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# University Courses & Curricula Committee 2017-2018

January 10, 2018
Talley Student Union 4140
12:45pm-2:45pm

## Call to Order 12:45pm

- Welcome from Chair Helmut Hergeth
- Remarks and Updates from OUCCAS/DASA
- Approval of UCCC November 29th 2017 Minutes
- Course and Curricular Business

## New Business

| Consent Agenda | | |
|---|---|---|
| **Action** | **Type** | **Notes** |
| BIO 424 Endocrinology | Minor | Updating requisites |
| BIO 434 Hormones and Behavior | Minor | Updating requisites |
| BIO 488 Neurobiology | Minor | Updating requisites |
| GPH 425 Global Health and Physiology | Minor | Updating requisites |
| ISE 495 Project Work in Industrial Engineering | Minor | Adjusting Credit Hour Range for Independent Study Course |
| ST 361 Introduction to Statistics for Engineers | Dropping | Course being dropped |
| ZO 317 Primate Ecology and Evolution | Minor | Updating requisites |
| ZO 350 Animal Phylogeny and Diversity | Minor | Updating requisites |
| ZO 402 Invertebrate Biology | Minor | Updating requisites |

| College of Design | | | |
|---|---|---|---|
| **Presenter** | **Reviewers** | **Action** | **Type** |
| Rieder | Robinson, Podurgal, Despain | GD 492 Special Topics in Graphic Design | Revising grading to provide letter grading option. |
| Rieder | Orphanides, Hessling, Bruce | BA Design Studies (12DSBA) | Revisions to 8 semester display |

| College of Humanities and Social Sciences | | | |
|---|---|---|---|
| **Presenter** | **Reviewers** | **Action** | **Type** |
| Despain | Ferguson, Lindsay, Kotek | COM 292 Language, Communication, and Culture | New Course |
| Despain | Seracino, Carlson Welch, Fath | ENG/AFS 248 Survey of African-American Literature | Revising SLOs, objective |
| Cherry | Seracino, Rieder, Krause | HI 217 Caribbean History | New Course |

| College of Natural Resources | | | |
|---|---|---|---|
| **Presenter** | **Reviewers** | **Action** | **Type** |
| Lindsay | Ferguson, Cherry, Griffin Hillis | FOR/NR 491 Special Topics in Forestry and Related Natural Resources | Revising grading to provide letter grading option. |

| College of Agriculture and Life Sciences | | | |
|---|---|---|---|
| **Presenter** | **Reviewers** | **Action** | **Type** |
| Bruce | Seracino, Nadvi, Ferguson | AEE 495 Special Topics in Agricultural and Extension Education | Adding letter grade and S/U option to grading method. |
| Trivedi | Ferguson, Podurgal, Klesath | New CSSC Prefix | New prefix for merging Crop Science and Soil Science Departments |

| College of Engineering | | | |
|---|---|---|---|
| **Presenter** | **Reviewers** | **Action** | **Type** |
| Seracino | Trivedi, Rieder, Orphanides | MAE 420/(520) Dynamic Analysis of Human Movement | New Course |
| Seracino | Hessling, Rieder, Trivadi | Biomedical Engineering (BS) (14BMEBS) | Revisions to 8 semester display |
| Ferguson | Bruce, Cherry, Robinson | Chemical Engineering (BS) (14CHEBS) | Revisions to 8 semester display to include the new required IP course E 102. |
| | Klesath, Griffin Hillis, Lindsay | Chemical Engineering (BS) Biomanufacturing Sciences (14CHEBS-14CHEBMF) | |
| | Lindsay, Klesath, Orphanides | Chemical Engineering (BS) Biomolecular (14CHEBS-14CHEBIO) | |
| | Hessling, Nadvi, Bruce | Chemical Engineering (BS) Honors Program (14CHEBS-14CHEHON) | |
| | Carlson Welch, Robinson, Fath | Chemical Engineering (BS) Nanoscience (14CHEBS-14CHENAN) | |
| | Krause, Klesath, Kotek | Chemical Engineering (BS) & Textile Engineering (BS) (14CHEBS-14CHETE) | |
| | Griffin Hillis, Krause, Bruce | Chemical Engineering (BS) Sustainable Engineering, Energy & the Environment (14CHEBS-14CHESEE) | |
| | Hessling, Despain, Nadvi | Civil Engineering (14CEBS) | |
| | Robinson, Cherry, Podurgal | Computer Engineering (BS) (14CPEBS) | |
| | Lindsay, Trivedi, Despain | Environmental Engineering (BS) (14ENEBS) | |
| | Klesath, Cherry, Griffin Hillis | Electrical Engineering (BS) (14EEBS) | |
| | Rieder, Fath, Podurgal | Industrial Engineering (BS) (14IEBS) | |
| | Lindsay, Robinson, Orphanides | Materials Science & Engineering (BS) (14MSEBS) | |
| | Kotek, Fath, Carlson Welch | Mechanical Engineering (BS) (14MEBS) | |
| | Krause, Klesath, Cherry | Nuclear Engineering (BS) (14NEBS) | |

