |     | Natural Science                         |     |
| .. G-Studio                     | ..  | from:                     |     | .. w/Lab                                | ..  |
| .. H-Field course               | ..  | to:                       |     | .. Math or Science                      | ..  |
| .. I-Study Abroad               | ..  |                           |     | .. A&H (Literature)                     | ..  |
| .. L-Lab (no/fee)               | ..  |                           |     | A&H (Non-                               |     |
| N/B-Lecture/Lab                 | ..  |                           |     | .. Literature)                          | ..  |
| X (w/fee)                       | ..  |                           |     | .. Social Science                       | ..  |
| N/L-Lecture/Lab(no              | ..  |                           |     | .. CCA                                  | ..  |
| .. fee)                         | ..  |                           |     | .. STS                                  | ..  |

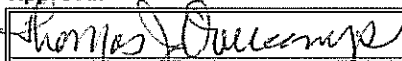

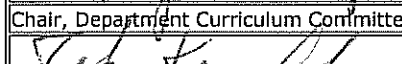




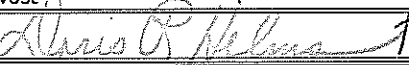
**.. Change Catalog Description:**

from:  
 to:

**X Change Prerequisite(s):**

from: GEOL 206 or consent of instructor  
 to: GEOL 205

**Learning Objectives:****Topical Outline:****Evaluation:****Form Originator:** MSCHLAU, Mark Schlautman **Date Form Created:** 10/27/2012**Form Last Updated by:** MSCHLAU, Mark Schlautman **Date Form Last Updated:** 10/27/2012**Form Number:** 5559**Approval**

|   |           |  |           |
|---|-----------|--|-----------|
|  | 11/2/2012 |  | 12/7/2012 |
| Chair, Department Curriculum Committee  | Date      | Chair, Undergraduate Curriculum Committee  | Date      |
|  | 11/2/12   |  |           |
| Department Chair  | Date      | Chair, Graduate Curriculum Committee   | Date      |
|  | 11/19/12  |  | 2/3/13    |
| Chair, College Curriculum Committee   | Date      | Provost  | Date      |
|  | 11/19/12  |  | 2/3/13    |
| College Dean  | Date      | President  | Date      |
|   |           |  |           |
| Director, Calhoun Honors College  | Date      |  |           |



## Curriculum and Course Change System - Print Change/Delete Course Form

000101

X Change a Course - Abbrev & Number: GEOL- 316  
 Corresponding Lab Course: GEOL-L-316  
 Corresponding Honors course: GEOL-H-316  
 .. Add Honors course: --  
 Corresponding Graduate course: --  
 .. Add Graduate course: --  
 Course Title: IGN & META PETROLOGY

## Brief Statement of Change:

Fixes error - GEOL 206 and GEOL 216 are no longer in catalog

Last Term taught: 1101  
 Effective Term: 01/2013

.. Change Abbrev to:  
 .. Change Number to:

.. Change Catalog Title:  
 from:  
 to:

.. Change Transcript Title:  
 from: IGN & META PETROLOGY  
 to:

.. Change of Credit  
 From: Fixed Credit: 3 (2,3) To: Fixed Credit: (,) Variable Credit: - (-), (-) Variable Credit: - (-), (-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| .. Change Method of Instruction | .. Change Course Modifier | .. Change General Education Designation |
|---------------------------------|---------------------------|---|
| from: to:                       | from: to:                 | from: to:                               |
| .. A-Lecture Only               | .. Pass/Fail Only         | .. English                              |
| .. B-Lab (w/fee)                | X Graded                  | .. Composition                          |
| .. D-Seminar                    | .. Variable Title         | .. Oral                                 |
| .. E-Independent                | .. Creative Inquiry       | .. Communication                        |
| .. Study                        | .. Repeatable             | .. Mathematics                          |
| .. F-Tutorial (w/fee)           | maximum credits           | .. Natural Science                      |
| .. G-Studio                     | from:                     | .. w/Lab                                |
| .. H-Field course               | to:                       | .. Math or Science                      |
| .. I-Study Abroad               |                           | .. A&H (Literature)                     |
| .. L-Lab (no/fee)               |                           | .. A&H (Non-                            |
| .. N/B-Lecture/Lab              |                           | .. Literature)                          |
| X (w/fee)                       |                           | .. Social Science                       |
| .. N/L-Lecture/Lab(no           |                           | .. CCA                                  |
| .. fee)                         |                           | .. STS                                  |

## .. Change Catalog Description:

from:  
 to:

## X Change Prerequisite(s):

from: GEOL 206, 216, or consent of instructor  
 to: GEOL 205

## Learning Objectives:

## Topical Outline:

## Evaluation:

Form Originator: MSCHLAU, Mark Schlautman Date Form Created: 10/27/2012

Form Last Updated by: MSCHLAU, Mark Schlautman Date Form Last Updated: 10/27/2012

Form Number: 5560

## Approval

|  |           |   |           |
|--|-----------|---|-----------|
|  | 11/2/2012 |   | 12/7/2012 |
| Chair, Department Curriculum Committee | Date      | Chair, Undergraduate Curriculum Committee | Date      |
|  | 11/2/12   |   |           |
| Department Chair                       | Date      | Chair, Graduate Curriculum Committee      | Date      |
|  | 11/19/12  |   | 2/3/13    |
| Chair, College Curriculum Committee    | Date      | Provost                                   | Date      |
|  | 11/19/12  |   | 2/3/13    |
| College Dean                           | Date      | President                                 | Date      |
|  |           |   |           |
| Director, Calhoun Honors College       | Date      |   |           |



## Curriculum and Course Change System - Print Change/Delete Course Form

000102

X Change a Course - Abbrev &amp; Number: GEOL- 318

Corresponding Lab Course: --

Corresponding Honors course: --

.. Add Honors course: --

Corresponding Graduate course: --

.. Add Graduate course: --

Course Title: INTRO GEOCHEMISTRY

## Brief Statement of Change:

Changes prerequisite from 100-level introductory geology and chemistry courses to 200-level mineralogy course

Last Term taught: 1201

Effective Term: 01/2013

.. Change Abbrev to:

.. Change Number to:

.. Change Catalog Title:

from:

to:

.. Change Transcript Title:

from: INTRO GEOCHEMISTRY

to:

.. Change of Credit

From: Fixed Credit: 3 (3,)

To: Fixed Credit: (,)

Variable Credit: - (-), (-)

Variable Credit: - (-),(-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

.. Change Method of Instruction

.. Change Course Modifier

.. Change General Education Designation

from:

to:

from:

to:

from:

to:

X A-Lecture Only

..

.. Pass/Fail Only

..

.. English

..

.. B-Lab (w/fee)

..

X Graded

..

.. Composition

..

.. D-Seminar

..

.. Variable Title

..

.. Oral

..

.. E-Independent

..

.. Creative Inquiry

..

.. Communication

..

.. Study

..

.. Repeatable

..

.. Mathematics

..

.. F-Tutorial (w/fee)

..

maximum credits

.. Natural Science

..

.. G-Studio

..

from:

.. w/Lab

..

.. H-Field course

..

to:

.. Math or Science

..

.. I-Study Abroad

..

.. A&amp;H (Literature)

..

.. L-Lab (no/fee)

..

.. A&amp;H (Non-

..

.. N/B-Lecture/Lab

..

.. Literature)

..

.. (w/fee)

..

.. Social Science

..

.. N/L-Lecture/Lab(no

..

.. CCA

..

.. fee)

..

.. STS

..

.. Change Catalog Description:

from:

to:

X Change Prerequisite(s):

from: GEOL 101 and CH 102 or consent of instructor

to: GEOL 205

Learning Objectives:

Topical Outline:

Evaluation:

Form Originator: MSCHLAU, Mark Schlautman Date Form Created: 10/27/2012

Form Last Updated by: MSCHLAU, Mark Schlautman Date Form Last Updated: 10/27/2012

Form Number: 5561

## Approval

|  |          |   |         |
|--|----------|---|---------|
|  | 11/2/12  |   | 12/7/12 |
| Chair, Department Curriculum Committee | Date     | Chair, Undergraduate Curriculum Committee | Date    |
|  | 11/2/12  |   |         |
| Department Chair                       | Date     | Chair, Graduate Curriculum Committee      | Date    |
|  | 11/19/12 |   | 2/3/13  |
| Chair, College Curriculum Committee    | Date     | Provost                                   | Date    |
|  | 11/19/12 |   | 2/3/13  |
| College Dean                           | Date     | President                                 | Date    |
|  |          |   |         |
| Director, Calhoun Honors College       | Date     |   |         |





## Curriculum and Course Change System - Print Change/Delete Course Form

X Change a Course - Abbrev &amp; Number: GEOL- 403

Corresponding Lab Course: GEOL-L-403

Corresponding Honors course: --

.. Add Honors course: --

Corresponding Graduate course: --

.. Add Graduate course: --

Course Title: INVERT PALEONTOLOGY

000103

## Brief Statement of Change:

Fixes typographical error in prerequisite for GEOL 403; Deleted prerequisite for GEOL 603

Last Term taught: 0801

Effective Term: 01/2013

.. Change Abbrev to:

.. Change Number to:

.. Change Catalog Title:

from:

to:

.. Change Transcript Title:

from: INVERT PALEONTOLOGY

to:

|                      |                             |                             |
|----------------------|-----------------------------|-----------------------------|
| .. Change of Credit: | From: Fixed Credit: 3 (2,3) | To: Fixed Credit: (,)       |
|                      | Variable Credit: - (-), (-) | Variable Credit: - (-), (-) |

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| .. Change Method of Instruction | .. Change Course Modifier | .. Change General Education Designation |
|---------------------------------|---------------------------|---|
| from: to:                       | from: to:                 | from: to:                               |
| .. A-Lecture Only               | .. Pass/Fail Only         | .. English                              |
| .. B-Lab (w/fee)                | .. X Graded               | .. Composition                          |
| .. D-Seminar                    | .. Variable Title         | .. Oral                                 |
| .. E-Independent                | .. Creative Inquiry       | .. Communication                        |
| .. Study                        | .. Repeatable             | .. Mathematics                          |
| .. F-Tutorial (w/fee)           | .. maximum credits        | .. Natural Science                      |
| .. G-Studio                     | from:                     | .. w/Lab                                |
| .. H-Field course               | to:                       | .. Math or Science                      |
| .. I-Study Abroad               |                           | .. A&H (Literature)                     |
| .. L-Lab (no/fee)               |                           | .. A&H (Non-                            |
| .. N/B-Lecture/Lab              |                           | .. Literature)                          |
| .. X (w/fee)                    |                           | .. Social Science                       |
| .. N/L-Lecture/Lab(no           |                           | .. CCA                                  |
| .. fee)                         |                           | .. STS                                  |

## .. Change Catalog Description:

from:

to:

## X Change Prerequisite(s):

from: GEOL 101 or consent of instructor

to: GEOL 403; GEOL 102 or consent of instructor; GEOL 603 : -

## Learning Objectives:

## Topical Outline:

## Evaluation:

Form Originator: MSCHLAU, Mark Schlautman Date Form Created: 10/27/2012

Form Last Updated by: , Date Form Last Updated: 10/31/2012

Form Number: 5562

## Approval

|  |           |   |           |
|--|-----------|---|-----------|
| <i>Thomas H. Schlautman</i>            | 11/2/2012 | <i>Kevin W. Mendenhall</i>                | 12/7/2012 |
| Chair, Department Curriculum Committee | Date      | Chair, Undergraduate Curriculum Committee | Date      |
| <i>Cal L. Lora</i>                     | 11/2/12   |   |           |
| Department Chair                       | Date      | Chair, Graduate Curriculum Committee      | Date      |
| <i>2/3/13</i>                          | 11/19/12  | <i>Thomas H. Schlautman</i>               | 2/3/13    |
| Chair, College Curriculum Committee    | Date      | Provost                                   | Date      |
| <i>Brenden Blum</i>                    | 11/19/12  | <i>Thomas H. Schlautman for</i>           | 2/3/13    |
| College Dean                           | Date      | President                                 | Date      |
|  |           | <i>John D. ...</i>                        |           |
| Director, Calhoun Honors College       | Date      |   |           |



## Curriculum and Course Change System - Print Change/Delete Course Form

000104

**X Change a Course - Abbrev & Number: GEOL- 408**

Corresponding Lab Course: --

Corresponding Honors course: GEOL-H-408

.. Add Honors course: --

Corresponding Graduate course: GEOL- -608

.. Add Graduate course: --

Course Title: GEOHYDROLOGY

**Brief Statement of Change:**

Changes prerequisite for GEOL 408 from 100-level introductory geology courses to junior or senior standing; Deleted prerequisite for GEOL 608

Last Term taught: 1108

.. Change Abbrev to:

Effective Term: 01/2013

.. Change Number to:

.. Change Catalog Title:

.. Change Transcript Title:

from:

from: GEOHYDROLOGY

to:

to:

.. Change of Credit From: Fixed Credit: 3 (3,) To: Fixed Credit: (,)

Variable Credit: - (-), (-) Variable Credit: - (-),(-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| .. Change Method of Instruction | .. Change Course Modifier | .. Change General Education Designation |
|---------------------------------|---------------------------|---|
| from: to:                       | from: to:                 | from: to:                               |
| X A-Lecture Only                | .. Pass/Fail Only         | English                                 |
| .. B-Lab (w/fee)                | X Graded                  | .. Composition                          |
| .. D-Seminar                    | .. Variable Title         | Oral                                    |
| E-Independent                   | .. Creative Inquiry       | .. Communication                        |
| .. Study                        | .. Repeatable             | .. Mathematics                          |
| .. F-Tutorial (w/fee)           | maximum credits           | Natural Science                         |
| .. G-Studio                     | from:                     | .. w/Lab                                |
| .. H-Field course               | to:                       | .. Math or Science                      |
| .. I-Study Abroad               |                           | .. A&H (Literature)                     |
| .. L-Lab (no/fee)               |                           | A&H (Non-                               |
| N/B-Lecture/Lab                 |                           | .. Literature)                          |
| .. (w/fee)                      |                           | .. Social Science                       |
| N/L-Lecture/Lab(no              |                           | .. CCA                                  |
| .. fee)                         |                           | .. STS                                  |

**.. Change Catalog Description:**

from:

to:

**X Change Prerequisite(s):**

from: GEOL 101,102

to: GEOL 408: junior or senior standing; GEOL 608 : -

**Learning Objectives:****Topical Outline:****Evaluation:**

Form Originator: MSCHLAU, Mark Schlautman Date Form Created: 10/27/2012

Form Last Updated by: , Date Form Last Updated: 10/31/2012

Form Number: 5563

**Approval**

|  |          |   |           |
|--|----------|---|-----------|
| <i>Thomas J. Quisenberry</i>           | 11/2/12  | <i>Patricia W. Anderson</i>               | 12/7/2012 |
| Chair, Department Curriculum Committee | Date     | Chair, Undergraduate Curriculum Committee | Date      |
| <i>John Carroll</i>                    | 11/2/12  |   |           |
| Department Chair                       | Date     | Chair, Graduate Curriculum Committee      | Date      |
| <i>John Carroll</i>                    | 11/19/12 | <i>Thomas A. Nelson</i>                   | 2/3/13    |
| Chair, College Curriculum Committee    | Date     | Provost                                   | Date      |
| <i>Deborah Klein</i>                   | 11/19/12 | <i>Thomas A. Nelson</i> for               | 2/3/13    |
| College Dean                           | Date     | President                                 | Date      |
|  |          | <i>John J. ...</i>                        |           |
| Director, Calhoun Honors College       | Date     |   |           |



## Curriculum and Course Change System - Print Change/Delete Course Form

000105

**X Change a Course - Abbrev & Number: GEOL- 409**  
 Corresponding Lab Course: GEOL-L-409  
 Corresponding Honors course: GEOL-H-409  
 .. **Add Honors course:** --  
 Corresponding Graduate course: GEOL- -609  
 .. **Add Graduate course:** --  
**Course Title: ENV & EXP GEOPHYSICS**

**Brief Statement of Change:**

Changes prerequisite for GEOL 409 to junior or senior standing; Deleted prerequisite for GEOL 609

|   |   |
|---|---|
| Last Term taught:<br>Effective Term: 01/2013    | .. <b>Change Abbrev to:</b><br>.. <b>Change Number to:</b>              |
| .. <b>Change Catalog Title:</b><br>from:<br>to: | .. <b>Change Transcript Title:</b><br>from: ENV & EXP GEOPHYSICS<br>to: |

|                            |  |   |
|----------------------------|--|---|
| .. <b>Change of Credit</b> | From: Fixed Credit: 4 (3,3)<br>Variable Credit: - (-), (-) | To: Fixed Credit: (,)<br>Variable Credit: - (-),(-) |
|----------------------------|--|---|

.. **Add cross-listing with the following child course(s):**.. **Delete cross-listing with the following child course(s):**.. **Reverse Parent/Child relationship with:**

| .. <b>Change Method of Instruction</b> |     | .. <b>Change Course Modifier</b> |     | .. <b>Change General Education Designation</b> |     |
|--|-----|----------------------------------|-----|--|-----|
| from:                                  | to: | from:                            | to: | from:  | to: |
| .. A-Lecture Only                      | ..  | .. Pass/Fail Only                | ..  | English  | ..  |
| .. B-Lab (w/fee)                       | ..  | .. X Graded                      | ..  | .. Composition                                 | ..  |
| .. D-Seminar                           | ..  | .. Variable Title                | ..  | Oral   | ..  |
| E-Independent                          | ..  | .. Creative Inquiry              | ..  | .. Communication                               | ..  |
| .. Study                               | ..  | .. Repeatable                    | ..  | .. Mathematics                                 | ..  |
| .. F-Tutorial (w/fee)                  | ..  | maximum credits                  | ..  | Natural Science                                | ..  |
| .. G-Studio                            | ..  | from:                            | ..  | .. w/Lab                                       | ..  |
| .. H-Field course                      | ..  | to:                              | ..  | .. Math or Science                             | ..  |
| .. I-Study Abroad                      | ..  |                                  | ..  | .. A&H (Literature)                            | ..  |
| .. L-Lab (no/fee)                      | ..  |                                  | ..  | A&H (Non-                                      | ..  |
| N/B-Lecture/Lab                        | ..  |                                  | ..  | .. Literature)                                 | ..  |
| X (w/fee)                              | ..  |                                  | ..  | .. Social Science                              | ..  |
| N/L-Lecture/Lab(no                     | ..  |                                  | ..  | .. CCA   | ..  |
| .. fee)                                | ..  |                                  | ..  | .. STS   | ..  |

**.. Change Catalog Description:**

from:  
to:

**X Change Prerequisite(s):**

from: GEOL 313 or consent of Instructor  
 to: GEOL 409: junior or senior standing; GEOL 609 : -

**Learning Objectives:****Topical Outline:****Evaluation:**

Form Originator: MSCHLAU, Mark Schlautman Date Form Created: 10/27/2012

Form Last Updated by: , Date Form Last Updated: 10/31/2012

Form Number: 5564

**Approval**

|  |           |   |           |
|--|-----------|---|-----------|
|  | 11/2/2012 |   | 12/7/2012 |
| Chair, Department Curriculum Committee | Date      | Chair, Undergraduate Curriculum Committee | Date      |
|  | 11/2/12   |   |           |
| Department Chair                       | Date      | Chair, Graduate Curriculum Committee      | Date      |
|  | 11/19/12  |   | 2/3/13    |
| Chair, College Curriculum Committee    | Date      | Provost                                   | Date      |
|  | 11/19/12  |   | 2/3/13    |
| College Dean                           | Date      | President                                 | Date      |
|  |           |   |           |
| Director, Calhoun Honors College       | Date      |   |           |



## Curriculum and Course Change System - Print Change/Delete Course Form

000106

X Change a Course - Abbrev &amp; Number: GEOL- 459

Corresponding Lab Course: --

Corresponding Honors course: --

.. Add Honors course: --

Corresponding Graduate course: GEOL- 659

.. Add Graduate course: --

Course Title: BIOGEOCHEMISTRY

## Brief Statement of Change:

Changes chemistry prerequisite for GEOL 459 from general chemistry to organic chemistry; Deleted prerequisite for GEOL 659

Last Term taught: 0808

Effective Term: 01/2013

.. Change Abbrev to:

.. Change Number to:

.. Change Catalog Title:

from:

to:

.. Change Transcript Title:

from: BIOGEOCHEMISTRY

to:

.. Change of Credit From: Fixed Credit: 3 (3,) To: Fixed Credit: (,)

Variable Credit: - (-), (-) Variable Credit: - (-),(-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| .. Change Method of Instruction | .. Change Course Modifier | .. Change General Education Designation |
|---------------------------------|---------------------------|---|
| from: to:                       | from: to:                 | from: to:                               |
| X A-Lecture Only ..             | .. Pass/Fail Only ..      | English                                 |
| .. B-Lab (w/fee) ..             | X Graded ..               | .. Composition ..                       |
| .. D-Seminar ..                 | .. Variable Title ..      | Oral                                    |
| E-Independent                   | .. Creative Inquiry ..    | .. Communication ..                     |
| .. Study ..                     | .. Repeatable ..          | .. Mathematics ..                       |
| .. F-Tutorial (w/fee) ..        | maximum credits           | Natural Science                         |
| .. G-Studio ..                  | from:                     | .. w/Lab ..                             |
| .. H-Field course ..            | to:                       | .. Math or Science ..                   |
| .. I-Study Abroad ..            |                           | .. A&H (Literature) ..                  |
| .. L-Lab (no/fee) ..            |                           | A&H (Non-                               |
| N/B-Lecture/Lab                 |                           | .. Literature) ..                       |
| .. (w/fee) ..                   |                           | .. Social Science ..                    |
| N/L-Lecture/Lab(no              |                           | .. CCA ..                               |
| .. fee) ..                      |                           | .. STS ..                               |

## .. Change Catalog Description:

from:

to:

## X Change Prerequisite(s):

from: CH 102 or GEOL 318 or consent of instructor

to: GEOL 459; GEOL 318 and (CH 201 or CH 223); or consent of instructor; GEOL 659: -

## Learning Objectives:

## Topical Outline:

## Evaluation:

Form Originator: MSCHLAU, Mark Schlautman Date Form Created: 10/27/2012

Form Last Updated by: , Date Form Last Updated: 10/31/2012

Form Number: 5565

## Approval

|  |          |   |           |
|--|----------|---|-----------|
| Thomas J. Schlaup                      | 11/2/12  | Charles W. Moore                          | 12/7/2012 |
| Chair, Department Curriculum Committee | Date     | Chair, Undergraduate Curriculum Committee | Date      |
| Tah L. Hall                            | 11/2/12  |   |           |
| Department Chair                       | Date     | Chair, Graduate Curriculum Committee      | Date      |
| 2/19/12                                | 11/19/12 | Thomas R. Nelson                          | 2/13/13   |
| Chair, College Curriculum Committee    | Date     | Provost                                   | Date      |
| Thomas R. Nelson                       | 11/19/12 | Thomas R. Nelson for                      | 2/13/13   |
| College Dean                           | Date     | President                                 | Date      |
|  |          | Charles W. Moore                          |           |
| Director, Calhoun Honors College       | Date     |   |           |



## Curriculum and Course Change System - Print Change/Delete Course Form

000107

**X Change a Course - Abbrev & Number: PH SC- 107**  
 Corresponding Lab Course: PH SC-L-107  
 Corresponding Honors course: --  
 .. Add Honors course: --  
 Corresponding Graduate course: --  
 .. Add Graduate course: --  
**Course Title: INTRO TO EARTH SCI**

**Brief Statement of Change:**

Change method of instruction from lecture/ lab course with lab fee, to lecture/ lab course without a lab fee. This course is now offered online only, students are required to purchase their own lab kits to work with from their own locations, students will not use the university lab premises, therefore are not required to pay lab fees.

Last Term taught: 1206  
 Effective Term: 01/2013

.. Change Abbrev to:  
 .. Change Number to:

.. Change Catalog Title:  
 from:  
 to:

.. Change Transcript Title:  
 from: INTRO TO EARTH SCI  
 to:

.. From: Fixed Credit: 4 (3,3) To: Fixed Credit: (,)  
 Change of Credit Variable Credit: - (-), (-) Variable Credit: - (-),(-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| X Change Method of Instruction |     | .. Change Course Modifier |     | .. Change General Education Designation |     |
|--------------------------------|-----|---------------------------|-----|---|-----|
| from:                          | to: | from:                     | to: | from:                                   | to: |
| .. A-Lecture Only              | ..  | .. Pass/Fail Only         | ..  | .. English                              | ..  |
| .. B-Lab (w/fee)               | ..  | X Graded                  | ..  | .. Composition                          | ..  |
| .. D-Seminar                   | ..  | .. Variable Title         | ..  | .. Oral                                 | ..  |
| .. E-Independent               | ..  | .. Creative Inquiry       | ..  | .. Communication                        | ..  |
| .. Study                       | ..  | .. Repeatable             | ..  | .. Mathematics                          | ..  |
| .. F-Tutorial (w/fee)          | ..  | .. maximum credits        | ..  | .. Natural Science                      | ..  |
| .. G-Studio                    | ..  | from:                     | ..  | .. w/Lab                                | ..  |
| .. H-Field course              | ..  | to:                       | ..  | .. Math or Science                      | ..  |
| .. I-Study Abroad              | ..  |                           | ..  | .. A&H (Literature)                     | ..  |
| .. L-Lab (no/fee)              | ..  |                           | ..  | .. A&H (Non-                            | ..  |
| .. N/B-Lecture/Lab             | ..  |                           | ..  | .. Literature)                          | ..  |
| X (w/fee)                      | ..  |                           | ..  | .. Social Science                       | ..  |
| .. N/L-Lecture/Lab(no          | ..  |                           | ..  | .. CCA                                  | ..  |
| .. fee)                        | X   |                           | ..  | .. STS                                  | ..  |

**.. Change Catalog Description:**

from:  
 to:

**.. Change Prerequisite(s):**

from:  
 to:

**Learning Objectives:** • Construct ideas and connections between concepts to make sense of the ideas rather than simply memorizing isolated facts.

- Gain an appreciation for and understanding of the way science and scientists work.
- Provide an adequate foundation in science content that will enable students to understand scientific concepts and processes.
- Apply scientific concepts and process to daily life and career related situations.

**Topical Outline:** Earth in space (9 hrs.)

Students will learn that the way earth moves in space is used to define time and describe location on the surface, and causes recurrent phenomena such as seasons, the following are topics covered in this unit:

Earth's shape and size  
 Motions (Revolution, Rotation, Precession)  
 Place and time (Identifying place, measuring time)  
 The moon (Composition and features, History of the moon)  
 The earth-moon system (phases of the moon, eclipses of the sun and moon)

**Rocks and Minerals (9 hrs.)**

Students will learn that Earth is a dynamic body that cycles rocks and minerals through ongoing changes. The following are topics covered in this unit:

Minerals (crystal structure, physical properties, forming processes)  
 Mineral forming processes  
 Rocks  
 Igneous rocks  
 Sedimentary rocks

000108

Metamorphic rocks  
The rock cycle

Plate tectonic (9 hrs.)

Students will learn that Earth has an internal structure and cycles materials between the surface and the interior. The following are topics introduced in this unit:

History of Earth's Interior

Earth's Internal Structure

The crust

The mantle

The core

Theory of plate tectonics

Evidence from earth's magnetic field

Evidence from the ocean

Lithosphere plates and boundaries

Building Earth's surface (9 hrs.)

Students will learn that the surface of Earth is involved in plate tectonic processes that result in an ongoing building up of the surface.

The following topics will be covered in this unit:

Interpreting earth's surface

Diatrophism

Stress and Strain

Folding

Faulting

Earthquakes

Causes of earthquakes

Locating and Measuring earthquakes

Shaping Earth's surface (9 hrs.)

Students will learn that the surface of Earth is involved in an ongoing process of destruction and tearing down higher elevations. The following topic will be covered in this unit:

Weathering, erosion, and transportation

Weathering

Soils

Erosion

Mass movement

Running water

Glaciers

Wind

**Evaluation:** Lab Reports 20%

Weekly homework assignments 15%

Discussion board participation 10%

Safety Quiz 5%


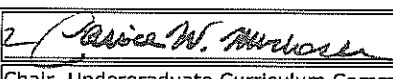
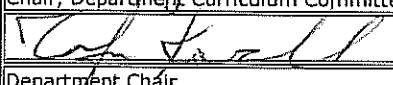
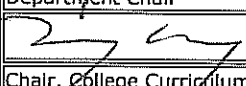

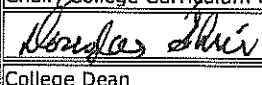

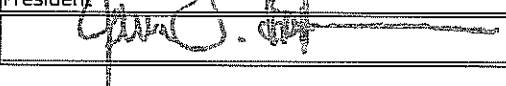
Five Chapter Exams (5 @ 10%) 50%

**Form Originator:** MNAMMOU, Minory Nammouz **Date Form Created:** 10/31/2012

**Form Last Updated by:** MNAMMOU, Minory Nammouz **Date Form Last Updated:** 11/1/2012

**Form Number:** 5586

#### Approval

|   |          |  |           |
|---|----------|--|-----------|
|  | 11/2/24  |      | 12/7/2012 |
| Chair, Department Curriculum Committee  | Date     | Chair, Undergraduate Curriculum Committee  | Date      |
|  | 11/2/12  |  |           |
| Department Chair  | Date     | Chair, Graduate Curriculum Committee   | Date      |
|  | 11/19/12 |      | 2/3/13    |
| Chair, College Curriculum Committee   | Date     | Provost  | Date      |
|  | 11/19/12 |  For | 2/3/13    |
| College Dean  | Date     | President  | Date      |
|   |          |      |           |
| Director, Calhoun Honors College  | Date     |  |           |



## Curriculum and Course Change System - Print Change/Delete Course Form

000109

**X Change a Course - Abbrev & Number: PH SC- 108**  
 Corresponding Lab Course: PH SC-L-108  
 Corresponding Honors course: --  
 .. Add Honors course: --  
 Corresponding Graduate course: --  
 .. Add Graduate course: --  
**Course Title: INTRO TO PHYS SCI**

**Brief Statement of Change:**

Change method of instruction from lecture/ lab course with lab fee, to lecture/ lab course without a lab fee. This course is now offered online only, students are required to purchase their own lab kits to work with from their own locations, students will not use the university lab premises, therefore are not required to pay lab fees.

Last Term taught: 1205  
 Effective Term: 01/2013

.. Change Abbrev to:  
 .. Change Number to:

.. Change Catalog Title:  
 from:  
 to:

.. Change Transcript Title:  
 from: INTRO TO PHYS SCI  
 to:

.. From: Fixed Credit: 4 (3,3)  
**Change of Credit** Variable Credit: - (-), (-)

To: Fixed Credit: (,)  
 Variable Credit: - (-),(-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| X Change Method of Instruction |     | .. Change Course Modifier |     | .. Change General Education Designation |     |
|--------------------------------|-----|---------------------------|-----|---|-----|
| from:                          | to: | from:                     | to: | from:                                   | to: |
| .. A-Lecture Only              | ..  | .. Pass/Fail Only         | ..  | English                                 | ..  |
| .. B-Lab (w/fee)               | ..  | X Graded                  | ..  | .. Composition                          | ..  |
| .. D-Seminar                   | ..  | .. Variable Title         | ..  | Oral                                    | ..  |
| E-Independent                  | ..  | .. Creative Inquiry       | ..  | .. Communication                        | ..  |
| .. Study                       | ..  | .. Repeatable             | ..  | .. Mathematics                          | ..  |
| .. F-Tutorial (w/fee)          | ..  | maximum credits           | ..  | Natural Science                         | ..  |
| .. G-Studio                    | ..  | from:                     | ..  | .. w/Lab                                | ..  |
| .. H-Field course              | ..  | to:                       | ..  | .. Math or Science                      | ..  |
| .. I-Study Abroad              | ..  |                           | ..  | .. A&H (Literature)                     | ..  |
| .. L-Lab (no/fee)              | ..  |                           | ..  | A&H (Non-                               | ..  |
| N/B-Lecture/Lab                | ..  |                           | ..  | .. Literature)                          | ..  |
| X (w/fee)                      | ..  |                           | ..  | .. Social Science                       | ..  |
| N/L-Lecture/Lab(no             | ..  |                           | ..  | .. CCA                                  | ..  |
| .. fee)                        | X   |                           | ..  | .. STS                                  | ..  |

**.. Change Catalog Description:**

from:  
 to:

**.. Change Prerequisite(s):**

from:  
 to:

**Learning Objectives:** • Construct ideas and connections between concepts to make sense of the ideas rather than simply memorizing isolated facts.

- Gain an appreciation for and understanding of the way science and scientists work.
- Provide an adequate foundation in science content that will enable students to understand scientific concepts and processes.
- Apply scientific concepts and process to daily life and career related situations.

**Topical Outline:** What is Science? (9 hrs.)

Students will learn that science is a way of thinking about and understanding their environment. The following topics will be covered in this unit:

Objects and properties  
 Measurement system  
 The metric system  
 Metric prefixes  
 The density ration  
 The nature of science  
 The scientific method

**Motion (9 hrs.)**

Students will learn that a net force is required for any change in a state of motion. The following topics will be covered in this unit:

Describing motion  
 Measuring motion  
 Speed  
 Velocity

000120

Acceleration  
Forces  
Newton's Three laws of motion

Heat and temperature (9 hrs.)

Students will learn that a relationship exists between heat, temperature, and the motion and position of molecules. The following topics will be covered in this unit:

The kinetic molecular theory

Temperature

Heat

Energy, heat and molecular theory

Chemical reactions (9 hrs.)

Students will learn that chemical symbols, formulas, and equations can be used to concisely represent elements, compounds, and what happens in a chemical reaction. The following topics will be covered in this unit:

Chemical equations

Chemical formulas

Types of chemical reactions

Information from chemical reactions

Water and solutions (9 hrs.)