**Discussion:** Process Mapping

**Notes:**

- All linked course actions are viewable in CIM.
- To view actions, please click on the hyperlink. You may need to use your Unity ID to log in.
- If you experience issues logging in, please go to https://next-catalog.ncsu.edu/courseadmin/ and type the course prefix and number into the search bar.

***SLO = Student Learning Outcomes***

NC STATE UNIVERSITY

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## University Courses and Curricula Committee

November 29, 2017
Talley Student Union 4140
Call to Order: 12:46 pm

**Members Present:** Chair Helmut Hergeth, Chair Elect Marta Klesath, Amanda Beller, Elizabeth Fath, Andreas Orphanides, Kathleen Rieder, Richard Podurgal, Scott Ferguson, Edwin Lindsay, Walter Robinson, Peter Hessling, Jackie Bruce, Scott Despain, Wendy Krause, Rudi Seracino, Jackie Bruce, Berkley Griffin Hillis, Shweta Trivedi, Erin Peterson, Zeenat Nadvi, Richard Kotek

**Members Absent**: Megan Cherry

**Guest**: Tom Koch, Hatice Ozturk, Tim Petty, Lianne Cartee, Kanton Reynolds, Annie Carlson Welch

**Ex-Officio Members Present:** Lexi Hergeth, Li Marcus, Rebecca Swanson, Kyle Pysher, Charles Clift, Jordan Luzander, John Harrington

**WELCOME AND INTRODUCTIONS**

- **Lunch was served during the meeting beginning at 12 noon.**
- **Remarks from Chair** - Welcomed the committee members introduced guests.
- **Remarks and Updates from OUCCAS/DASA**- Dr. Bret Smith thanked the committee on Dr. Mullen's behafe as Dr. Mullen is sick. Li Marcus informed the committee we will be sending Google Calendar invitations will be sent out next week.
- **Approval of the Minutes from November 8th 2017** – *Approved Unanimously*
    - Discussion: Member Scott Despain moved to approve. Minutes from the previous meeting were presented and approved without further discussion.

**NEW BUSINESS**

- **Consent Agenda** -*Approved Unanimously*
  Discussion: Member Walter Robinson moved to approve.

  **ARC 292 Special Topics in Architecture** -*Approved Unanimously with friendly suggestions*
  Discussion: Member Kathleen Rieder presented the course. Member indicated a grading scale of an A+ to F, there is grading criteria, however it would be beneficial to have the scale. In the SLOs "learn how to construct" should just read "construct". Member indicated under objectives dropping the word "understand" and just using "translate". Member also pointed out the incomplete grading statement is not included in the syllabus. The presenter agreed to these friendly suggestions.

- **MUS 116 African American Choral Ensemble** -*Approved Unanimously with Friendly Suggestions.*
  Discussion: Member Beth Fath presented the course. A member indicated the syllabus indicated there would be a nominal charge for concert dress and would like to know what nominal is. Guest Tom Koch said certain ensembles will need specific choir attire and predicted that the charge will be under $100 and one outfit would be needed per course. A friendly suggestion is made to provide a range of how much an ensemble attire would cost. Member also asked if the performance schedule would be provided at the beginning of the semester. Member indicated there is a grading portion for music markups, however there is a fee that would be applied if the course materials were damaged. Another member indicated music is generally marked with a pencil and able to be erased. Member asked about the indicated activities in the syllabus and said this should be described so students would know what is expected. The guest indicated the activity may be walking or swaying while singing. Member suggested making a statement that accommodations would be made if a student had a disability. Member suggested making the A+ portion of the grading scale range from 98-100 instead of 99-100. Member indicated a course schedule should be included in the syllabus. Guest indicated they do not have a set schedule and members suggested making a "subject to change" for rehearsals. Guest indicated the topic schedule would be subject to change based on what each ensemble needs. Member suggested not making a schedule, but suggested a statement that indicates how often rehearsals would be scheduled each week for the semester and showing how the 2 contact hours to 1 credit hour ratio is being met.

- **MUS 190 Preparatory Applied Music Lessons** –*Approved Unanimously*
  Discussion: Member Amanda Beller presented the course.

- **PB 495 Special Topics in Botany** –*Approved Unanimously*
  Discussion: Member Jackie Bruce presented the course.

- **HI 317 Cuba Today: Historical and Sociopolitical Perspectives** -*Approved Unanimously with Friendly Suggestions*
  Discussion: Member Scott Despain presented the course. Member asked about the attendance policy and asked if the attendance policy should have the Li Marcus indicated the required attendance policy has been included. Member pointed out in the requirements there is a specific Member pointed out that the enrollment total for DELTA reads zero and asked if this should be clarified, another member indicated there could be an administrative cap that we will get clarification on after the meeting. Member said the syllabus was difficult to follow because of the wording and language is laid out in a way that flowed better and suggested the instructor use the syllabus tool. Member said there are 5 assignments in the grading list but there is only an outline for one assignment, in CIM the "written assignment" would be preparation and critical reflections and how this would be grading. Member made the friendly suggestion to include a rounding statement for the grading scale

- **HI 318 Environmental History of Cuba: Prehistory to the Present**-*Approved Unanimously with Friendly Suggestions*
  Discussion: Member Scott Despain presented the course. Member made the friendly suggestion to use the syllabus tool to make the syllabus more user friendly. Member asked if there is a plan in place if the experience is canceled for reasons outside of the course. Guest Kanton Reynolds indicated the funds are generally refunded to the students.

- **HSS 120 Introduction to Humanities & Social Sciences** *Approved Pending*
  Discussion: Member Scott Despain presented the course. Member found a slight discrepancy in the contact hour components seem to be written one for the Fall and one for the Spring, recitation should be 400 to match the lecture. Member brought attention to the common reading saying this is required for the course and asked if there should be Member asked for clarity on the repercussions of missing a course, how many points will be deducted. Member complimented the assignment breakdown but suggested including the grading scale. Member motioned to change the motion to Approve Pending the addition of a grading scale and clarifying the points for attendance, committee voted to approve pending.

- **Ethics (16ETHM) Minor** –*All Approved Unanimously*
  Discussion: Member Scott Despain presented the curricular action. Motion to bundle all of the Humanities and Social Sciences curricula actions. Motion approved. All actions approved unanimously
- **BA Foreign Languages & Literature 16FLLBA-16FLLASIAN**
- **History BA (16HISTBA) and History BS (16HISTBS)**
- **History Minor (16HIM)**
- **16PHILBA, *and* 16PHILBA-16PHILLAW, *and* 16PHILBA-16PHILETH**
- **16PHILBS *and* 16PHILBS-16PHILLOG**

- **BME 205 Introduction to Biomedical Mechanics-** *Approved Unanimously*
  Discussion: Member Rudi Seracino presented the course. Member said the attendance policy in the syllabus indicates "regular attendance policy is expected". Li Marcus reminded the committee that the Provost has indicated the policy is to have a record of the attendance but does not require repercussions. Members concluded the syllabus indicates this effectively. Member asked if the title of the course and outcomes should somehow indicate that most the course is based on solid mechanics and if it is necessary to have this separate course for this. Member responded the lab component of this course makes this course specifically a biomechanical course and the guest Hatice Ozturk confirmed. Guest Lianne Cartee stated that the course will be taught from a Biomechanical view point, member made the friendly suggestion to emphasize that this course is different than a standard mechanics class. Member asked if there is a companion course that goes with the fluid mechanics, guest Lianne Cartee there are required courses that

- **BME 209 Introduction to the Materials Science of Biomaterials-** *Approved Unanimously with Friendly Suggestions*
  Discussion: Member Rudi Seracino presented the course. Outcome #2 starts with "understand" suggestion to remove this word and correct the typo of the word "mechanical" in CIM. Member indicated the number of weeks in the course schedule should equal 16 and it currently reads 15, members agreed the final exam week in the syllabus counts as the $16^{th}$ week.

- **BME 215 Biomedical Mechanics Laboratory-** *Approved Unanimously*
  Discussion: Member Rudi Seracino presented the course.

- **BME 219 Materials Science of Biomaterials Lab-** *Approved Unanimously with Friendly Suggestions*
  Discussion: Member Rudi Seracino presented the course. Member said there are no details about the lab reports and

when they are due, guest Hatice Ozturk indicated these details are provided in the topic schedule and said lab reports will usually be every three weeks. Guest indicated the labs are written in class (as a self-containing lab) and said they will included the due date for the lab reports. Members and Guest discussed the grading scale and how it has been agreed upon by the partnering institution. Member suggested combining the recommended sanctions, guests indicated they will remove the line indicating individual possession of past lab materials is not permitted.

- **BME 295 Research in Biomedical Engineering for Undergraduates-** *Approved Unanimously*
  Discussion: Member Rudi Seracino presented the course.