Students will learn that water and solutions of water have unique properties. The following topics will be covered in this unit:

Household water

Properties of water

Solutions

Acids bases and salts

**Evaluation:** Lab Reports 20%

Weekly homework assignments 15%

Discussion board participation 10%

Safety Quiz 5%

Five Chapter Exams (5 @ 10%) 50%



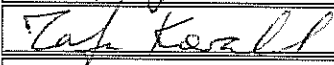

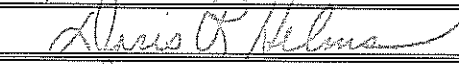
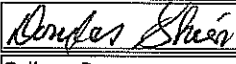
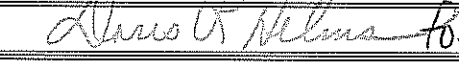

TOTAL 100%

**Form Originator:** MNAMMOU, Minory Nammouz **Date Form Created:** 11/1/2012

**Form Last Updated by:** MNAMMOU, Minory Nammouz **Date Form Last Updated:** 11/1/2012

**Form Number:** 5590

#### Approval

|   |           |  |           |
|---|-----------|--|-----------|
|  | 11/2/2012 |  | 12/4/2012 |
| Chair, Department Curriculum Committee  | Date      | Chair, Undergraduate Curriculum Committee  | Date      |
|  | 11/2/12   |  |           |
| Department Chair  | Date      | Chair, Graduate Curriculum Committee   | Date      |
|  | 11/19/12  |  | 2/3/13    |
| Chair, College Curriculum Committee   | Date      | Provost  | Date      |
|  | 11/19/12  |  | 2/3/13    |
| College Dean  | Date      | President  | Date      |
|   |           |  |           |
| Director, Calhoun Honors College  | Date      |  |           |





## Curriculum and Course Change System - Print Major Form

000111

**Change Major Name:** Biosystems Engineering**Degree:** BS**Effective Catalog Year:** 2013**.. Change Major Name to:****.. Change Degree to:** (CHE approval required)**X Change Curriculum Requirements**

(Submit or upload Curriculum map in catalog format. CHE approval required for &gt; 18 hours of changes)

**.. Change General Education Requirements**

(Must also submit a General Education Checklist)

**.. Add, Change or Delete Concentration(s)**

(Submit or upload Curriculum map in catalog format. CHE approval required)

**.. Add, Change or Delete Emphasis Area(s)****Explanation:** A number of revisions are needed to address 1) change in requirements; and 2) change in course sequence, as follows:

Replace ENGR 130 with ENGR 141

Switch semesters for BE 212 and BE 210

Replace BE 222 with BE 320

Add ECE 309

Drop BE 415 and include as engineering option

Move BE 475 to Fall semester, senior year

Adjust credits for ecological option in Ecological Engineering emphasis

**Form Originator:** CDRAPCH, Caye Drapcho **Date Form Created:** 11/2/2012**Form Last Updated by:** , **Date Form Last Updated:** 11/5/2012**Form Number:** 5596**Approval**

|  |            |   |           |
|--|------------|---|-----------|
| <i>Thomas J. Overcamp</i>              | 12/20/2012 | <i>Charles W. Williams</i>                | 12/7/2012 |
| Chair, Department Curriculum Committee | Date       | Chair, Undergraduate Curriculum Committee | Date      |
| <i>Caye Koral</i>                      | 11/12/12   |   |           |
| Department Chair                       | Date       | Chair, Graduate Curriculum Committee      | Date      |
| <i>[Signature]</i>                     | 11/19/12   | <i>Alvin R. Williams</i>                  | 2/3/13    |
| Chair, College Curriculum Committee    | Date       | Provost                                   | Date      |
| <i>Douglas Siler</i>                   | 11/19/12   | <i>Alvin R. Williams for</i>              | 2/3/13    |
| College Dean                           | Date       | President                                 | Date      |

*[Signature]*

**BIOSYSTEMS ENGINEERING****Bachelor of Science****Freshman Year***First Semester*

- 2 - ENGR 102 Engineering Disciplines and Skills
- 4 - CH 101 General Chemistry
- 4 - MTHSC 106 Calculus of One Variable I
- 3 - ENGL 103 Accelerated Composition
- 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>

**16***Second Semester*

- 3 - ENGR 141 Programming and Problem Solving
- 4 - CH 102 General Chemistry
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - PHYS 122 Physics with Calculus I
- 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>

**17****Sophomore Year***First Semester*

- 2 - BE 212 Fundamentals of Biosystems Engr.
- 4 - MTHSC 206 Calculus of Several Variables
- 3 - PHYS 221 Physics w/Calculus II
- 4 - Biology Requirement<sup>2</sup>
- 3 - CE 201<sup>3</sup> Statics

**16***Second Semester*

- 2 - BE 210 Introduction to Biosystems Engr.
- 2 - ENGR 210 Computer-Aided Design and Engineering Applications
- 3 - ME 310 Thermodynamics and Heat Transfer
- 4 - MICRO 305 General Microbiology
- 4 - MTHSC 208 Intro. Ordinary Diff. Equations
- 2 - CE 208<sup>3</sup> Dynamics

**17****Junior Year***First Semester*

- 3 - BE 320 Geomeasurements
- 3 - BE 410 Biol. Kinetics and Reactor Modeling
- 3 - Mechanics of Materials Requirement<sup>4</sup>
- 2 - ECE 307 Basic Electrical Engineering
- 1 - ECE 309 Electrical Engineering Lab I
- 3 - CH 223 Organic Chemistry
- 1 - CH 227 Organic Chemistry Lab

**16***Second Semester*

- 3 - BE 322 Small Watershed Hydrology and Sedimentology
- 3 - BE 412 Heat and Mass Transport in BE
- 4 - CE 341 Introduction to Fluid Mechanics
- 3 - BE 438 Bioprocess Engineering Design
- 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>

**16**

<sup>1</sup> Students should choose courses to fulfill General Education requirements including Humanities, Social Science, Cross-Cultural Awareness and Science and Technology in Society components. See Undergraduate Announcement and academic advisor for details.

<sup>2</sup> BIOL 103/105 or BIOL 110

<sup>3</sup> ME 201 may be substituted for CE 201 and 208

<sup>4</sup> ME 302 or CE 206

**ECOLOGICAL ENGINEERING EMPHASIS AREA****Senior Year***First Semester*

- 2 - BE 474 Biosystems Engr Design/Project Mgt
- 2 - BE 475 Biosystems Engr Capstone Design
- 3 - BIOSC 441 Ecology
- 2 - Engineering Requirement<sup>2</sup>
- 3 - Ecological Requirement<sup>3</sup>
- 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>

**15***Second Semester*

- 2 - BE 421 Engr. Syst. Soil Water Management
- 3 - BE 424 Ecological Engineering
- 3 - Engineering Requirement<sup>2</sup>
- 4 - Ecological Requirement<sup>3</sup>
- 3 - Arts and Humanities Requirement<sup>1</sup> or  
3 - Social Science Requirement<sup>1</sup>

**15**

<sup>1</sup> Students should choose courses to fulfill General Education requirements including Humanities, Social Science, Cross-Cultural Awareness and Science and Technology in Society components. See Undergraduate Announcement and academic advisor for details.

<sup>2</sup> See Departmental List (Minimum 600 level for BS/MS program)

<sup>3</sup> Ecological Requirement: Choose from BIOSC, CSENV, FOR, WFB 300-level or above or other approved course

**BIOPROCESS ENGINEERING EMPHASIS AREA****Senior Year***First Semester*

- 2 - BE 474 Biosystems Engr Design/Project Mgt
- 2 - BE 475 Biosystems Engr Capstone Design
- 3 - BIOSC 441 Ecology
- 3 - BE 428 Biochemical Engineering
- 5 - Biochemistry Requirement<sup>3</sup>

**15**

*Second Semester*3 - Engineering Requirement<sup>2</sup>3 - Engineering Requirement<sup>2</sup>3 - Life Science Requirement<sup>4</sup>6 - Arts and Humanities Requirement<sup>1</sup> or6 - Social Science Requirement<sup>1</sup>**15**

<sup>1</sup> Students should choose courses to fulfill General Education requirements including Humanities, Social Science, Cross-Cultural Awareness and Science and Technology in Society components. See Undergraduate Announcement and academic advisor for details.

<sup>2</sup> See Departmental List (Minimum 600 level for BS/MS program)

<sup>3</sup> Choose BIOCH 305 and BIOSC 434

<sup>4</sup> Life Science Requirement: Choose from BIOSC, BIOCHEM, GEN, MICRO, WFB 300-level or above or other approved course

Notes for both emphasis areas:

<sup>A</sup> Biosystems Engineering students are allowed to enroll in upper-level BE courses only when the following prerequisites have been completed with C or better: CE 201, 206, 208, 341, CHE 220, 230, ME 201, 302, 310, MTHSC 206, 208, PHYS 221.

<sup>B</sup> Biosystems Engineering students are encouraged to complete a Minor, Coop Ed program, Internship (BE 370) and/or a Study Abroad Program.

<sup>C</sup> Possible minors include Environmental Engineering, Environmental Science and Policy, Sustainability, Wildlife, Forestry and Fisheries.

<sup>D</sup> Departmental Honors Thesis (BE H300/H301/H400) is available for qualifying Junior/Senior students.

<sup>E</sup> Biosystems Engineering majors are encouraged to consider possibilities of graduate study early in the undergraduate program and plan accordingly; including the possibility of participating in Clemson's BS/MS program wherein six credits may count in both the BS and a MS degree.

Proposed changes to BE curriculum:

| Change # | Current  | Change To  | Notes  |
|----------|--|--|--|
| 1        | ENGR 130 2(2,2)  | ENGR 141 3(3,2)  | To coincide with other engineering curricula                                     |
| 2        | ECE 307 2(2,0)   | ECE 307 + 309 1(0,1)   | Student assessment indicates lab content helps understanding of lecture material |
| 3        | BE 222 2(1,3)<br>Geomeasurements                                 | BE 320 3(2,3)<br>Geomatics                                       | Course changed to add 1 hr lecture to existing course                            |
| 4        | BE 415 4(3,3)  | Engineering option   | Lack of faculty resources prevents offering of BE 415                            |
| 5        | In Ecological emphasis –<br>Engr option 3 cr<br>Ecol option 3 cr | In Ecological emphasis –<br>Engr option 2 cr<br>Ecol option 4 cr | Ecological option with lab needed for ecological emphasis students               |
| 6        | Change in course sequences (see below)                           |  |  |

**1. Change ENGR 130 to ENGR 141** – ENGR 130 being dropped.

**2. Add ECE 309 lab concurrent with ECE 307** – assessment data indicates lab content aids in understanding of lecture material.

**E C E 309 Electrical Engineering Laboratory I 1(0,2)** Laboratory to accompany ECE 307. Basic electrical circuits and instrumentation. *Coreq:* ECE307.

**3. BE 222- 2(1,3) Geomeasurements replaced with BE 320 – 3(2,3) Geomatics.** Additional lecture hour added.

**4. Change BE 415/615 to an engineering option** – due to lack of faculty resources; this course cannot be offered.

**B E 415, 615 Instrumentation and Control for Biosystems Engineers 4(3,3)** overview of modern instrumentation techniques and digital electronic components and subsystems to integrate them into digital data acquisition and control systems for biosystems. Laboratory use of equipment is emphasized. topics include characteristics of instruments, signal conditioning, transducer theory and applications, programmable logic controllers, and digital data acquisition and control.

**5. Ecological option with lab needed for ecological emphasis.**

**6. Course sequence changes:**

BE 210 and BE 212 switched. BE 212 is better first course for sophomores.

BE 475 moved to Fall semester senior year. Assessment data indicated seniors lose focus during second semester, senior year. A one-semester senior design series consisting of BE 474 and 475 is incorporated.

## Second Semester

- 3 - BIOCH 305 Essential Elements of Biochem.
- 3 - BIO E 321 Biofluid Mechanics
- 3 - MTHSC 302 Statistics for Science and Engr.
- 3 - Bioengineering Technical Requirement<sup>3</sup>
- 3 - Arts and Humanities Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>

15

## Senior Year

### First Semester

- 3 - BIO E 370 Bioinstrumentation and Bioimaging
- 3 - BIO E 401 Bioengineering Design Theory
- 3 - BIOSC 461 Cell Biology
- 3 - MS&E 415 Intro. to Polymer Science and Engr.
- 3 - Bioengineering Technical Requirement<sup>3</sup>

15

### Second Semester

- 1 - BIO E 400 Senior Seminar
- 3 - BIO E 403 Applied Biomedical Design
- 3 - BIO E 448 Tissue Engineering
- 6 - Arts and Humanities Requirement<sup>1</sup> or
- 6 - Social Science Requirement<sup>1</sup>
- 3 - Bioengineering Technical Requirement<sup>3</sup>

16

128 Total Semester Hours

<sup>1</sup>See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>2</sup>Students planning to enter medical school should take CH 223/227 instead of CH 201 and take CH 224/228 as an additional course sequence. Students planning to enter medical school should also take physics laboratories as additional courses (PHYS 124 and PHYS 223).

<sup>3</sup>Select from department-approved list.

Note: To transfer from General Engineering into the Bioengineering degree program, students must have a minimum cumulative grade-point ratio of 3.0 in courses taken at Clemson and must have earned a C or better in each course in the General Engineering freshman curriculum including the Arts and Humanities/Social Science Requirements.

## BIOSYSTEMS ENGINEERING

### Bachelor of Science

The principal objective of the Biosystems Engineering program is to educate and prepare students for a wide range of engineering endeavors involving biological entities. Two main areas are supported: engineering for management of natural resources and the environment and engineering for production of value-added products from bioprocessing technologies.

Biosystems engineers work at the interface between engineering and life sciences and must be knowledgeable in both disciplines. In addition to the common objectives of all engineering programs listed on page 87, Biosystems Engineering students should achieve familiarity with both biosystems concentrations, experience an interdisciplinary education, and develop a career goal of professional recognition and licensure.

Students develop specialization in one of two emphasis areas. The Bioprocessing Engineering area equips students to apply engineering and biological sciences to problem solving for biological systems and production of value-added bioproducts in a wide range of industries.

The Ecological Engineering area equips students to apply engineering, agricultural, and environmental sciences to assess and control the impact of human activities on the biosphere.

Students are urged to complete a minor and participate in the Cooperative Education, Biosystems Engineering Intern, and/or Study Abroad Programs. Those interested in medical careers should consider graduate study and/or medical school.

Additional information is available from the departmental offices or at: <http://www.clemson.edu/cafs/departments/biosystemseug/index.html>.

### Combined Bachelor's/Master's Program

Under this plan, students may reduce the time necessary to earn both degrees by applying graduate credits to both undergraduate and graduate program requirements.

Undergraduate students in Biosystems Engineering may begin a Master of Science or a Master of Engineering Degree in Environmental Engineering and Science or Master of Science Degree in Bioengineering while completing the BS degree.

Students are encouraged to obtain the specific requirements for the dual degree from the academic departments involved as early as possible in their undergraduate program. See *Academic Regulations* in this catalog for enrollment guidelines and procedures.

## Freshman Year

### First Semester

- 2 - CES 102 Engineering Disciplines and Skills
- 4 - CH 101 General Chemistry
- 3 - ENGL 103 Accelerated Composition
- 4 - MTHSC 106 Calculus of One Variable I
- 3 - Arts and Humanities Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>

16

### Second Semester

- 4 - CH 102 General Chemistry
- 2 - ENGR 130 Engineering Fundamentals
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - PHYS 122 Physics with Calculus I
- 3 - Arts and Humanities Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>

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## Sophomore Year

### First Semester

- 2 - B E 210 Intro. to Biosystems Engineering
- 3 - C E 201 Statics<sup>2</sup>
- 4 - MTHSC 206 Calculus of Several Variables
- 3 - PHYS 221 Physics with Calculus II
- 4-5 - Biology Requirement<sup>3</sup>

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## Second Semester

- 2 - B E 212 Fundamentals of Biosystems Engr.
- 2 - C E 208 Dynamics<sup>2</sup>
- 2 - E G 210 Computer-Aided Design and Engineering Applications
- 3 - M E 310 Thermodynamics and Heat Transfer or
- 3 - CH E 220 Chem. Engr. Thermodynamics I
- 4 - MICRO 305 General Microbiology
- 4 - MTHSC 208 Intro. to Ordinary Diff. Equations

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## Junior Year

### First Semester

- 2 - B E 222 Geomeasurements
- 3 - B E 410 Biol. Kinetics and Reactor Modeling
- 3 - CH 223 Organic Chemistry
- 1 - CH 227 Organic Chemistry Laboratory
- 2 - E C E 307 Basic Electrical Engineering
- 3 - Mechanics of Materials Requirement<sup>4</sup>
- 3 - Arts and Humanities Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>

17

### Second Semester

- 3 - B E 322 Small Watershed Hydrology and Sedimentology
- 3 - B E 412 Heat and Mass Transport in B E
- 4 - B E 415 Instrumentation and Control for Biosystems Engineers
- 3 - B E 438 Bioprocess Engineering Design
- 4 - C E 341 Introduction to Fluid Mechanics

17

<sup>1</sup>See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>2</sup>M E 201 may be substituted for C E 201 and 208

<sup>3</sup>BIOE 103/105 or 110

<sup>4</sup>C E 206 or M E 302

## BIOPROCESS ENGINEERING EMPHASIS AREA

### Senior Year

#### First Semester

- 3 - B E 428 Biochemical Engineering
- 2 - B E 474 Biosystems Engr. Design/Project Mgt.
- 3 - BIOCH 305 Essential Elements of Biochemistry
- 2 - BIOSC 434 Biological Chemistry Lab. Techniques
- 3 - BIOSC 441 Ecology
- 3 - Arts and Humanities Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>

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#### Second Semester

- 2 - B E 475 Biosystems Engr. Capstone Design
- 6 - Engineering Requirement<sup>2</sup>
- 3 - Life Science Requirement<sup>1</sup>
- 3 - Arts and Humanities Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>

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129 Total Semester Hours

<sup>1</sup>See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.

<sup>B</sup> E 314, 408, 414, 417, 422, 440, 464, 473, 484, C E 321, 352, 402, 406, 482, EE&S 401, 402, 410, 430, 480, 484, 485, 486, I E 384, GEOL 421, or any other pre-approved engineering course. Students accepted to a combined BS/MS program must take 600-level instead of 400-level courses for Engineering Requirements.

<sup>A</sup>ny BIOCH, BIOSC, BIOL, CH, CSENV, GEN, MICRO or W F B course at the 300 level or higher.

## ECOLOGICAL ENGINEERING EMPHASIS AREA

### Senior Year

#### First Semester

- 2 - B E 474 Biosystems Engr. Design/Project Mgt.
- 3 - BIOSC 441 Ecology
- 3 - Ecological Requirement<sup>1</sup>
- 3 - Engineering Requirement<sup>2</sup>
- 3 - Arts and Humanities Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>

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#### Second Semester

- 2 - B E 421 Engineering Systems for Soil Water Mgt.
- 3 - B E 424 Ecological Engineering
- 2 - B E 475 Biosystems Engr. Capstone Design
- 3 - Ecological Requirement<sup>1</sup>
- 3 - Engineering Requirement<sup>2</sup>
- 3 - Arts and Humanities Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>

16

129 Total Semester Hours

<sup>B</sup> E 464, BIOSC 410, 413, 428, 443, 446, CSENV 202, ENTOX 437, F N R 466, GEOL 408

<sup>B</sup> E 314, 408, 414, 417, 422, 440, 464, 473, 484, C E 321, 352, 402, 406, 482, EE&S 401, 402, 410, 430, 480, 484, 485, 486, I E 384, GEOL 421, or any other pre-approved engineering course. Students accepted to a combined BS/MS program must take 600-level instead of 400-level courses for Engineering Requirements.

<sup>2</sup>See Policy on Humanities and Social Sciences for Engineering Curricula. Six of these credit hours must also satisfy General Education Cross-Cultural Awareness and Science and Technology in Society Requirements.

#### Notes:

1. Biosystems Engineering students are allowed to enroll in upper-level B E courses only when the following prerequisites have been completed with C or better: C E 201, 206, 208, 341, CH E 220, 230, M E 201, 302, 310, MTHSC 206, 208, PHYS 221.
2. Biosystems Engineering students are encouraged to complete a minor, cooperative education program, internship (B E 370) and/or study abroad program. Probable minors include Environmental Engineering or Environmental Science and Policy.
3. A Departmental Honors Thesis (B E H300/H301/H400) is available to qualified juniors and seniors.
4. Biosystems Engineering majors are encouraged to consider possibilities of graduate study early in the undergraduate program and plan accordingly, including the possibility of participating in the Combined Bachelor's/Master's Program, wherein six credits may count in both the BS and MS degree. Probable graduate programs include Biosystems Engineering, Environmental Engineering, and other engineering and non-engineering programs. An agreement exists for the Combined Bachelor's/Master's Program in Biosystems Engineering.
5. Students are required to update their portfolios for each course completed.