- **BME 298 Biomedical Engineering Design and Manufacturing I-** *Approved Unanimously*
  Discussion: Member Rudi Seracino presented the course.

- **BME 299 BME Design and Manufacturing I Lab-** *Approved Unanimously*
  Discussion: Member Rudi Seracino presented the course.

- **BME 301 Human Physiology: Electrical Analysis-** *Approved Unanimously with Friendly Suggestions*
  Discussion: Member Scott Ferguson presented the course. Member brought attention to a typo in the catalog description and suggested adjusting. Member also suggested removing the blank page from the syllabus as well. Guests also agreed to adjust the integrity statement in the same way as the BME 219 for this course and BME 302.

- **BME 302 Human Physiology: Mechanical Analysis-** *Approved Unanimously with Friendly Suggestions*
  Discussion: Member Scott Ferguson presented the course. Member made a friendly suggested embellish the statement from the course structure clarifying how many lectures and labs per week.

- **BME 325 Biochemistry for Biomedical Engineers-** *Approved Unanimously with Friendly Suggestions*
  Discussion: Member Scott Ferguson presented the course. Member suggested stating how a new course will not require any additional resources (ie: existing faculty will teach course). Member made the friendly suggestion under the grading components “periodl” should be “period.”.

- **BME 335 Biomaterials-** *Approved Unanimously with Friendly Suggestions*
  Discussion: Member Scott Ferguson presented the course. Member suggested the same clarification for additional resources. Member suggested fixing typos in the student learning outcomes.

- **BME 345 Biomedical Solid Mechanics-** *Approved Unanimously with Friendly Suggestions*
  Discussion: Member Scott Ferguson presented the course. Member suggested eliminating the book reading at the bottom of the syllabus to avoid student confusion. Member suggested they would like to see overlap why a standard mechanics class would not be sufficient, possibly include this in the justification field in CIM. Chair and members agreed that as these is within the same college, it would have been addressed at the college level if it were an issue.

- **CSC 412/(512) Compiler Construction-** *Approved Unanimously with Friendly Suggestions*
  Discussion: Member Scott Ferguson presented the course. Member suggested the course schedule is very terse and suggested that the schedule should be more detailed. Member indicated generally the dual level courses have one syllabus and the distinction between the graduate and undergraduate levels are indicated.

**Discussion**:

Meeting adjourned at 2:08 pm

*Respectfully submitted by Lexi Hergeth*

**MEMORANDUM**

To: University Course and Curriculum Committee

From: Chandra D. Cox, Head, Department of Art +Design

November 15, 2017

**RE: Art + Design | Design Studies Revision**

The Department has decided to update the 2009 curriculum required courses for Design Studies. These revisions include the Design Studies; foundational courses, the required math and the elective options available in various subject areas. Many of the courses are no longer available and/or the numbers have changed. Design Studies has introduced new courses with permanent numbers.

We believe the revisions will help provide a clearer understanding of the eight-semester curriculum display. A record of these revisions is provided as a tracked version of the curriculum display.

11·15·17

Chandra D. Cox, Head Department of Art +Design

11/15/17

Art Rice, Associate Dean, College of Design

# GEP FORMAT A
(SEMESTER-BY-SEMESTER CURRICULUM DISPLAY)

Current: Proposed: X Proposed Effective Semester: **11/2017**

DEGREE TITLE: **Bachelor of Arts Degree in Design Studies**

CONCENTRATION TITLE: N/A

| FRESHMAN YEAR | | | |
|---|---|---|---|
| FALL SEMESTER | CREDITS | SPRING SEMESTER | CREDITS |
| ENG 101 Acad Writing & Research[H] | 4 | GEP PE/Healthy Living course[E] | 1 |
| MA 111 Precalculus Algebra and Trigonometry[12, A] | 3 | GEP Mathematical Sciences requirement[12, A] | 3 |
| D100 Design Thinking I[1] | 3 | DS 100 Design, Culture and Context[1] | 3 |
| Art History Survey[8] | 3 | Art History Survey[8] | 3 |
| ADN 281 Basic Drawing[3] | 3 | COM 110 Public Speaking | 3 |
| | | ADN 219 Digital Imaging[4] | 3 |
| | Total:16 | | *Total:*16 |
| SOPHOMORE YEAR | | | |
| FALL SEMESTER | CREDITS | SPRING SEMESTER | CREDITS |
| GEP PE/Healthy Living course[E] | 1 | GEP Interdisciplinary Perspectives requirement[G] | 3 |
| GEP Social Science requirement[D] | 3 | Design History[9] | 3 |
| DS 200 Survey of Design Studies[2] | 3 | FL - Foreign Language[11] | 3 |
| Advanced Writing[13] | 3 | GEP Humanities requirement[C] | 3 |
| History elective[10,C] | 3 | Design Foundations[3] | 3 |
| FL - Foreign Language[11] | 3 | | |
| | Total:16 | | *Total:*15 |
| JUNIOR YEAR | | | |
| FALL SEMESTER | CREDITS | SPRING SEMESTER | CREDITS |
| Design History[9] | 3 | GEP Natural Sciences requirement (w/lab)[B] | 4 |
| GEP Natural Sciences requirement[B] | 3 | GEP Additional Breadth requirement[F] | 3 |
| GEP Social Science requirement[D] | 3 | Design Studies Elective[15] | 3 |
| ADN418 Contemporary Issues [14] | 3 | Design Studies Elective[15] | 3 |
| Art History Survey[8] | 3 | | |
| | Total:15 | | *Total:*13 |
| **SUMMER** | | | |
| **ADN 490 International Studio / Experience[4]** | | | CREDITS |
| | | | *Total:6* |
| SENIOR YEAR | | | |
| FALL SEMESTER | CREDITS | SPRING SEMESTER | CREDITS |
| DS 481 Design Studies Senior Research Seminar[6] | 3 | DS 483 Capstone Seminar [7] | 3 |
| Design History[9] | 3 | Design Studies Elective[15] | 3 |
| Design Studies Elective[15] | 3 | Design Studies Elective[15] | 3 |
| Design Studies Elective[15] | 3 | Design Studies Elective[15] | 3 |
| Design Studies Elective[15] | 3 | | |
| | Total:15 | | *Total:12* |
| Minimum Credit Hours Required for Graduation: 124* | | | |

**Major/Program Footnotes:**

1. D 100 and DS 100 are required in the first year of Design Studies. and part of the critical path.
2. DS 200 Survey of Design Studies is required and part of the critical path.
3. Basic Drawing ADN 281 is required fall semester first year. In addition one more course (3 credit hours) in Design Foundations is required and may be selected from the following: ADN 111, ADN 112, ADN 414
4. Digital Imaging ADN 219 Spring semester first year
5. International Experience (6 credit hours) is required. This may be a Design Studio worth 6 credit hours (when available), or two 3-credit-hour advised electives.
6. Design Studies Senior Research Seminar is required. DS 481 - 3 hours.
7. Design Studies Capstone Seminar is required. DS 483 - 3 hours.
8. Two survey courses (6 credit hours) in Art History are required and may be selected from the following: HA 202, 203,298,310,395; Art 221, 222 from Meredith College; or Art 151, 152 with Recitation Sections from UNC-CH.
9. Three courses (9 credit hours) in Design History are required and may be selected from the following: ADN 475, ARC 242, D 231, GD 331, LAR 444, ID 444, ADN 492.
10. Choose a History course (HI) from the GEP Humanities course list.
11. Design Studies requires 6 credit hours of FL beyond FL 102 and may be selected from different language courses at the 200 level or above.
12. MA 111 is required. Choose an additional MA course from the GEP Mathematical Sciences course list.
13. Advanced Writing (3 credit hours) select one: ENG 201,214, 215, 287, 288, 292, 301, 316, 323,325
14. ADN 418 Contemporary Issues in Art and Design is required in the junior year.

**Major Advised electives:**

15. A total number of 24 credit hours of advised electives are required when pursuing the Design Studies curriculum. The Advised electives are divided into three units: Application, History and Theory. From each of these units a minimum of two courses (6 credit hours) and a maximum of three courses (9 credit hours) can be selected. 6 credit hours must be at the 300 level or higher.

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied beyond the major requirements listed above. University approved GEP course lists for each of the following units can be found at https://oucc.dasa.ncsu.edu/general-education-program-gep/gep-category-requirements/

A. **Mathematical Sciences** (6 credit hours – *Includes MA 111 and one course from the University approved GEP Mathematical Sciences course list).*

B. **Natural Sciences** (7 credit hours – include one laboratory course or course with a lab)
*Choose from the University approved GEP Natural Sciences course list .*

C. **Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list . The History elective in the major requirements fulfills 3 hours of this requirement.*

D. **Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Social Sciences course list .*

E. **Physical Education/Healthy Living** (2 credit hours – at least one 100-level Fitness and Wellness Course)
*Choose from the University approved GEP Physical Education/Healthy Living course list.*

F. **Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
Choose a course from the GEP Mathematical Sciences or Natural Sciences course list.

G. **Interdisciplinary Perspectives** (3 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*

H. **Introduction to Writing** (4 credit hours satisfied by completing ENG 101 with a C- or better )

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or* ***choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*** Only one course that satisfies this co-requisite is required.