## CHEMICAL ENGINEERING

### Bachelor of Science

The Department of Chemical and Biomolecular Engineering offers the Bachelor of Science degree in Chemical Engineering. Chemical Engineering students select one of several emphasis areas (such as energy studies or environmental engineering), a concentration in Biomolecular Engineering (to prepare them for medical school or a career in biotechnology), or any approved minor.

Chemical engineering is based on chemistry, biology, physics, and mathematics. The curriculum at Clemson includes classroom and laboratory instruction and emphasizes broadly applicable fundamental principles and current technology to prepare graduates for professional practice and professional growth. The Educational Objective of the BS degree program is for graduates to have careers characterized by:

- success in chemical engineering practice, post-graduate education, or other areas making use of engineering skills, as defined by accomplishments and/or job satisfaction;
- demonstrated success in the design of chemical processes and/or identification, formulation, and solution of chemical engineering problems;
- ethical behavior in all endeavors;
- demonstrated effectiveness in teamwork, communication, and service to society through professional contributions;
- demonstrated technical and/or managerial leadership; and
- demonstrated commitment to lifelong learning.

Chemical engineers are involved in the research, manufacture, sales, and use of commodity and specialty chemicals, fuels, pharmaceuticals, electronic components, synthetic fibers and textiles, food and consumer goods, and many other products. They work on environmental pollution prevention and remediation and apply engineering science to solve medical and health-related problems.

### Combined Bachelor of Science/ Master of Science

Qualified students can reduce the time to earn a Master's Degree by applying graduate credits to both the Bachelor's and Master's program requirements. Undergraduate Chemical and Biomolecular Engineering students who have earned a grade-point ratio of 3.4 or above and completed 90 credit hours can begin work toward a Master of Science in Chemical Engineering or a Master of Science or Master of Engineering in Environmental Engineering and Science by selecting approved graduate courses for their emphasis area. Details are available in the ChBE Undergraduate Handbook, which can be found at [www.clemson.edu/ces/chbe](http://www.clemson.edu/ces/chbe).

### Freshman Year

#### First Semester

- 2 - CES 102 Engineering Disciplines and Skills
- 4 - CH 101 General Chemistry
- 3 - ENGL 103 Accelerated Composition
- 4 - MTHSC 106 Calculus of One Variable I
- 3 - Arts and Humanities Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>

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### Second Semester

- 4 - CH 102 General Chemistry
- 2 - CH E 130 Chemical Engineering Tools
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - PHYS 122 Physics with Calculus I
- 3 - Arts and Humanities Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>

16

### Sophomore Year

#### First Semester

- 3 - CH 223 Organic Chemistry
- 4 - CH E 211 Intro. to Chemical Engineering
- 4 - MTHSC 206 Calculus of Several Variables
- 3 - PHYS 221 Physics with Calculus II
- 3 - Arts and Humanities Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>

17

#### Second Semester

- 3 - CH 224 Organic Chemistry
- 1 - CH 229 Organic Chemistry Lab.
- 3 - CH E 220 Chemical Engr. Thermodynamics I
- 4 - CH E 230 Fluids/Heat Transfer
- 4 - MTHSC 208 Intro. to Ordinary Diff. Equations

15

### Junior Year

#### First Semester

- 3 - BIOCH 305 Essential Elements of Biochem.
- 1 - CH 339 Physical Chemistry Lab.
- 3 - CH E 307 Unit Operations Lab. I
- 3 - CH E 319 Engineering Materials
- 2 - E C E 307 Basic Electrical Engineering
- 1 - E C E 309 Electrical Engineering Lab. I
- 3 - EX ST 411 Statistical Methods for Process Development and Control

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#### Second Semester

- 3 - CH 332 Physical Chemistry
- 1 - CH 340 Physical Chemistry Lab.
- 3 - CH E 321 Chemical Engr. Thermodynamics II
- 4 - CH E 330 Mass Transfer and Separation Proc.
- 3 - Arts and Humanities Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>
- 3 - Emphasis Area Requirement<sup>2</sup>

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### Senior Year

#### First Semester

- 3 - CH E 407 Unit Operations Lab. II
- 3 - CH E 431 Chemical Process Design I
- 1 - CH E 443 Chemical Engr. Senior Seminar I
- 3 - CH E 450 Chemical Reaction Engineering
- 3 - Arts and Humanities Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>
- 3 - Emphasis Area Requirement<sup>2</sup>

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#### Second Semester

- 3 - CH E 353 Process Dynamics and Control
- 3 - CH E 433 Process Design II
- 1 - CH E 444 Chemical Engr. Senior Seminar II
- 3 - MICRO 413 Industrial Microbiology
- 3 - Arts and Humanities Requirement<sup>1</sup> or
- 3 - Social Science Requirement<sup>1</sup>
- 3 - Emphasis Area Requirement<sup>2</sup>

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## Curriculum and Course Change System - Print Change/Delete Course Form

000117

**X Change a Course - Abbrev & Number: B E- 222**  
 Corresponding Lab Course: B E-L-222  
 Corresponding Honors course: --  
 .. **Add Honors course:** --  
 Corresponding Graduate course: --  
 .. **Add Graduate course:** --  
**Course Title: GEOMEASUREMENTS**

**Brief Statement of Change:**

Proposal is for BE 222 to increase from 2 credit hours to 3 credit hours essential to increase the GIS/GPS content and geomesurements problem solving content of the syllabus.

|   |                                   |
|---|-----------------------------------|
| Last Term taught: 1108                    | .. <b>Change Abbrev to:</b>       |
| Effective Term: 01/2013                   | <b>X Change Number to: 320</b>    |
| <b>X Change Catalog Title:</b>            | <b>X Change Transcript Title:</b> |
| from: GEOMESUREMENTS                      | from: GEOMEASUREMENTS             |
| to: PRINCIPLES AND PRACTICES OF GEOMATICS | to: GEOMATICS                     |

|                           |                             |                            |
|---------------------------|-----------------------------|----------------------------|
| <b>X Change of Credit</b> | From: Fixed Credit: 2 (1,3) | To: Fixed Credit: 3 (2,3)  |
|                           | Variable Credit: - (-), (-) | Variable Credit: - (-),(-) |

.. **Add cross-listing with the following child course(s):**

.. **Delete cross-listing with the following child course(s):**

.. **Reverse Parent/Child relationship with:**

| .. <b>Change Method of Instruction</b> |     | .. <b>Change Course Modifier</b> |     | .. <b>Change General Education Designation</b> |     |
|--|-----|----------------------------------|-----|--|-----|
| from:                                  | to: | from:                            | to: | from:  | to: |
| .. A-Lecture Only                      | ..  | .. Pass/Fail Only                | ..  | .. English                                     | ..  |
| .. B-Lab (w/fee)                       | ..  | .. X Graded                      | ..  | .. Composition                                 | ..  |
| .. D-Seminar                           | ..  | .. Variable Title                | ..  | .. Oral  | ..  |
| .. E-Independent                       | ..  | .. Creative Inquiry              | ..  | .. Communication                               | ..  |
| .. Study                               | ..  | .. Repeatable                    | ..  | .. Mathematics                                 | ..  |
| .. F-Tutorial (w/fee)                  | ..  | .. maximum credits               | ..  | .. Natural Science                             | ..  |
| .. G-Studio                            | ..  | from:                            | ..  | .. w/Lab                                       | ..  |
| .. H-Field course                      | ..  | to:                              | ..  | .. Math or Science                             | ..  |
| .. I-Study Abroad                      | ..  |                                  | ..  | .. A&H (Literature)                            | ..  |
| .. L-Lab (no/fee)                      | ..  |                                  | ..  | .. A&H (Non-                                   | ..  |
| .. N/B-Lecture/Lab                     | ..  |                                  | ..  | .. Literature)                                 | ..  |
| X (w/fee)                              | ..  |                                  | ..  | .. Social Science                              | ..  |
| .. N/L-Lecture/Lab(no                  | ..  |                                  | ..  | .. CCA   | ..  |
| .. fee)                                | ..  |                                  | ..  | .. STS   | ..  |

**X Change Catalog Description:**

**from:** Fundamentals of land measurement and traverse calculations. Leveling, earthwork, area, and topographic measurements using levels, total stations, and GPS. Application of Mapping via GIS.

**to:** Basic surveying measurements and computations for engineering project control, mapping, and construction layout. Leveling, earthwork, area, and topographic measurements using levels, total stations, and GPS. Application of Mapping via GIS.

**X Change Prerequisite(s):**

**from:** MTHSC 106

**to:** MTHSC 106

**Learning Objectives:** 1. Demonstrate the ability to work within a team environment

2. Demonstrate an ability to solve surveying problems using mathematics, GPS and GIS.

3. Learn how to design a traverse, take observations, perform computations, and analyze and interpret the data

4. Recognize the importance of surveying in other disciplines and consequences of dishonesty during observation, computation, and reporting of survey data

5. Plot the map and write a report

**Topical Outline:** 1. Introduction (Week 1)

2. Linear measurements (Week 1)

Maps and GPS Navigation (Week 1 Lab)

3. Units and significant Figures (Week 2)

4. Problems Solving in Linear measurements (Week 2)

Distance Measurements (Week 2 Lab.)

5. Leveling: Introduction (Week 3)

6. Equipment for Differential leveling (Week 3)

Differential Leveling I (week 3 Lab.)

7. Leveling: Differential, Profile, and Grid leveling (Week 4)

8. Leveling: Problem solving (Week 4)

Differential Leveling II (Week 4 Lab.)

9. Test # 1 (Week 5)

10. Total station applications (Week 5)

Profile leveling (Week 5. Lab)

11. Angular Measurements: Introduction to bearing, azimuths and conversions (Week 6)

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12. Angular Measurements: Balancing angles and computations (Week 6)  
 Grid leveling (Week 6. Lab)  
 13. Rectangular coordinates of Traverse Stations (Week 7)  
 14. Illustrative problems in Rectangular Coordinates (Week 7)  
 Topographic Surveying (Week 7. Lab)  
 15. Satellite Position; Introduction (Week 8)  
 16. GPS position measurements (Week 8)  
 Total Station Setup and Use (Week 8. Lab)  
 17. GPS error (Week 9)  
 18. GPS field procedures (Week 9)  
 Random Traverse using Total Station (Week 9. Lab)  
 19. GPS applications (Week 10)  
 20. Test # 2 (Week 10)  
 Boundary Retrace using Total Station (Week 10. Lab)  
 21. Topographic Survey and Mapping: Introduction (Week 11)  
 22. Maps and Plans (Week 11)  
 Creating Data Dictionary using GPS (Week 11. Lab)  
 23. Introduction to contours (Week 12)  
 24. Topographic field surveys (Week 12)  
 Almanac, Mission Planning and data Collection Using GPS Receiver (Week 12. Lab)  
 25. Topographic Survey: Problem solving (Week 13)  
 26. Construction surveys: Introduction (Week 13)  
 GPS Data Processing (Week 13. Lab)  
 27. Construction controls (Week 14)  
 28. Building construction (Week 14)  
 GPS/GIS Mapping I (Week 14. Lab)  
 29. US public survey system, Role of surveyors and ethics in surveying (Week 15)  
 30. Test # 3 (Week 15)  
 GPS/GIS Mapping II (Week 15. Lab)


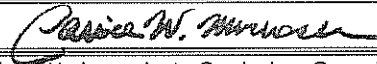
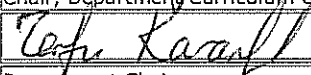
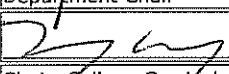

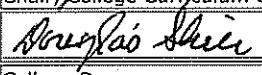
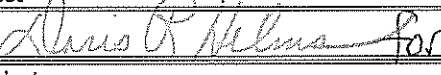
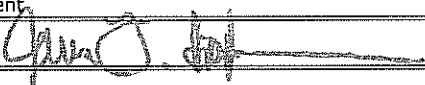
**Evaluation:** Three Tests, 33%; Homework, 10%; Lab, 40%; Final Exam, 12%; Quizzes 5%  
**Grading Scale:** A(90-100), B(80-90), C(70-80), D(60-70), F (<60)

**Form Originator:** TOWINO, Tom Owino **Date Form Created:** 10/28/2012

**Form Last Updated by:** , **Date Form Last Updated:** 11/9/2012

**Form Number:** 5571

#### Approval

|   |             |  |           |
|---|-------------|--|-----------|
|   | 12 Nov 2012 |   | 12/7/2012 |
| Chair, Department Curriculum Committee  | Date        | Chair, Undergraduate Curriculum Committee  | Date      |
|  | 11/12/12    |  |           |
| Department Chair  | Date        | Chair, Graduate Curriculum Committee   | Date      |
|  | 11/19/12    |  | 2/3/13    |
| Chair, College Curriculum Committee   | Date        | Provost  | Date      |
|  | 11/19/12    |  | 2/3/13    |
| College Dean  | Date        | President  | Date      |
|   |             |  |           |
| Director, Calhoun Honors College  | Date        |  |           |



CLEMSON

UNIVERSITY Curriculum and Course Change System - Print Change/Delete Course Form

000119

**X Change a Course - Abbrev & Number: B E- 440**  
 Corresponding Lab Course: B E-L-440  
 Corresponding Honors course: --  
 .. **Add Honors course:** --  
 Corresponding Graduate course: B E- -640  
 .. **Add Graduate course:** --  
**Course Title: RENEWABLE ENERGY ENG**

**Brief Statement of Change:**

change of prerequisite for 440/640

Last Term taught: 1206  
 Effective Term: 01/2013

.. **Change Abbrev to:**  
 .. **Change Number to:**

**X Change Catalog Title:**  
 from: Renewable Energy Engineering  
 to: Sustainable Energy Engineering

**X Change Transcript Title:**  
 from: RENEWABLE ENERGY ENG  
 to: Sustain Energy Eng

.. **Change of Credit** From: Fixed Credit: 3 (2,2) To: Fixed Credit: (,) Variable Credit: - (-), (-) Variable Credit: - (-),(-)

**X Add cross-listing with the following child course(s): CE 440/640**.. **Delete cross-listing with the following child course(s):**.. **Reverse Parent/Child relationship with:**

| .. <b>Change Method of Instruction</b> |     | .. <b>Change Course Modifier</b> |     | .. <b>Change General Education Designation</b> |     |
|--|-----|----------------------------------|-----|--|-----|
| from:                                  | to: | from:                            | to: | from:  | to: |
| .. A-Lecture Only                      | ..  | .. Pass/Fail Only                | ..  | English  |     |
| .. B-Lab (w/fee)                       | ..  | X Graded                         | ..  | .. Composition                                 | ..  |
| .. D-Seminar                           | ..  | .. Variable Title                | ..  | Oral   |     |
| E-Independent                          | ..  | .. Creative Inquiry              | ..  | .. Communication                               | ..  |
| .. Study                               | ..  | .. Repeatable                    | ..  | .. Mathematics                                 | ..  |
| .. F-Tutorial (w/fee)                  | ..  | maximum credits                  |     | Natural Science                                |     |
| .. G-Studio                            | ..  | from:                            |     | .. w/Lab                                       | ..  |
| .. H-Field course                      | ..  | to:                              |     | .. Math or Science                             | ..  |
| .. I-Study Abroad                      | ..  |                                  |     | .. A&H (Literature)                            | ..  |
| .. L-Lab (no/fee)                      | ..  |                                  |     | A&H (Non-                                      |     |
| N/B-Lecture/Lab                        |     |                                  |     | .. Literature)                                 | ..  |
| X (w/fee)                              | ..  |                                  |     | .. Social Science                              | ..  |
| N/L-Lecture/Lab(no                     |     |                                  |     | .. CCA   | ..  |
| .. fee)                                | ..  |                                  |     | .. STS   | ..  |

.. **Change Catalog Description:**

from:  
 to:

**X Change Prerequisite(s):**

from: Science or engineering major, consent of instructor

to: Junior or senior standing in engineering - for 440 enrollment(none) - for 640 enrollment

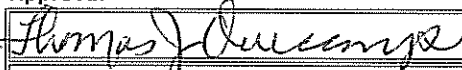
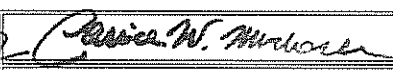
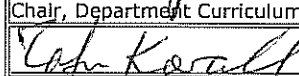


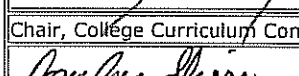
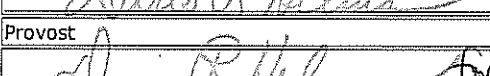

**Learning Objectives:****Topical Outline:****Evaluation:**

Form Originator: CDRAPCH, Caye Drapcho Date Form Created: 11/2/2012

Form Last Updated by: , Date Form Last Updated: 11/3/2012

Form Number: 5595

**Approval**

|   |            |  |           |
|---|------------|--|-----------|
|  | 12/10/2012 |  | 12/7/2012 |
| Chair, Department Curriculum Committee  | Date       | Chair, Undergraduate Curriculum Committee  | Date      |
|  | 11/12/12   |  |           |
| Department Chair  | Date       | Chair, Graduate Curriculum Committee   | Date      |
|  | 11/19/12   |  | 2/3/13    |
| Chair, College Curriculum Committee   | Date       | Provost  | Date      |
|  | 11/19/12   |  | 2/3/13    |
| College Dean  | Date       | President  | Date      |
|   |            |  |           |

|  |      |  |      |
|--|------|--|------|
| Director, Calhoun Honors College                                     |      | Date   |      |
| Approvals related to cross-listing require the following signatures: |      |  |      |
|  |      |  |      |
| [Child Course] Chair, Department Curriculum Committee                | Date | [Child Course] Chair, College Curriculum Committee | Date |
|  |      |  |      |
| [Child Course] Department Chair                                      | Date | [Child Course] College Dean                        | Date |



## Curriculum and Course Change System - Print Change/Delete Course Form

X Change a Course - Abbrev &amp; Number: B E- 438

Corresponding Lab Course: B E-L-438

Corresponding Honors course: --

.. Add Honors course: --

Corresponding Graduate course: B E- -638

.. Add Graduate course: --

Course Title: BIOPROCESS ENG DES

## Brief Statement of Change:

Change Prerequisite of BE 428 to Concurrent prerequisite of BE 410 or ChE 330 or EES 402. Prerequisite for BE 638 is proposed to be removed.