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or* ***choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*** Only one course that satisfies this co-requisite is required.

K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation. **Design Studies requires 6 credit hours of FL beyond FL 102.**

**Major/Program CORE Courses Required**

D100 ..... 3
DS100 Culture/DN Context ..... 3
DS 200 Survey of Design Studies ..... 3
Art History: HA 202, 203,298,310 or 395 ..... 6
Design History: ARC 241, LAR 444, GD 331, ADN 475 or D 231 ..... 9
Design Foundations: ADN 111 2D, ADN 112 3D or ADN 414 Color & Light ..... 6
ADN 281 Basic Drawing ..... 3
ADN 219 Digital Imaging ..... 3
ADN 490 International Studio/Experience ..... 6
ADN418 Contemporary Issues ..... 3
DS 481 Design Studies Capstone Seminar ..... 3
DS 483 Design Studies Capstone Research Paper ..... 3
FL Foreign Language ..... 6
COM 110 Public Speaking ..... 3
Humanities: 3 credit hours must be (HI) History (fulfills GEP requirement) .....3
Advanced Writing: ENG 201,214, 215, 287, 288, 292, 301, 316, 323, 325,.....3

**66 total credit hours**

***GEP Requirements**

Humanities .....3
Mathematical Science .....6
Natural Sciences.....7
Social Sciences.....6
Additional Breadth (ADB).....3
Interdisciplinary Perspective (IDP).....5
English 101 Intro to Writing .....4
Health and Exercise Studies.....2

**36 total credit hours**

**(DS) DESIGN STUDIES ADVISED ELECTIVES: 24 CREDIT HOURS** (3 credit hours per course)
*From each of the three units select a minimum of two courses (6 credit hours) and a maximum of three courses (9 credit hours). 6 credit hours must be at the 300 level or higher.*

## Application Unit

| | | |
|---|---|---|
| ADN | 111 | 2D Design Process & Methods |
| ADN | 112 | 3D Design Process & Methods |
| ADN | 212 | Basic Photography |
| ADN | 219 | Digital Imaging |
| ARC | 232 | Structure & Materials |
| ADN | 272 | Intro to Printing & Surface Design |
| ADN | 273 | Fibers, Materials & Processes |
| ADN | 292 | Special Topics in Art+Design |
| ADN | 311 | Basic Visual Laboratories |
| ADN | 312 | Intermediate Photography |
| ADN | 386 | Basic Sculpture |
| ADN | 411 | Visual Laboratory II |
| ADN | 414 | Color and Light |
| ADN | 415 | Visualizing Narrative |
| ADN | 419 | Multimedia & Digital Imaging |
| ADN | 481 | Intermediate Drawing |
| ADN | 486 | Intermediate Sculpture |
| ID | 492 | Special Topics in Industrial Design |
| DS | 494 | Design Studies Internship |

## Theory Unit

| | | |
|---|---|---|
| GD | 200 | Graphic Design Theory & Practice |
| LAR | 221 | Intro to Environment & Behavior for Designers |
| ID | 262 | Professional Practice in Industrial Design |
| D | 292 | Special Topics in Design |
| ID | 445 | Human-Centered Design |
| D | 492 | Special Topics in Design |
| LAR | 511 | Community Design Policy |
| ADN | 571 | Fibers & Surface Design Seminar |
| LAR | 579 | Human Use of Urban Landscape |
| D | 592 | Special Topics in Design |
| ADN | 492 | Special Topics in Art + Design |
| DS | 481 | Design Studies Senior Research Seminar |
| DS | 483 | Design Studies Senior Capstone |

## History Unit

| | | |
|---|---|---|
| ARC | 241 | Introduction to World Architecture |
| ARC | 242 | History of Western Architecture |
| D | 292 | Special Topics in Design |
| GD | 342 | History of Graphic Design |
| ARC | 441 | History of Cont. Architecture (ARC 241 ADN ARC 242 Pre-Reqs) |
| LAR | 444 | History of Landscape Architecture |
| ADN | 475 | Pre-Industrial World Textiles |
| D | 492 | Special Topics in Design |
| ID | 492 | Special Topics in Industrial Design |
| ADN | 561 | Animation Seminar |
| HI | 591 | Intro to Museology |
| D | 592 | Special Topics in Design |
| HI | | Any History Course from GEP Humanities List |
| ID | 444 | History of Industrial Design |