Last Term taught: 1201

Effective Term: 01/2013

.. Change Abbrev to:

.. Change Number to:

.. Change Catalog Title:

from:

to:

.. Change Transcript Title:

from: BIOPROCESS ENG DES

to:

.. Change of Credit

From: Fixed Credit: 3 (2,2)

To: Fixed Credit: (,)

Variable Credit: - (-), (-)

Variable Credit: - (-), (-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| .. Change Method of Instruction | .. Change Course Modifier | .. Change General Education Designation |
|---------------------------------|---------------------------|---|
| from: to:                       | from: to:                 | from: to:                               |
| .. A-Lecture Only               | .. Pass/Fail Only         | .. English                              |
| .. B-Lab (w/fee)                | X Graded                  | .. Composition                          |
| .. D-Seminar                    | .. Variable Title         | .. Oral                                 |
| .. E-Independent                | .. Creative Inquiry       | .. Communication                        |
| .. Study                        | .. Repeatable             | .. Mathematics                          |
| .. F-Tutorial (w/fee)           | .. maximum credits        | .. Natural Science                      |
| .. G-Studio                     | from:                     | .. w/Lab                                |
| .. H-Field course               | to:                       | .. Math or Science                      |
| .. I-Study Abroad               |                           | .. A&H (Literature)                     |
| .. L-Lab (no/fee)               |                           | .. A&H (Non-                            |
| .. N/B-Lecture/Lab              |                           | .. Literature)                          |
| X (w/fee)                       |                           | .. Social Science                       |
| .. N/L-Lecture/Lab(no           |                           | .. CCA                                  |
| .. fee)                         |                           | .. STS                                  |

## .. Change Catalog Description:

from:

to:

## X Change Prerequisite(s):

from: BE 428

to: Concurrent prerequisite of BE 410 or ChE 330 or EES 402.

## Learning Objectives:

## Topical Outline:

## Evaluation:

Form Originator: WALKER4, Terry Walker Date Form Created: 11/2/2012

Form Last Updated by: , Date Form Last Updated: 11/2/2012

Form Number: 5594

## Approval

|  |            |   |            |
|--|------------|---|------------|
| <i>Thomas J. Overcamp</i>              | 12/07/2012 | <i>Cassie W. Anderson</i>                 | 12/07/2012 |
| Chair, Department Curriculum Committee | Date       | Chair, Undergraduate Curriculum Committee | Date       |
| <i>Carla K. Kraft</i>                  | 11/12/12   |   |            |
| Department Chair                       | Date       | Chair, Graduate Curriculum Committee      | Date       |
| <i>[Signature]</i>                     | 11/19/12   | <i>Chris R. Nelson</i>                    | 2/3/13     |
| Chair, College Curriculum Committee    | Date       | Provost                                   | Date       |
| <i>Debra R. Davis</i>                  | 11/19/12   | <i>David R. Nelson for</i>                | 2/3/13     |
| College Dean                           | Date       | President                                 | Date       |
|  |            | <i>[Signature]</i>                        |            |
| Director, Calhoun Honors College       | Date       |   |            |

0000122



## Curriculum and Course Change System - Print New Course Form

**Course Abbreviation & Number:**  
 X New Undergraduate Course: EN SP- 201  
 .. New Honors Course: --  
 .. New Graduate Course: -

**Effective Term:** 01/2014

**Catalog Title:** Introduction to Environmental Science for Education Majors

**Transcript Title:** ENV SC for ED MAJ

**Fixed Credit Course:** 3 (3,0)

**Variable Credit Course:** - (-), (-)

| Method of Instruction | Course Modifier     | General Education Designation |
|-----------------------|---------------------|-------------------------------|
| X A-Lecture Only      | .. Pass/Fail Only   | English                       |
| .. B-Lab (w/fee)      | X Graded            | .. Composition                |
| .. D-Seminar          | .. Variable Title   | Oral                          |
| E-Independent         | .. Creative Inquiry | .. Communication              |
| .. Study              | .. Repeatable       | .. Mathematics                |
| .. F-Tutorial (w/fee) | maximum credits:    | Natural Science               |
| .. G-Studio           |                     | .. w/Lab                      |
| .. H-Field course     |                     | X Math or Science             |
| .. I-Study Abroad     |                     | .. A&H (Literature)           |
| .. L-Lab (no/fee)     |                     | A&H (Non-                     |
| N/B-Lecture/Lab       |                     | .. Literature)                |
| .. (w/fee)            |                     | .. Social Science             |
| N/L-Lecture/Lab(no    |                     | .. CCA                        |
| .. fee)               |                     | .. STS                        |

**Add cross-listing with the following child course(s):**

**Catalog Description:** Introduction to basic principles of environmental science including physical science of the environment, energy, resources, waste management, air and water pollution. It emphasizes the practical applications to demonstrations and activities appropriate for the elementary classroom. Credit toward a degree will be given for only one of ENSP 200 and ENSP 201.

**Prerequisite(s):** PH SC 117, PH SC 118, and BIOL 109; Concurrent.req: MTHSC 316 or consent of instructor.

**Projected Enrollment:**

Year 1 - 40 Year 2 - 40 Year 3 - 40 Year 4 - 40

**Required course for students in:** Elementary Education program with emphasis on science/math education

**Statement of need and justification based on assessment results of student learning outcomes:** This course fulfills a environmental science content requirement for students in the elementary education program. In order for the Elementary Education program to meet their accreditation requirements (i.e. ACEI SPA requirements), their students need to show evidence that they "know, understand, and use fundamental concepts of physical, life, and earth/space sciences" (ACEI SPA Standard 2.2 Science). This course provides content that will help them address that need.

**Textbook(s):** The Environment and You, by Christensen, 1st edition

**Learning Objectives:** • Develop analytical and critical thinking about environmental issues.

- Gain appreciation and understanding of the discipline of environmental science.
- Gain experience in the practical application of science to real-life problems and to do so with topics that generally are of personal interest and societal importance.
- Provide an adequate foundation in environmental science content that will enable future teachers to incorporate environmental science topics in elementary school.

**Topical Outline:** Week Topic

- 1 Environment, Sustainability, and Science
  - Environment and sustainability
  - Ecosystems
  - Acting Sustainably
- 2 Environmental Ethics, Economics, and Policy
  - Changing views of humans and nature
  - Environmental ethics
  - U.S. Environmental law and policy
  - International Environmental law and policy
- 3 The Physical Science of the Environment
  - Chemistry of the environment
  - The organic chemistry of life
- 4 The Physical Science of the Environment, Cont.
  - Earth's structure
  - Earth's atmosphere
  - Earth's energy budget, weather, and climate
- 5 Climate Change
  - Long-term climate patterns
  - Causes of global warming
  - Consequences of global warming
- 6 Air Quality
  - Air quality and air pollution
  - Indoor air pollution
  - Air pollution policy and law

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- 7 Water
  - Streams
  - Lakes and ponds
  - Groundwater
  - Wetlands
- 8 Water
  - Estuaries
  - Oceans
  - Strategies for conserving water
  - Water conservation policy and law
- 9 Nonrenewable Energy and Electricity
  - Energy production and consumption
  - Sources and environmental impacts of extraction of Coal, Oil, Natural gas, and nuclear power.
- 10 Renewable Energy and Energy Conservation
  - Hydropower
  - Wind power
  - Solar energy
  - Energy conservation
- 11 Waste Management
  - Wastewater
  - Solid waste
  - Hazardous, electronic, and radioactive waste
- 12 The Environment and Human Health
  - Introduction to public health
  - Physical hazards in the environment
  - Chemical hazards in the environment
  - Environmental change and human health
- 13 The Environment and You
  - What does the future holds?
  - Sustainable living
  - Environmental leadership
- 14 Big Theme Project Presentations
- 15 Big Theme Project Presentations, Cont., and Course Review

**Evaluation:** Homework assignments 20%  
 Class participation (attendance + class activities) 10%  
 Big theme project 20%  
 Two Exams (2@15%) 30%  
 Final Exam 20%

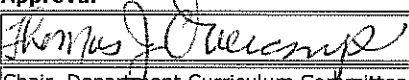
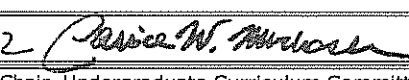

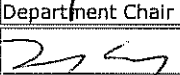

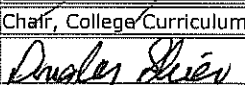
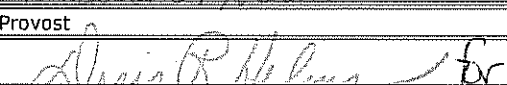
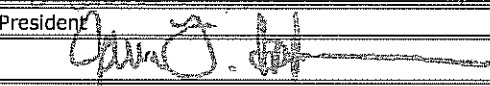
TOTAL 100%

Form Originator: MNAMMOU, Minory Nammouz Date Form Created: 11/8/2012

Form Last Updated by: , Date Form Last Updated: 11/14/2012

Form Number: 5634

## Approval

|   |             |   |            |
|---|-------------|---|------------|
|  | 14 Nov 2012 |     | 12/07/2012 |
| Chair, Department Curriculum Committee  | Date        | Chair, Undergraduate Curriculum Committee   | Date       |
|  | 11/14/12    |   |            |
| Department Chair  | Date        | Chair, Graduate Curriculum Committee  | Date       |
|  | 11/19/12    |     | 2/3/13     |
| Chair, College Curriculum Committee   | Date        | Provost   | Date       |
|  | 11/19/12    |  Sr | 2/3/13     |
| College Dean  | Date        | President   | Date       |
|   |             |     |            |
| Director, Calhoun Honors College  | Date        |   |            |
|   |             |   |            |



## Curriculum and Course Change System - Print New Course Form

000124

**Course Abbreviation & Number:**

X New Undergraduate Course: MTHSC- 411

.. New Honors Course: --

X New Graduate Course: MTHSC- 411

**Effective Term:** 08/2013**Catalog Title:** Introduction to Combinatorics**Transcript Title:** Intro Combinatorics**Fixed Credit Course:** 3 (3,0)**Variable Credit Course:** - (-), (-)

| Method of Instruction      | Course Modifier     | General Education Designation |
|----------------------------|---------------------|-------------------------------|
| X A-Lecture Only           | .. Pass/Fail Only   | .. English Composition        |
| .. B-Lab (w/fee)           | X Graded            | .. Oral Communication         |
| .. D-Seminar               | .. Variable Title   | .. Mathematics                |
| .. E-Independent Study     | .. Creative Inquiry | .. Natural Science w/Lab      |
| .. F-Tutorial (w/fee)      | .. Repeatable       | .. Math or Science            |
| .. G-Studio                | maximum credits:    | .. A&H (Literature)           |
| .. H-Field course          |                     | .. A&H (Non-Literature)       |
| .. I-Study Abroad          |                     | .. Social Science             |
| .. L-Lab (no/fee)          |                     | .. CCA                        |
| .. N/B-Lecture/Lab(w/fee)  |                     | .. STS                        |
| .. N/L-Lecture/Lab(no fee) |                     |                               |

**Add cross-listing with the following child course(s):****Catalog Description:** An introductory course in combinatorial analysis with topics including enumeration, graph theory, posets, and extremal combinatorics.**Prerequisite(s):** Prerequisites for 411: MthSc 311 and MthSc 119; Prerequisite for 611: MthSc 311**Projected Enrollment:**

Year 1 - 10 Year 2 - 15 Year 3 - 15 Year 4 - 20

**Required course for students in:****Statement of need and justification based on assessment results of student learning outcomes:** The proposed course will fill the gap created by MthSc 419 becoming a service course for ECE students. This course is meant to replace MthSc 419 in the abstract concentration. Furthermore, combinatorics arises in many areas of mathematics, including algebra, probability theory, topology, and geometry. It is also a useful tool in applied fields such as computer science, optimization, and physics. Hence, a course in combinatorics serves as a gateway to other areas of mathematical study and is a natural starting point for understanding the rigors of mathematical proofs and techniques.**Textbook(s):** A Walk Through Combinatorics: An introduction to Enumeration and Graph Theory, 3rd Edition by Miklos Bona  
or  
Introductory Combinatorics, 5th Edition by Richard Brualdi  
or  
another appropriate book.**Supplemental material:**

Proofs from THE BOOK, 4th Edition by Martin Aigner and Gunter M. Ziegler

**Learning Objectives:** Undergraduate Learning Objectives:

- 1) Be able to solve basic enumeration questions using standard counting formulas and linear recurrences, generating functions and exponential generating functions.
- 2) Be able to prove theorems and solve problems requiring asymptotic behavior of combinatorial structures.
- 3) Be able to solve problems and prove theorems related to integer partitions.
- 4) Be able to apply basic properties of partially ordered sets, such as extremal set theory and Sperner's lemma.
- 5) Be able to apply basic graph theoretic properties, such as Cayley's theorem for counting trees and the chromatic polynomial.

**Graduate Learning Objectives:**

- 1) Be able to solve intermediate enumeration questions using standard counting formulas and recurrences, generating functions, and exponential generating functions
- 2) Be able to develop generating functions and exponential generating functions to solve problems.
- 3) Be able to solve problems and prove theorems related to graph connectivity, planarity, and matchings.
- 4) Be able to apply Ramsey theory to posets, graphs, and other combinatorial structures.
- 5) Be able to apply the Mobius inversion formula to compute quantities in number theory.

**Topical Outline:** Topical Outline:

Basic Tools and Introduction (8 hours in total)

Introduction (1 hour)

Basic counting - permutations and combinations (2 hours)

Induction (1 hour)

Pigeonhole principle (1 hour)

Inclusion - exclusion principle (1 hour)

Binomial theorem (including Newton's generalization) (1 hour)  
The 12-Fold Way (1 hour)

Enumeration (10 hours in total)  
Recurrence relations (1 hour)  
Generating functions (2 hours)  
Special sequences (including Stirling numbers, Catalan numbers, and Fibonacci numbers) (2 hours)  
Continued fractions (1 hour)  
Partitions of integers (2 hours)  
Polya enumeration (2 hours)

Graph Theory (11 hours in total)  
Basic graph theory (1 hour)  
Eulerian and Hamiltonian paths (1 hour)  
Trees (1 hour)  
Connectivity (including Menger's theorem) (1 hour)  
Chromatic number (1 hour)  
Planarity (2 hours)  
Enumeration (including Cayley's formula and Kirchoff's theorem) (4 hours)

Matrices (5 hours in total)  
Matching (including bipartite graphs and Hall's theorem) (1 hour)  
Latin and magic squares (1 hour)  
Doubly stochastic matrices (1 hour)  
The permanent and Van de Waerden's conjecture (1 hour)  
Combinatorial designs (1 hour)

Posets (3 hours in total)  
Basic definitions (1 hour)  
Dilworth's theorem and Sperner's theorem (2 hours)

Additional topics (6 hours in total)  
Some possible additional topics include the following:  
Extremal combinatorics (including Ramsey theory) (2 hours)  
Asymptotic combinatorics (including the prime number theorem) (2 hours)  
Number theory (including multiplicative functions and Mobius inversion) (2 hours)

Exams (2 hours)

**Evaluation:** The grading scheme will be the standard 10 percentage points per letter scheme.

Undergraduate evaluation: There will be quizzes, homeworks, a final exam and 2 in-class exams. Quizzes will count for 15% of the final grade, homework will count for 15% of the final grade, the two in-class exams will each count for 20% of the final grade, and the final will count for 30% of the final grade.

Graduate evaluation: There will be additional additional 600-level questions on homeworks and exams. In addition, these students will have an additional project covering a topic which is related to, but not discussed in, the lecture material. Quizzes will count for 12% of the final grade, homework will count for 12% of the final grade, the two in-class exams will each count for 16% of the final grade, the final will count for 24% of the final grade, and the project will count for 20% of the final grade.

**Add course requirements for honors and/or 600-level courses (if applicable):** Graduate level credit:


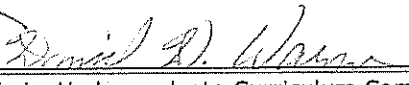
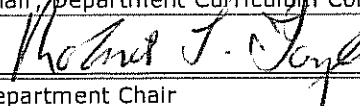
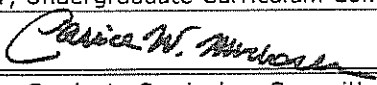
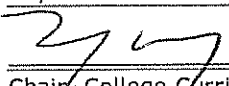

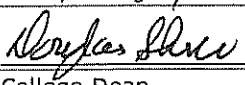

There will be additional 600-level questions on homeworks and exams. There will also be an additional project covering a topics which is related to, but not discussed in, the lecture material.

**Form Originator:** BURR2, Michael Burr **Date Form Created:** 10/2/2012

**Form Last Updated by:** , **Date Form Last Updated:** 11/6/2012

**Form Number:** 5407

**Approval**

|   |          |  |           |
|---|----------|--|-----------|
|  | 11-13-12 |  | 11/12/12  |
| Chair, Department Curriculum Committee  | Date     | Chair, Undergraduate Curriculum Committee  | Date      |
|  | 11-13-12 |  | 12/7/2012 |
| Department Chair  | Date     | Chair, Graduate Curriculum Committee   | Date      |
|   | 11/19/12 |  | 2/3/13    |
| Chair, College Curriculum Committee   | Date     | Provost  | Date      |
|   | 11/19/12 |  | 2/3/13    |
| College Dean  | Date     | President  | Date      |
|   |          |  |           |

|                                  |      |  |  |
|----------------------------------|------|--|--|
| Director, Calhoun Honors College | Date |  |  |
|                                  |      |  |  |

000126



000127



## Curriculum and Course Change System - Print New Course Form

**Course Abbreviation & Number:**

X New Undergraduate Course: MTHSC- 442

X New Honors Course: MTHSC-H-442

X New Graduate Course: MTHSC- 442

**Effective Term:** 08/2013**Catalog Title:** Advanced Mathematical Programming**Transcript Title:** Adv Math Prog**Fixed Credit Course:** 3 (3,0)**Variable Credit Course:** - (-), (-)

| Method of Instruction      | Course Modifier     | General Education Designation |
|----------------------------|---------------------|-------------------------------|
| X A-Lecture Only           | .. Pass/Fail Only   | .. English Composition        |
| .. B-Lab (w/fee)           | X Graded            | .. Oral Communication         |
| .. D-Seminar               | .. Variable Title   | .. Mathematics                |
| .. E-Independent Study     | .. Creative Inquiry | .. Natural Science            |
| .. F-Tutorial (w/fee)      | .. Repeatable       | .. w/Lab                      |
| .. G-Studio                | maximum credits:    | .. Math or Science            |
| .. H-Field course          |                     | .. A&H (Literature)           |
| .. I-Study Abroad          |                     | .. A&H (Non-Literature)       |
| .. L-Lab (no/fee)          |                     | .. Social Science             |
| .. N/B-Lecture/Lab(w/fee)  |                     | .. CCA                        |
| .. N/L-Lecture/Lab(no fee) |                     | .. STS                        |

**Add cross-listing with the following child course(s):**

**Catalog Description:** Theory, methodology, and applications of integer and nonlinear programming. Topics include model development, computer solutions, branch and bound, unconstrained and constrained optimization algorithms, complexity and convergence analysis. Case studies are included.

**Prerequisite(s):** MthSc 440 for MTHSC 442; MTHSC 640 or MTHSC 810 for MTHSC 642

**Projected Enrollment:**

Year 1 - 10 Year 2 - 10 Year 3 - 10 Year 4 - 10

**Required course for students in:** Mathematical Sciences Operations Research Concentration

**Statement of need and justification based on assessment results of student learning outcomes:**

Broad-based training in operations research requires exposure to a variety of techniques in mathematical programming. MthSc 440 covers basics of linear programming and network optimization, but additional exposure to integer and nonlinear programming will enhance professional and academic preparation of students in the operations research concentration of the Mathematical Sciences major.

**Textbook(s):** Katta G. Murty, Operations Research: Deterministic Optimization Models, Prentice Hall, 1995, or suitable alternative. Additional materials covering recent developments will be utilized.

**Learning Objectives:** Students will be able to formulate mathematical models of applications as integer and nonlinear programs, recognize problem classes and properties of problems that place them in different classes, identify and apply strategies for constructing solution methods for various problem classes, and use computer modeling systems and optimization codes to find solutions to applied problems. All students will be required to write in the case studies, supporting the use of this course as a capstone course.

**Topical Outline:** (Hours in parentheses.)

Modeling integer and combinatorial optimization problems (4).

Using computer-based tools to construct and solve optimization models(6).

The branch-and-bound algorithm for integer programs (4).

Heuristic and metaheuristic algorithms for integer programs (4).

Dynamic programming (4).

Modeling nonlinear optimization problems (3).

Optimality conditions for smooth problems (3).

Algorithms for unconstrained optimization on a line (2).

Algorithms for unconstrained optimization in higher dimensions (4).

Algorithms for constrained optimization problems (4).

Multiobjective models and efficient solutions (2).

Tests and student presentations (5).

**Evaluation:** For MTHSC 442: Periodic homework assignments 25%, midterm exams, 25%, final exam 30%, case studies 20%.

For MTHSC H 442: Periodic homework assignments 25%, midterm exams, 25%, final exam 30%, case studies 20%

009128

For MTHSC 642: Periodic homework assignments 15%, midterm exams, 20%, final exam 25%, case studies 20%, research project 20%.

MTHSC H 442 students will be required to consider additional criteria for their case studies.

MTHSC 642 students will be required to develop the rationale and supporting evidence for their approach, including an effective written and oral defense of the approach.

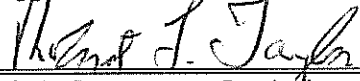
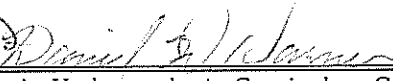
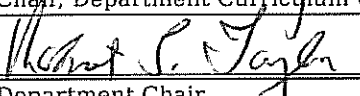

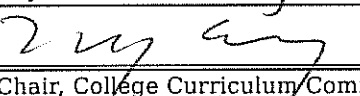

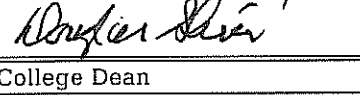
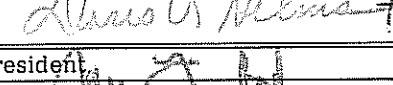
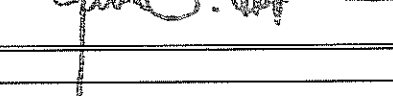
**Add course requirements for honors and/or 600-level courses (if applicable):** Additional project including class presentation.

**Form Originator:** MJS, Matthew Saltzman **Date Form Created:** 10/1/2012

**Form Last Updated by:** , **Date Form Last Updated:** 10/31/2012

**Form Number:** 5383

**Approval**

|   |          |  |           |
|---|----------|--|-----------|
|  | 11-11-12 |  | 11/12/12  |
| Chair, Department Curriculum Committee  | Date     | Chair, Undergraduate Curriculum Committee  | Date      |
|  | 11-13-12 |  | 12/7/2012 |
| Department Chair  | Date     | Chair, Graduate Curriculum Committee   | Date      |
|  | 11/19/12 |  | 2/3/13    |
| Chair, College Curriculum Committee   | Date     | Provost  | Date      |
|  | 11/19/12 |  | 2/3/13    |
| College Dean  | Date     | President  | Date      |
|   |          |  |           |
| Director, Calhoun Honors College  | Date     |  |           |
|   |          |  |           |



## Curriculum and Course Change System - Print New Course Form

000129

**Course Abbreviation & Number:**

X New Undergraduate Course: MTHSC- 455

X New Honors Course: MTHSC-H-455

X New Graduate Course: MTHSC- 455

**Effective Term:** 01/2013**Catalog Title:** Topics in Geometry**Transcript Title:** Topics in Geometry**Fixed Credit Course:** 3 (3,0)**Variable Credit Course:** - (-), (-)

| Method of Instruction      | Course Modifier     | General Education Designation |
|----------------------------|---------------------|-------------------------------|
| X A-Lecture Only           | .. Pass/Fail Only   | .. English Composition        |
| .. B-Lab (w/fee)           | X Graded            | .. Oral Communication         |
| .. D-Seminar               | .. Variable Title   | .. Mathematics                |
| .. E-Independent Study     | .. Creative Inquiry | .. Natural Science w/Lab      |
| .. F-Tutorial (w/fee)      | .. Repeatable       | .. Math or Science            |
| .. G-Studio                | maximum credits:    | .. A&H (Literature)           |
| .. H-Field course          |                     | .. A&H (Non-Literature)       |
| .. I-Study Abroad          |                     | .. Social Science             |
| .. L-Lab (no/fee)          |                     | .. CCA                        |
| .. N/B-Lecture/Lab(w/fee)  |                     | .. STS                        |
| .. N/L-Lecture/Lab(no fee) |                     |                               |

**Add cross-listing with the following child course(s):**

**Catalog Description:** This course will cover a variety of geometries, such as Euclidean, hyperbolic, projective, and spherical. The intrinsic properties of these spaces, such as their geodesics and isometries will be studied. Other topics include differential geometry of curves and surfaces, Gaussian curvature, and the celebrated Gauss-Bonnet theory linking geometry with topology.

**Prerequisite(s):** For MthSc 455: MthSc 206, MthSc 311, MthSc 119/~~419~~.

**Projected Enrollment:**

Year 1 - 15 Year 2 - 0 Year 3 - 15 Year 4 - 0

**Required course for students in:**

**Statement of need and justification based on assessment results of student learning outcomes:** We used to offer a yearly Topics in Geometry class (MthSc 408) but that is now a secondary math education course. This proposed course would be roughly what MthSc 408 used to be, which was an elective for the abstract mathematics concentration until 2011. The material is essential for both mathematics and physics students. In fact, several faculty members in the physics department have (very recently) strongly recommended to their undergraduate advisees to take a geometry class in the math department if it is offered.

**Textbook(s):** One of the following, or a suitable alternative:

- A Gateway to Modern Geometry: The Poincare Half-Plane, by S. Stahl
- Differential Geometry of Curves and Surfaces, by M. Do Carmo
- Elements of Differential Geometry, by Millman and Parker.

**Learning Objectives:** Upon successful completion of this course, students will be able to

- Analyze curves and surfaces in 2- and 3-dimensional space using the tools of calculus and linear algebra.
- Recognize and mathematically formalize different non-Euclidean geometries.
- Identify key features of a geometry, such as its geodesics and isometries.
- Write rigorous proofs on basic ideas and theorems in geometry.
- Construct surfaces via identification maps and classify all surfaces via invariants.

**Topical Outline:** 1. What is a geometry? (1 week)

2. Parametrized paths and surfaces (1 week)

3. Intrinsic properties of a geometry: geodesics, and Isometries (1 week)

4. Circle inversion, hyperbolic geometry, and models of the hyperbolic plane (1 weeks)

5. Basic properties of hyperbolic geometry such as lengths, angles, and triangles (2 weeks)

6. Classification of Euclidean and hyperbolic isometries, and analysis of isometries of the three types: elliptic, parabolic, hyperbolic (2 weeks)

7. Simplicial complexes, quotient maps, and construction of surfaces by identification (2 weeks)

8. Classification of surfaces, both orientable and non-orientable (2 weeks)

9. The Gauss map, Euler characteristic, Gaussian curvature, and the Gauss-Bonnet theorem (2 weeks)

**Evaluation:** For MthSc 455: Weekly homework (20%), 2 exams (40%), final exam (40%).

For MthSc 455H and 655: Weekly homework (20%), 2 exams (30%), final exam (30%), final project (20%).

**Add course requirements for honors and/or 600-level courses (if applicable):** Additional project including class presentation.

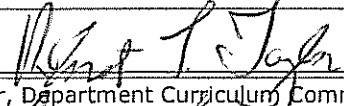
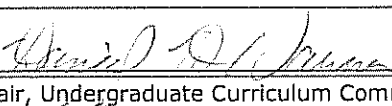

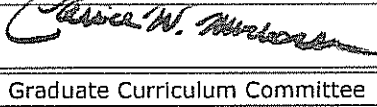
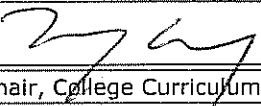
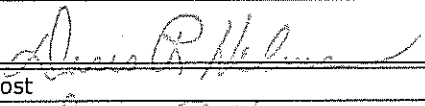
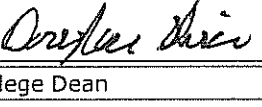
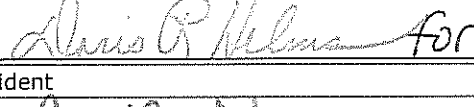

**Form Originator:** MACAULE, Matthew Macauley **Date Form Created:** 10/2/2012

Form Last Updated by: , Date Form Last Updated: 11/6/2012

Form Number: 5405

000130

## Approval

|   |          |  |           |
|---|----------|--|-----------|
|  | 11-13-12 |  | 11/12/12  |
| Chair, Department Curriculum Committee  | Date     | Chair, Undergraduate Curriculum Committee  | Date      |
|  | 11-13-12 |  | 12/7/2012 |
| Department Chair  | Date     | Chair, Graduate Curriculum Committee   | Date      |
|   | 11/19/12 |  | 2/3/13    |
| Chair, College Curriculum Committee   | Date     | Provost  | Date      |
|   | 11/19/12 |  | 2/3/13    |
| College Dean  | Date     | President  | Date      |
|   |          |  |           |
| Director, Calhoun Honors College  | Date     |  |           |
|   |          |  |           |



## Curriculum and Course Change System - Print New Course Form

000131

**Course Abbreviation & Number:**X **New Undergraduate Course:** MTHSC- 456X **New Honors Course:** MTHSC-H-456X **New Graduate Course:** MTHSC- 456**Effective Term:** 01/2013**Catalog Title:** Topology**Transcript Title:** Topology**Fixed Credit Course:** 3 (3,0)**Variable Credit Course:** - (-), (-)

| Method of Instruction      | Course Modifier     | General Education Designation |
|----------------------------|---------------------|-------------------------------|
| X A-Lecture Only           | .. Pass/Fail Only   | .. English Composition        |
| .. B-Lab (w/fee)           | X Graded            | .. Oral Communication         |
| .. D-Seminar               | .. Variable Title   | .. Mathematics                |
| .. E-Independent Study     | .. Creative Inquiry | .. Natural Science w/Lab      |
| .. F-Tutorial (w/fee)      | .. Repeatable       | .. Math or Science            |
| .. G-Studio                | maximum credits:    | .. A&H (Literature)           |
| .. H-Field course          |                     | .. A&H (Non-Literature)       |
| .. I-Study Abroad          |                     | .. Social Science             |
| .. L-Lab (no/fee)          |                     | .. CCA                        |
| .. N/B-Lecture/Lab(w/fee)  |                     | .. STS                        |
| .. N/L-Lecture/Lab(no fee) |                     |                               |

**Add cross-listing with the following child course(s):**

**Catalog Description:** Introduction to point-set topology. Topics include metric spaces, topological spaces, Hausdorff spaces, homeomorphisms, continuity, product and quotient spaces, compactness, and connectedness. Additional topics such as homotopy equivalence of paths, the fundamental group, and basic knot theory may be introduced as time permits.

**Prerequisite(s):** MthSc 456: MthSc 119/100.**Projected Enrollment:**

Year 1 - 15 Year 2 - 0 Year 3 - 15 Year 4 - 0

**Required course for students in:**

**Statement of need and justification based on assessment results of student learning outcomes:** A course in topology is essential for our undergraduates to be competitive for top graduate schools in mathematics as it is a standard undergraduate course at peer institutions. Not only is the material a necessary prerequisite for graduate work in mathematics, but it usually appears on the GRE math subject test. Topology plays a fundamental role in a wide range of areas of pure and applied mathematics and physics, from algebraic geometry, to data analysis, to general relativity to string theory, just to name a few. This course would be of interest to both math and physics majors.

**Textbook(s):** One of the following (or a suitable alternative)

- Introduction to Topology (Third Edition), by Bert Mendelson
- Basic Topology (Undergraduate Texts in Mathematics), by M.A. Armstrong
- Topology; A First Course, by James Munkres

**Learning Objectives:** At the end of this course, the student will be able to

1. Generalize fundamental notions from the real numbers (open, closed, continuous, compact, connected) to topological concepts.
2. Write rigorous mathematical proofs on basic topology.
3. Recognize fundamental features of topological spaces.
4. Construct new topological spaces from old via operations such as taking subsets, products, and quotients.
5. Distinguish different topological spaces by their fundamental groups.

**Topical Outline:** 1. Basic review of the theory of sets and functions (1~~1/2~~ week)

2. Introduction to metric spaces (1 week)
3. What is a topology? (1~~1/2~~ week)
4. Neighborhoods, closure, interior, and boundary (2 weeks)
5. Continuity and homeomorphisms (2 weeks)
6. Subspaces, product spaces, and quotient spaces (2 weeks)
7. Connectedness and path connectedness (1 week)
8. Compactness (2 weeks)
9. Homotopic paths and the fundamental group (2 weeks)
10. Surfaces by identification (1 week)

**Evaluation:** For MthSc 456: Weekly homework (20%), 2 exams (40%), final exam (40%).

For MthSc 456H and 656: Weekly homework (20%), 2 exams (30%), final exam (30%), final project (20%).

**Add course requirements for honors and/or 600-level courses (if applicable):** Additional project including class presentation.

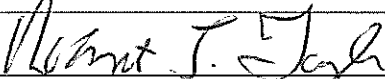

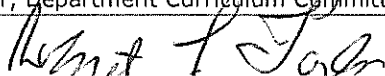

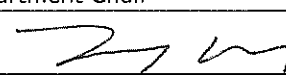

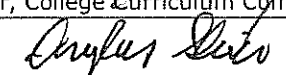
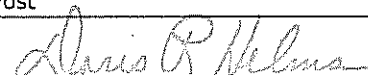

000132

Form Originator: MACAULE, Matthew Macauley Date Form Created: 10/2/2012

Form Last Updated by: , Date Form Last Updated: 11/6/2012

Form Number: 5404

## Approval

|   |          |  |           |
|---|----------|--|-----------|
|  | 11-13-12 |  | 12/7/2012 |
| Chair, Department Curriculum Committee  | Date     | Chair, Undergraduate Curriculum Committee  | Date      |
|  | 11-13-12 |  | 11/12/12  |
| Department Chair  | Date     | Chair, Graduate Curriculum Committee   | Date      |
|  | 11/19/12 |  | 2/3/13    |
| Chair, College Curriculum Committee   | Date     | Provost  | Date      |
|  | 11/19/12 |  | 2/3/13    |
| College Dean  | Date     | President  | Date      |
|   |          |  |           |
| Director, Calhoun Honors College  | Date     |  |           |
|   |          |  |           |

XDelete a Course - Abbrev & Number: EX ST- 311

Corresponding Graduate Course: --

..Corresponding Honors course: --

Course Title: INTRO STATISTICS II

**Brief Statement of Change:**

This course combined with MTHSC 301 is becoming EX ST 330.