# GEP FORMAT A
## (SEMESTER-BY-SEMESTER CURRICULUM DISPLAY)

Current: Proposed: X Proposed Effective Semester: ~~7/200~~911/2017

DEGREE TITLE: **Bachelor of Arts Degree in Design Studies**

CONCENTRATION TITLE: N/A

| FRESHMAN YEAR | | | |
|---|---|---|---|
| FALL SEMESTER | CREDITS | SPRING SEMESTER | CREDITS |
| ENG 101 Acad Writing & Research[H,~~11,12~~]<br>~~Mathematics[9,A]~~<br>MA 111 Precalculus Algebra and Trigonometry[12, A]<br>D100 Design Thinking I[~~1,~~11, 12]<br>~~D102 Design Culture/Context I[2,11,12]~~<br>Art History Survey[8]<br>ADN 281 Basic Drawing[3]<br>~~Survey[5]~~ | 4<br>3<br>~~2~~<br>3<br>3<br>3 | ~~HES_*** Health & Exercise Studies~~GEP<br>PE/Healthy Living course[E]<br>GEP Mathematical Sciences ~~Req.~~requirement[12, A]<br>~~D101~~DS 100 Design ~~Thinking II[1,11,12]~~<br>~~D103 Design~~, Culture~~/Context II[2,11,12]~~ and Context[1]<br>Art History ~~Survey[5,11,12]~~Survey[8]<br>COM 110 Public Speaking<br>ADN 219 Digital Imaging[4] | 1<br>3<br>~~2~~<br>3<br>3<br>3<br>3 |
| | Total:~~15~~16 | | *Total:~~15~~16* |
| SOPHOMORE YEAR | | | |
| FALL SEMESTER | CREDITS | SPRING SEMESTER | CREDITS |
| ~~HES_*** Health & Exercise Studies~~GEP<br>PE/Healthy Living course[E]<br>GEP Social Science ~~Req.~~[D]requirement[D]<br>DS 200 Survey of Design ~~Foundations[3,11,12]~~Studies[2]<br>Advanced ~~Writing[10]~~Writing[13]<br>History ~~elective[7]~~elective[10,C]<br>FL - Foreign ~~Language[8,11,12]~~Language[11] | 1<br>3<br>3<br>3<br>3<br>3 | ~~Free Elective~~<br>~~DS History[6,11,12]~~<br>GEP Interdisciplinary Perspectives requirement[G]<br>Design History[9]<br>~~ADN 281 Basic Drawing[3,11,12]~~<br>FL - Foreign ~~Language[8,11,12]~~Language[11]<br>GEP Humanities requirement[C]<br>Design Foundations[3] | ~~2~~3<br>3<br>3<br>3<br>3 |
| | Total:16 | | *Total:~~14~~15* |
| JUNIOR YEAR | | | |
| FALL SEMESTER | CREDITS | SPRING SEMESTER | CREDITS |
| ~~DS History[6,11,12]~~<br>Design History[9]<br>GEP Natural Sciences ~~Req.~~[B]requirement[B]<br>GEP Social Science ~~Req.~~[D]requirement[D]<br>~~ADN 418~~ADN418 Contemporary Issues ~~in~~[14]<br>Art ~~& Design~~<br>~~Design Foundations[3,11,12]~~History Survey[8] | 3<br>3<br>3<br>3<br>3 | ~~Free Elective~~<br>GEP Natural Sciences ~~Req.~~requirement (w/lab)[B]<br>GEP Additional Breadth ~~Req.~~[F]requirement[F]<br>~~DS Elective[13]~~<br>~~DS Elective[13]~~Design Studies Elective[15]<br>Design Studies Elective[15] | ~~3~~<br>4<br>3<br>3<br>3 |
| | Total:15 | | *Total:~~16~~13* |
| **SUMMER** | | | |
| **ADN 490 International Studio~~/Exp.[4,11,12]~~ / Experience[4]** | | | CREDITS |
| | | | *Total:6* |
| SENIOR YEAR | | | |
| FALL SEMESTER | CREDITS | SPRING SEMESTER | CREDITS |
| DS 481 Design Studies Senior Research ~~Seminar~~Seminar[6]<br>Design ~~History[6,11,12]~~History[9]<br>~~DS Elective[13]~~<br>~~DS Elective[13]~~<br>~~DS Elective[13]~~Design Studies Elective[15]<br>Design Studies Elective[15]<br>Design Studies Elective[15] | 3<br>3<br>3<br>3<br>3 | DS 483 Capstone ~~Research Paper~~Seminar [7]<br>~~DS Elective[13]~~<br>~~DS Elective[13]~~<br>~~DS Elective[13]~~Design Studies Elective[15]<br>Design Studies Elective[15]<br>Design Studies Elective[15] | 3<br>3<br>3<br>3 |
| | Total:15 | | *Total:12* |
| Minimum Credit Hours Required for Graduation: 124* | | | |

**~~M~~ajor~~Major~~/Program Footnotes:**

~~1.~~ D 100 and ~~D 101~~DS 100 are required in the first year of Design Studies.