Last Term taught:1201


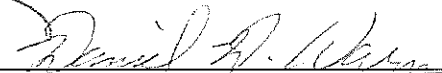
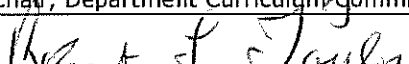
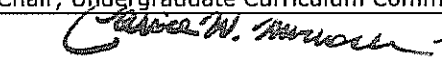

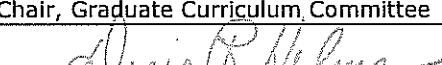
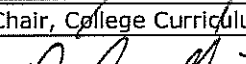
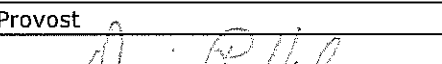

Effective Term:01/2013

Form Originator:EHEPFER, Ellen BreazelDate Form Created: 11/6/2012

Form Last Updated by: EHEPFER, Ellen BreazelDate Form Last Updated: 11/6/2012

Form Number: 5611

**Approval**

|  |          |   |           |
|--|----------|---|-----------|
|  | 11-7-12  |     | 11/7/12   |
| Chair, Department Curriculum Committee   | Date     | Chair, Undergraduate Curriculum Committee   | Date      |
|  | 11-7-12  |     | 12/7/2012 |
| Department Chair   | Date     | Chair, Graduate Curriculum Committee  | Date      |
|  | 11/19/12 |     | 2/3/13    |
| Chair, College Curriculum Committee  | Date     | Provost   | Date      |
|  | 11/19/12 |  fd | 2/3/13    |
| College Dean   | Date     | President   | Date      |
|  |          |     |           |
| Director, Calhoun Honors College   | Date     |   |           |

000134



## Curriculum and Course Change System - Print Major Form

**Change Major Name:** Physics**Degree:** BS**Effective Catalog Year:** 2013**.. Change Major Name to:****.. Change Degree to:** (CHE approval required)**X Change Curriculum Requirements**

(Submit or upload Curriculum map in catalog format. CHE approval required for &gt; 18 hours of changes)

**.. Change General Education Requirements**

(Must also submit a General Education Checklist)

**.. Add, Change or Delete Concentration(s)**

(Submit or upload Curriculum map in catalog format. CHE approval required)

**.. Add, Change or Delete Emphasis Area(s)**

**Explanation:** We propose a number of revisions to the Physics BS curriculum meant to streamline and freshen the degree, more efficiently utilize faculty resources, all while maintaining and improving program quality. 6 credit hours have been removed and 4 credit hours added, for a total of 120 hours. Changes also apply to the Physics BS/Biophysics Concentration, Physics BA, and Dual Major/Physics BA/Teaching Physics curricula and will be detailed there.

(1) PHYS 122 (with 124), 221 (with 223), and 222 have been moved up one semester so that our majors are starting introductory physics during their first semester. This is consistent with peer programs. We do not believe taking MTHSC 106 at the same time as (rather than prior to) will represent any obstacles to our prospective majors. In order to accommodate these changes, PHYS 101 and ASTR 105 have been eliminated from the curricula.

(2) PHYS 300, an introduction to current research in the department, which is similar to PHYS 101, has been moved up into the sophomore year. PHYS 222 will also cover material that is now taught in the 1-hour PHYS 356, including beginning quantum mechanics. Therefore, PHYS 356 can be deleted from the curriculum.

(3) The labs PHYS 325 and 326 have been already modernized to better prepare the students for experimental work and have been moved up to the sophomore year, as has PHYS 311. PHYS 325 is taken in parallel with PHYS 222 and therefore the lab PHYS 224 has been eliminated for our majors. By moving courses up, the heavy physics load in the junior year could be better distributed.

(4) For the junior year, we have created a new course PHYS 315 Introduction to Computational Physics, which fulfills the need to expose every physics student to basic computer and programming exercises with applications to physics problems ahead of the upper-level physics courses.

(5) PHYS 441, 442 (Electromagnetism I, II) would now be offered beginning in Fall. This will support those students in our graduate curriculum who would benefit from taking 641, 642 in their first year before taking the required graduate electrodynamics sequence (841, 842) later on.

(6) PHYS 465 (Thermodynamics) has been moved up. Students will be better prepared for the popular, optional solid state course.

(7) We have added a 1-hour elective to reach 120 hours and give opportunity for a broader education experience.

(8) The footnote for the Arts and Humanities (Lit.) requirement was changed to give student all options available in the General Education section as in other science curricula.

**Form Originator:** GLEHMAC, Gerald Lehmacher **Date Form Created:** 10/7/2012**Form Last Updated by:** , **Date Form Last Updated:** 11/6/2012**Form Number:** 5425**Approval**

|  |            |   |           |
|--|------------|---|-----------|
|  | 11/7/12    |   | 12/7/2012 |
| Chair, Department Curriculum Committee | Date       | Chair, Undergraduate Curriculum Committee | Date      |
|  | 7 Nov 2012 |   |           |
| Department Chair                       | Date       | Chair, Graduate Curriculum Committee      | Date      |
|  | 11/19/12   |   | 2/3/13    |
| Chair, College Curriculum Committee    | Date       | Provost                                   | Date      |
|  | 11/19/12   |   | 2/3/13    |
| College Dean                           | Date       | President                                 | Date      |



## PHYSICS

### Bachelor of Science

Physics, the most fundamental of the natural sciences, forms the basis of study upon which the other branches of science are founded. Physics is concerned with the fundamental behavior of matter and energy. Classical physics encompasses the fields of mechanics, heat and thermodynamics, electricity and magnetism, acoustics and optics. Modern physics is concerned with the study of atoms and molecules, atomic nuclei, elementary particles and the properties of liquids, crystalline solids, and other materials, as well as the areas of relativity, cosmology, and the large-scale structure of the universe.

The undergraduate Physics curricula provide students with a strong background in the classical areas of physics, as well as an introduction to the more important aspects of modern physics. The BS curriculum is directed toward preparing students for graduate study ultimately leading to the PhD degree or toward research and development work in industrial or governmental laboratories. It also provides a good background for graduate study or industrial work in many areas of engineering physics and applied science.

### Freshman Year

#### First Semester

- 4 - CH 101 General Chemistry
- 4 - MTHSC 106 Calculus of One Variable I
- 3 - PHYS 122 Physics with Calculus I
- 1 - PHYS 124 Physics Lab. I
- 3 - ENGL 103 Accelerated Composition

15

#### Second Semester

- 4 - CH 102 General Chemistry
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - PHYS 221 Physics with Calculus II
- 1 - PHYS 223 Physics Lab. II
- 3 - Arts and Humanities (Non-Lit.) Requirement<sup>1</sup>

15

### Sophomore Year

#### First Semester

- 4 - MTHSC 206 Calculus of Several Variables
- 3 - PHYS 222 Physics with Calculus III
- 3 - PHYS 325 Experimental Physics I
- 1 - PHYS 300 Introduction to Research
- 4 - Foreign Language Requirement<sup>2</sup>

15

#### Second Semester

- 4 - MTHSC 208 Intr. to Ordinary Diff. Equations
- 3 - PHYS 311 Intro. Meth. Theor. Phys.
- 3 - PHYS 326 Experimental Physics II
- 1 - Elective
- 4 - Foreign Language Requirement<sup>2</sup>

15

### Junior Year

#### First Semester

- 3 - PHYS 321 Mechanics I
- 3 - PHYS 315 Intro. Computational Physics
- 3 - PHYS 312 Methods of Theor. Phys. II
- 3 - Oral Communication Requirement<sup>1</sup>
- 3 - Emphasis Area Requirement<sup>3</sup>

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#### Second Semester

- 3 - PHYS 322 Mechanics II
- 3 - PHYS 465 Thermodynamics and Statistical Mechanics
- 3 - Physics Writing Requirement<sup>4</sup>
- 3 - Science Requirement<sup>5</sup>
- 3 - Emphasis Area Requirement<sup>3</sup>

15

### Senior Year

#### First Semester

- 3 - PHYS 401 Senior Thesis
- 3 - PHYS 441 Electromagnetics I
- 3 - PHYS 455 Quantum Physics I
- 3 - Arts and Humanities (Lit.) Requirement<sup>1</sup>
- 3 - Emphasis Area Requirement<sup>3</sup>

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#### Second Semester

- 3 - HIST 172 The West and the World I or  
3 - HIST 173 The West and the World II
- 3 - PHYS 442 Electromagnetics II
- 3 - PHYS 456 Quantum Physics II
- 3 - Social Science Requirement<sup>1</sup>
- 3 - Emphasis Area Requirement<sup>3</sup>

15

### 120 Total Semester Hours<sup>1</sup>

<sup>1</sup> See General Education Requirements. Three of these credit hours must also satisfy the Science and Technology in Society Requirement.

<sup>2</sup> Two semesters (through 102) in same modern foreign language are required.

<sup>3</sup> See advisor. Select from the following emphasis areas: Chemistry, Computer Science, Engineering, Environmental Engineering, Geology, Mathematical Sciences, or Physics and Astronomy. Twelve credit hours in one of these areas, with at least six at the 300-400 level, are required. Note: Requirements for a minor in one of these areas might be satisfied with three additional credits at the 300-400 level.

<sup>4</sup> ENGL 304, 312, 314, 315, 316, 345, 346, 348, M L 402, or THEA (ENGL) 347

<sup>5</sup> Any 200-400-level science course



000136

## Curriculum and Course Change System - Print Major Form

**Change Major Name:** Physics**Degree:** BS**Effective Catalog Year:** 2013**X Change Major Name to:** No Name Change; changes are for Physics BS/Biophysics Concentration**.. Change Degree to:** (CHE approval required)**X Change Curriculum Requirements**

(Submit or upload Curriculum map in catalog format. CHE approval required for &gt; 18 hours of changes)

**.. Change General Education Requirements**

(Must also submit a General Education Checklist)



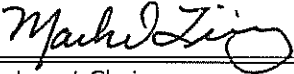
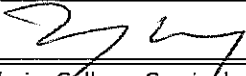


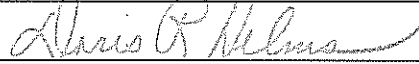
**.. Add, Change or Delete Concentration(s)**

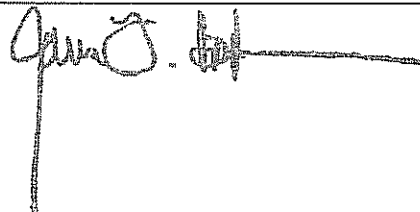
(Submit or upload Curriculum map in catalog format. CHE approval required)

**.. Add, Change or Delete Emphasis Area(s)**

**Explanation:** We propose a number of revisions to the Physics BS/Biophysics Concentration curriculum in line with the changes to the Physics BS curriculum. 6 credit hours have been removed and 3 credit hours added, for a total of 122 hours. The changes (1)-(6), (8) listed for the Physics BS curriculum apply.

**Form Originator:** GLEHMAC, Gerald Lehmacher **Date Form Created:** 11/6/2012**Form Last Updated by:** , **Date Form Last Updated:** 11/6/2012**Form Number:** 5606**Approval**

|   |            |  |           |
|---|------------|--|-----------|
|     | 11/7/12    |        | 12/7/2012 |
| Chair, Department Curriculum Committee  | Date       | Chair, Undergraduate Curriculum Committee  | Date      |
|    | 7 Nov 2012 |  |           |
| Department Chair  | Date       | Chair, Graduate Curriculum Committee   | Date      |
|    | 11/14/12   |       | 2/3/13    |
| Chair, College Curriculum Committee   | Date       | Provost  | Date      |
|  | 11/19/12   |  for | 2/3/13    |
| College Dean  | Date       | President  | Date      |



## PHYSICS

### BIOPHYSICS CONCENTRATION

The Biophysics Concentration offers an excellent preparation for medical school or graduate work in biological sciences. It includes the flexibility of selecting courses in chemistry, biological sciences, physics, and mathematics. This concentration also provides the necessary background for employment in industry, manufacturing, and instrumentation for clinical or molecular biology applications.

#### Freshman Year

##### First Semester

- 4 - CH 101 General Chemistry
  - 4 - MTHSC 106 Calculus of One Variable I
  - 3 - PHYS 122 Physics with Calculus I
  - 1 - PHYS 124 Physics Lab. I
  - 3 - ENGL 103 Accelerated Composition
- 15

##### Second Semester

- 4 - CH 102 General Chemistry
  - 4 - MTHSC 108 Calculus of One Variable II
  - 3 - PHYS 221 Physics with Calculus II
  - 1 - PHYS 223 Physics Lab. II
  - 3 - Arts and Humanities (Non-Lit.) Requirement<sup>1</sup>
- 15

#### Sophomore Year

##### First Semester

- 4 - MTHSC 206 Calculus of Several Variables
  - 3 - PHYS 222 Physics with Calculus III
  - 3 - PHYS 325 Experimental Physics I
  - 1 - PHYS 300 Introduction to Research
  - 5 - BIOL 110 Principles of Biology
- 16

##### Second Semester

- 4 - MTHSC 208 Intr. to Ordinary Diff. Equations
  - 3 - PHYS 311 Intr. Meth. Theor. Phys.
  - 3 - PHYS 326 Experimental Physics II *or* Science Requirement<sup>5</sup>
  - 4 - Biophysics Requirement<sup>2</sup>
- 14

#### Junior Year

##### First Semester

- 3 - PHYS 321 Mechanics I
  - 3 - PHYS 315 Intro. Computational Physics
  - 3 - PHYS 312 Methods of Theor. Phys. II
  - 3 - Biophysics Requirement<sup>2</sup>
  - 4 - Foreign Language Requirement<sup>3</sup>
- 16

##### Second Semester

- 3 - PHYS 322 Mechanics II
  - 3 - PHYS 465 Thermodynamics and Statistical Mechanics
  - 3 - Biophysics Requirement<sup>2</sup>
  - 3 - Oral Communication Requirement<sup>1</sup>
  - 4 - Foreign Language Requirement<sup>3</sup>
- 16

#### Senior Year

##### First Semester

- 3 - PHYS 441 Electromagnetics I
  - 3 - PHYS 455 Quantum Physics I
  - 3 - Biophysics Requirement<sup>2</sup>
  - 3 - Physics Writing Requirement<sup>4</sup>
  - 3 - Arts and Humanities (Lit.) Requirement<sup>1</sup>
- 15

##### Second Semester

- 3 - HIST 172 The West and the World I *or* 3 - HIST 173 The West and the World II
  - 3 - PHYS 442 Electromagnetics II
  - 3 - PHYS 456 Quantum Physics II
  - 3 - Social Science Requirement<sup>1</sup>
  - 3 - Biophysics Requirement<sup>2</sup>
- 15

122 Total Semester Hours<sup>1</sup>

<sup>1</sup> See General Education Requirements. Three of these credit hours must also satisfy the Science and Technology in Society Requirement.

<sup>2</sup> Select from department-approved list of courses in biological sciences, chemistry, mathematical sciences, and physics. At least six credit hours must be in biological sciences.

<sup>3</sup> Two semesters (through 102) in same modern foreign language are required.

<sup>4</sup> ENGL 304, 312, 314, 315, 316, 345, 346, 348, M L 402, or THEA (ENGL) 347

<sup>5</sup> Any 200-400-level science course

<sup>6</sup> An approved physics course may be substituted if CH 331 and 332 have been completed.

000138






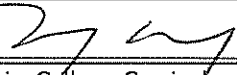


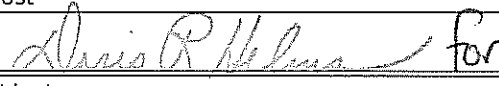
# Curriculum and Course Change System - Print Major Form

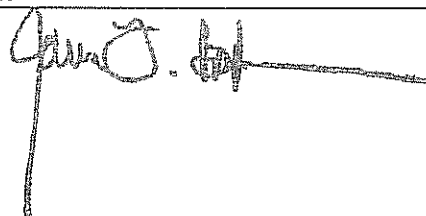
**Change Major Name:** Physics (BA)  
**Degree:** BA  
**Effective Catalog Year:** 2013  
 .. **Change Major Name to:**  
 .. **Change Degree to:** (CHE approval required)  
 X **Change Curriculum Requirements**  
 (Submit or upload Curriculum map in catalog format. CHE approval required for > 18 hours of changes)  
 .. **Change General Education Requirements**  
 (Must also submit a General Education Checklist)  
 .. **Add, Change or Delete Concentration(s)**  
 (Submit or upload Curriculum map in catalog format. CHE approval required)  
 .. **Add, Change or Delete Emphasis Area(s)**

**Explanation:** We propose a number of revisions to the Physics BA curriculum in line with the changes to the Physics BS curriculum. 6 credit hours have been removed and 4 credit hours added, for a total of 120 hours. The changes (1)-(5), (7), (8) listed for the Physics BS curriculum apply. (6) PHYS 465 (Thermodynamics) replaces PHYS 312 (Methods of Theor. Physics II), since it is a more important topic preparing physics students for their career.

**Form Originator:** GLEHMAC, Gerald Lehmacher **Date Form Created:** 11/6/2012  
**Form Last Updated by:** GLEHMAC, Gerald Lehmacher **Date Form Last Updated:** 11/6/2012  
**Form Number:** 5608

## Approval

|   |            |  |           |
|---|------------|--|-----------|
|    | 11/7/12    |        | 12/7/2012 |
| Chair, Department Curriculum Committee  | Date       | Chair, Undergraduate Curriculum Committee  | Date      |
|     | 7 Nov 2012 |  |           |
| Department Chair  | Date       | Chair, Graduate Curriculum Committee   | Date      |
|    | 11/19/12   |       | 2/3/13    |
| Chair, College Curriculum Committee   | Date       | Provost  | Date      |
|  | 11/19/12   |  for | 2/3/13    |
| College Dean  | Date       | President  | Date      |



AY 2013/14

**PHYSICS****Bachelor of Arts**

The Bachelor of Arts in Physics program is ideal for students interested in acquiring a broad-based liberal education that includes a strong and solid understanding of either science or a broad exposure to engineering with a strong physics foundation.

**Freshman Year****First Semester**

- 4 - CH 101 General Chemistry
- 4 - MTHSC 106 Calculus of One Variable I
- 3 - PHYS 122 Physics with Calculus I
- 1 - PHYS 124 Physics Lab. I
- 3 - ENGL 103 Accelerated Composition
- 15

**Second Semester**

- 4 - CH 102 General Chemistry
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - PHYS 221 Physics with Calculus II
- 1 - PHYS 223 Physics Lab. II
- 3 - Arts and Humanities (Non-Lit.) Requirement<sup>1</sup>
- 15

**Sophomore Year****First Semester**

- 4 - MTHSC 206 Calculus of Several Variables
- 3 - PHYS 222 Physics with Calculus III
- 3 - PHYS 325 Experimental Physics I
- 1 - PHYS 300 Introduction to Research
- 4 - Foreign Language Requirement<sup>2</sup>
- 15

**Second Semester**

- 4 - MTHSC 208 Intr. to Ordinary Diff. Equations
- 3 - PHYS 311 Intro. Meth. Theo. Phys.
- 3 - Oral Communication Requirement<sup>1</sup>
- 4 - Foreign Language Requirement<sup>2</sup>
- 1 - Elective
- 15

**Junior Year****First Semester**

- 3 - PHYS 321 Mechanics I
- 3 - PHYS 315 Intro. Computational Physics
- 3 - Physics Writing Requirement<sup>3</sup>
- 3 - Foreign Language Requirement<sup>2</sup>
- 3 - Minor Requirement<sup>4</sup>
- 15

**Second Semester**

- 3 - PHYS 322 Mechanics II
- 3 - PHYS 465 Thermodynamics and Stat. Mech.
- 3 - Social Science Requirement<sup>1</sup>
- 3 - Foreign Language Requirement<sup>2</sup>
- 3 - Minor Requirement<sup>3</sup>
- 15

**Senior Year****First Semester**

- 3 - PHYS 441 Electromagnetics I
- 3 - PHYS 455 Quantum Physics I
- 3 - Physics Requirement<sup>5</sup>
- 6 - Minor Requirement<sup>1</sup>
- 15

**Second Semester**

- 3 - HIST 172 The West and the World I or
- 3 - HIST 173 The West and the World II
- 3 - Arts and Humanities (Lit.) Requirement<sup>1</sup>
- 3 - Minor Requirement<sup>1</sup>
- 3 - Physics Requirement<sup>5</sup>
- 3 - Elective
- 15

120 Total Semester Hours<sup>1</sup>

---

<sup>1</sup> See General Education Requirements. Three of these credit hours must also satisfy the Science and Technology in Society Requirement.

<sup>2</sup> Four semesters (through 202) in the same modern foreign language are required.

<sup>3</sup> ENGL 304, 312, 314, 315, 316, 345, 346, 348, M L 402, or THEA (ENGL) 347

<sup>4</sup> See advisor.

<sup>5</sup> Any 300- or 400-level physics course.

000140

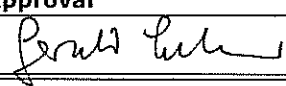
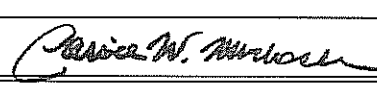
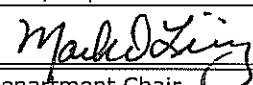
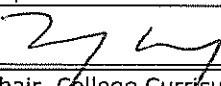

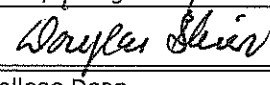
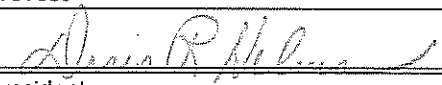



## Curriculum and Course Change System - Print Major Form

**Change Major Name:** Science Teaching (Physics)  
**Degree:** BA  
**Effective Catalog Year:** 2013  
 .. **Change Major Name to:**  
 .. **Change Degree to:** (CHE approval required)  
 X **Change Curriculum Requirements**  
 (Submit or upload Curriculum map in catalog format. CHE approval required for > 18 hours of changes)  
 .. **Change General Education Requirements**  
 (Must also submit a General Education Checklist)  
 .. **Add, Change or Delete Concentration(s)**  
 (Submit or upload Curriculum map in catalog format. CHE approval required)  
 .. **Add, Change or Delete Emphasis Area(s)**

**Explanation:** We propose a number of revisions to the Dual Degree/Science Teaching BA/Physics BA curriculum in line with the changes to the Physics BS curriculum. The total of 128-130 credit hours is unchanged.  
 The changes (1)-(5) listed for the Physics BS curriculum apply, except:  
 (6) An astronomy course (ASTR 101 instead of ASTR 105) is retained to cover earth science competencies.  
 (7) The Physical Chemistry requirement offers the choice between CHEM 330 and 331 as in the Teaching Physical Sciences curriculum.

**Form Originator:** GLEHMAC, Gerald Lehmacher **Date Form Created:** 11/6/2012  
**Form Last Updated by:** GLEHMAC, Gerald Lehmacher **Date Form Last Updated:** 11/6/2012  
**Form Number:** 5610

| Approval   |            |  |           |
|--|------------|--|-----------|
|    | 11/7/12    |        | 12/7/2012 |
| Chair, Department Curriculum Committee   | Date       | Chair, Undergraduate Curriculum Committee  | Date      |
|    | 7 Nov 2012 |  |           |
| Department Chair   | Date       | Chair, Graduate Curriculum Committee   | Date      |
|   | 11/17/12   |       | 2/3/13    |
| Chair, College Curriculum Committee  | Date       | Provost  | Date      |
|  | 11/19/12   |  for | 2/3/13    |
| College Dean   | Date       | President  | Date      |

  
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## SCIENCE TEACHING

### Double Majors in Science Teaching and Content Area

## TEACHING AREA: PHYSICS

### Bachelor of Arts

#### Freshman Year

##### First Semester

- 4 - CH 101 General Chemistry
- 4 - MTHSC 106 Calculus of One Variable I
- 3 - PHYS 122 Physics with Calculus I
- 1 - PHYS 124 Physics Lab. I
- 3 - ENGL 103 Accelerated Composition
- 2 - ED 105 Orientation to Education

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##### Second Semester

- 4 - CH 102 General Chemistry
- 4 - MTHSC 108 Calculus of One Variable II
- 3 - PHYS 221 Physics with Calculus II
- 1 - PHYS 223 Physics Lab. II
- 3 - Arts and Humanities (Non-Lit.) Requirement<sup>1</sup>
- 3 - Oral Communication Requirement<sup>1</sup>

18

#### Sophomore Year

##### First Semester

- 5 - BIOL 110 Principles of Biology I *or*
- 3 - BIOL 103 General Biology I *and*
- 1 - BIOL 105 General Biology I Lab.
- 4 - MTHSC 206 Calculus of Several Variables
- 3 - PHYS 222 Physics with Calculus III
- 3 - PHYS 325 Experimental Physics I

15-16

##### Second Semester

- 5 - BIOL 111 Principles of Biology II
- or* 3 - BIOL 104 General Biology II
- and* 1 - BIOL 106 General Biology II Lab.
- 4 - MTHSC 208 Intro. to Ordinary Diff. Equations
- 3 - ED F 301 Principles of American Education
- 1 - ED F 315 Tech. Skills for Learning
- 3 - Social Science Requirement<sup>1</sup>

15-16

#### Junior Year

##### First Semester

- 3 - ASTR 101 Solar System Astronomy
- 3 - PHYS 321 Mechanics I
- 3 - CH 330 Intro. Physical Chemistry *or*
- 3 - CH 331 Physical Chemistry
- 3 - EDSEC 327 Practicum in Secondary Science
- 3 - Foreign Language Requirement<sup>2</sup>

15

##### Second Semester

- 3 - BIOSC 482 Lab. Techniques for Teaching Sci.
- 3 - ED F 302 Educational Psychology
- 3 - ED F 335 Adolescent Growth and Develop.
- 3 - MTHSC 434 Advanced Engineering Math. *or*
- 3 - PHYS 311 Intro. Meth. Theor. Physics
- 3 - Social Science Requirement<sup>1</sup>
- 3 - Foreign Language Requirement<sup>2</sup>

18

#### Senior Year

##### First Semester

- 3 - EDSEC 427 Teaching Secondary Science<sup>3</sup>
- 3 - EDLT 498 Secondary Content Area Reading<sup>1</sup>
- 3 - PHYS 441 Electromagnetics I
- 3 - PHYS 455 Quantum Physics I
- 3 - Arts and Humanities (Lit.) Requirement<sup>1</sup>

15

##### Second Semester

- 3 - ED SP 370 Introduction to Special Education
- 9 - EDSEC 447 Teaching Internship in Secondary Science<sup>4</sup>
- 3 - EDSEC 457 Sec. Science Capstone Seminar<sup>4</sup>

15

128-30 Total Semester Hours<sup>1</sup>

<sup>1</sup> See General Education Requirements. Six of these credit hours must also satisfy the Cross-Cultural Awareness and Science and Technology in Society Requirement.

<sup>2</sup> Two semesters (through 202) in any modern foreign language or American Sign Language are required.

<sup>3</sup> To be taken the semester prior to EDSEC 447 and 457. EDSEC 427 and EDLT 498 must be taken concurrently.

<sup>4</sup> EDSEC 447 and 457 must be taken concurrently. Offered during spring semester only.

000142



## Curriculum and Course Change System - Print New Course Form

**Course Abbreviation & Number:**

X New Undergraduate Course: PHYS- 315

.. New Honors Course: --

.. New Graduate Course: -

**Effective Term:** 08/2015**Catalog Title:** Introduction to Computational Physics**Transcript Title:** INTR COMP PHYS**Fixed Credit Course:** 3 (3,0)**Variable Credit Course:** - (-), (-)

| Method of Instruction      | Course Modifier     | General Education Designation |
|----------------------------|---------------------|-------------------------------|
| X A-Lecture Only           | .. Pass/Fail Only   | .. English Composition        |
| .. B-Lab (w/fee)           | X Graded            | .. Oral Communication         |
| .. D-Seminar               | .. Variable Title   | .. Mathematics                |
| .. E-Independent Study     | .. Creative Inquiry | .. Natural Science w/Lab      |
| .. F-Tutorial (w/fee)      | .. Repeatable       | .. Math or Science            |
| .. G-Studio                | maximum credits:    | .. A&H (Literature)           |
| .. H-Field course          |                     | .. A&H (Non-Literature)       |
| .. I-Study Abroad          |                     | .. Social Science             |
| .. L-Lab (no/fee)          |                     | .. CCA                        |
| .. N/B-Lecture/Lab(w/fee)  |                     | .. STS                        |
| .. N/L-Lecture/Lab(no fee) |                     |                               |

**Add cross-listing with the following child course(s):** N/A

**Catalog Description:** Basic numerical methods important for data interpretation and modeling in physics, such as interpolation, derivatives, integration, solving differential and matrix equations, and Monte Carlo simulation. Methods will be applied to physics problems including realistic projectile motion, harmonic oscillators, chaotic pendulum, nonlinear systems, Ising model.

**Prerequisite(s):** PHYS 222**Projected Enrollment:**

Year 1 - 20 Year 2 - 20 Year 3 - 20 Year 4 - 20

**Required course for students in:** Physics BS, Physics BA

**Statement of need and justification based on assessment results of student learning outcomes:** Computers are one of the most important tools in any science, especially in physics. Computational physics has become an important branch of physics with its own division in the American Physical Society and journals. The Department of Physics and Astronomy would like to see our students be better prepared for advanced physics courses and potential graduate work by learning the use of computers in the undergraduate curriculum. Such physics-driven courses have been developed in physics departments for many years in close connection with the classical physics curriculum and filling specific needs of physics students. Clemson would be among the first institutions in our peer group offering a dedicated and required computational physics course.

**Textbook(s):** Introductory Computational Physics by Andi Klein and Alexander Godunov, Cambridge, 2006; Computational Physics by Rubin Landau and Manuel Paez, 2e, Wiley, 2011 (for more advanced problems).

**Learning Objectives:** At the end of the course, students will be able to:

- know about basic computer hardware and software
- navigate in a common operating and file system
- understand how mathematical methods are translated into algorithms
- implement such algorithms in an easily accessible higher computer language (e.g., Matlab) from scratch
- assess the accuracy of numerical solutions and compare with analytical solutions
- modify existing programs and use program libraries
- explore physics problems that are unsolvable without the help of computers
- evaluate the need and cost of solving problems with computers

**Topical Outline:** Basic computer hardware, introduction to operating system (3 MWF)

Program design, errors and uncertainties in computations (3 MWF)

Interpolation, cubic splines (3 MWF)

Least-square fitting (3 MWF)

Derivatives, central difference method, second derivatives, Newton's law (3 MWF)

Numerical integration (3 MWF)

Random processes, random walk, Monte Carlo methods (3 MWF)

Nonlinear equations, quantum eigenvalues (3 MWF)

Differential equations, Euler and Runge-Kutta methods, harmonic oscillators (3 MWF)

Anharmonic oscillators, pendulum (3 MWF)

Fourier analysis, discrete Fourier transform (3 MWF)

Dynamics of nonlinear systems, chaotic pendulum (3 MWF)

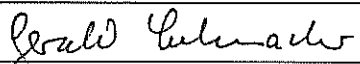
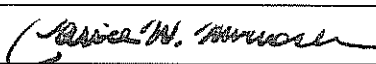
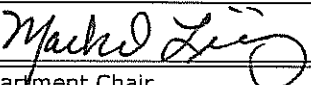
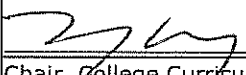
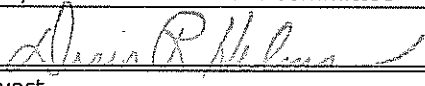
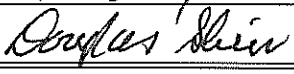
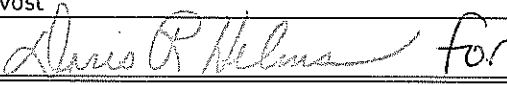



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Midterm and Review (3 MWF)

Matrices, eigenvalue problems (3 MWF)

~~High performance and parallel computing (3 MWF)~~**Evaluation:** Midterm and Final exam (50%), Problem sets (50%) Grading Scale: 100-90% A; 90%-80% B; 80%-70% C; 70%-60% D, <60% F**Duplication (if applicable):** N/A**Add course requirements for honors and/or 600-level courses (if applicable):** N/A**Learning Activities associated with General Education competencies (if applicable):** N/A**Form Originator:** GLEHMAC, Gerald Lehmacher **Date Form Created:** 11/6/2012**Form Last Updated by:** , **Date Form Last Updated:** 11/6/2012**Form Number:** 5603**Approval**

|   |            |  |         |
|---|------------|--|---------|
|  | 11/7/12    |  | 12/7/12 |
| Chair, Department Curriculum Committee  | Date       | Chair, Undergraduate Curriculum Committee  | Date    |
|  | 7 Nov 2012 |  |         |
| Department Chair  | Date       | Chair, Graduate Curriculum Committee   | Date    |
|   | 11/19/12   |  | 2/13/13 |
| Chair, College Curriculum Committee   | Date       | Provost  | Date    |
|   | 11/19/12   |  | 2/13/13 |
| College Dean  | Date       | President  | Date    |
|   |            |  |         |
| Director, Calhoun Honors College  | Date       |  |         |
|   |            |  |         |

Approvals related to cross-listing require the following signatures:

|   |      |  |      |
|---|------|--|------|
|   |      |  |      |
| [Child Course] Chair, Department Curriculum Committee | Date | [Child Course] Chair, College Curriculum Committee | Date |
|   |      |  |      |
| [Child Course] Department Chair                       | Date | [Child Course] College Dean                        | Date |



## Curriculum and Course Change System - Print Change/Delete Course Form

X Change a Course - Abbrev &amp; Number: PHYS- 445

Corresponding Lab Course: --

Corresponding Honors course: --

.. Add Honors course: --

Corresponding Graduate course: PHYS- -645

.. Add Graduate course: --

Course Title: SOLID STATE PHYS I

## Brief Statement of Change:

Change prerequisite PHYS 455 to PHYS 221, since course is generally offered and taken in the same semester as PHYS 455

Last Term taught: 1108

.. Change Abbrev to:

Effective Term: 01/2013

.. Change Number to:

.. Change Catalog Title:

.. Change Transcript Title:

from:

from: SOLID STATE PHYS I

to:

to:

.. From: Fixed Credit: 3 (3,) To: Fixed Credit: (,)

Change of Credit: Variable Credit: - (-), (-) Variable Credit: - (-), (-)

.. Add cross-listing with the following child course(s):

.. Delete cross-listing with the following child course(s):

.. Reverse Parent/Child relationship with:

| .. Change Method of Instruction | .. Change Course Modifier | .. Change General Education Designation |
|---------------------------------|---------------------------|---|
| from: to:                       | from: to:                 | from: to:                               |
| X A-Lecture Only                | .. Pass/Fail Only         | .. English Composition                  |
| .. B-Lab (w/fee)                | .. X Graded               | .. Oral Communication                   |
| .. D-Seminar                    | .. Variable Title         | .. Mathematics                          |
| .. E-Independent Study          | .. Creative Inquiry       | .. Natural Science w/Lab                |
| .. F-Tutorial (w/fee)           | .. Repeatable             | .. Math or Science                      |
| .. G-Studio                     | .. maximum credits        | .. A&H (Literature)                     |
| .. H-Field course               | from:                     | .. A&H (Non-Literature)                 |
| .. I-Study Abroad               | to:                       | .. Social Science                       |
| .. L-Lab (no/fee)               |                           | .. CCA                                  |
| .. N/B-Lecture/Lab(w/fee)       |                           | .. STS                                  |
| .. N/L-Lecture/Lab(no fee)      |                           |   |

## .. Change Catalog Description:

from:

to:

X Change Prerequisite(s):

from: PHYS 455 or consent of instructor

to: 445: PHYS 221, 645: none

Learning Objectives: no change

Topical Outline: no change

Evaluation: no change

Duplication (if applicable): no change

Add course requirements for honors and/or 600-level courses (if applicable): no change

Learning Activities associated with General Education competencies (if applicable): no change

Form Originator: GLEHMAC, Gerald Lehmacher Date Form Created: 10/7/2012

Form Last Updated by: , Date Form Last Updated: 10/23/2012

Form Number: 5424

## Approval

|  |          |   |           |
|--|----------|---|-----------|
|  | 10/29/12 |   | 12/7/2012 |
| Chair, Department Curriculum Committee | Date     | Chair, Undergraduate Curriculum Committee | Date      |
|  | 10/29/12 |   |           |
| Department Chair                       | Date     | Chair, Graduate Curriculum Committee      | Date      |
|  | 11/17/12 |   |           |

|                                     |                 |                           |                |
|-------------------------------------|-----------------|---------------------------|----------------|
| <i>Douglas Stier</i>                | <i>11/19/12</i> | <i>David R. Helms</i>     | <i>2/13/13</i> |
| Chair, College Curriculum Committee | Date            | Provost                   | Date           |
|                                     |                 | <i>David R. Helms for</i> | <i>2/13/13</i> |
| College Dean                        | Date            | President                 | Date           |
|                                     |                 | <i>James D. Helms</i>     |                |
| Director, Calhoun Honors College    | Date            |                           |                |