1. ~~D 102~~ and ~~D 103 are required in~~ part of the ~~first year~~critical path.

~~1.~~2. DS 200 Survey of Design Studies is required and part of the critical path.

Basic Drawing ADN 281 is required~~:~~ fall semester first year. In addition ~~two~~one more ~~courses (6~~course (3 credit hours) in Design Foundations ~~are~~is required and may be selected from the following: ADN 111, ADN 112, ADN 414~~:~~

4. Digital Imaging ADN 219 Spring semester first year
3.5. International Experience (6 credit hours) is required. This may be ~~taken at the Prague Institute or some other approved international program to fulfill the department's International Experience requirement. In addition,~~ a ~~summer international studio in Art &~~ Design ~~or other design discipline may also fulfill this requirement. Please consult with your advisor~~Studio worth 6 credit hours (when available), or two 3-credit-hour advised electives.
6. Design Studies Senior Research Seminar is required. DS 481 - 3 hours.
7. Design Studies Capstone Seminar is required. DS 483 - 3 hours.
4.8. Two survey courses (6 credit hours) in Art History are required and may be selected from the following: HA 202, 203,298,310,395; Art 221, 222 from Meredith College; or Art 151, 152 with Recitation Sections from UNC~~,~~ CH.
5.9. Three courses (9 credit hours) in Design History are required and may be selected from the following: ADN 475, ARC 242, D 231, GD ~~342~~331, LAR 444, ID 444, ADN 492.
6.10. Choose a History ~~(HI)~~ course (HI) from the GEP Humanities course list.
7.11. Design Studies ~~required~~requires 6 credit hours of FL beyond FL 102 and may be selected from different language courses at the 200 level or above.
8.12. ~~Mathematics requirement:~~MA 111 is required. Choose an additional MA course from~~: MA 114, 121, 131, 141, 231 or equivalent~~ the GEP Mathematical Sciences course list.
9.13. Advanced Writing ~~requirement to be chosen from~~ (3 credit hours) select one: ENG 201,214, 215, ~~422.~~287, 288, 292, 301, 316, 323,325

~~2. Minimum grade of C- required.~~
~~3. Cannot be taken pass/fail.~~

14. ~~Design (~~ADN 418 Contemporary Issues in Art and Design is required in the junior year.

**Major Advised~~)~~ electives:**

10.15. A total number of 24 credit hours of advised electives are required when pursuing the Design Studies curriculum. The Advised electives are divided into three
units: Application, History and Theory. From each of these units a minimum of two courses (6 credit hours) and a maximum of three courses (9 credit hours) can be selected. ~~(~~6 ~~credits~~credit hours must be at the 300 level or higher~~)~~.

~~*Select 3 credit hours from each unit. Check the course lists for each unit in the SIS degree audit for this program for the most up-to-date course lists.*~~

~~**Application Unit:**~~

~~ADN 111 2D Design~~
~~ADN 112 3D Design~~
~~ADN 212 Basic Photography~~
~~ADN 219 Digital Imaging~~
~~ADN 271 Intro to Printing & Surface Design~~
~~ADN 273 Fibers, Materials & Processes~~
~~ADN 292 Special Topics in Design~~
~~ADN 311 Basic Visual Laboratories~~
~~ADN 312 Intermediate Photography~~
~~ADN 384 Basic Painting~~
~~ADN 386 Basic Sculpture~~
~~ADN 411 Visual Laboratory II~~
~~ADN 414 Color and Light~~
~~ADN 419 Multimedia & Digital Imaging~~
~~ADN 472 Advanced Surface Design~~
~~ADN 481 Intermediate Drawing~~
~~ADN 484 Intermediate Painting~~
~~ADN 486 Intermediate Sculpture~~
~~ADN 492 Special Topics in Design~~
~~ARC 232 Structure & Materials~~
~~DS 494 Design Internship~~
~~ID 255 Contemporary Mfg. Process I~~

~~ID 256 Contemporary Mfg. Process II~~
~~ID 492 Digital Rendering~~

**~~Theory Unit~~:**

~~ADN 418 Contemporary Issues in Art & Design~~
~~ADN 571 Fibers & Surface Design Seminar~~
~~DS 244 Material Culture & Industrial Design~~
~~DS 492 Museum Theory & Practice~~
~~GD 200 Graphic Design Theory & Practice~~
~~LAR 221 Intro to Environment & Behavior for Designers~~
~~LAR 511 Community Design Policy~~
~~LAR 579 Human Use of Urban Landscape~~
~~ID 262 Professional Practice in Industrial Design~~
~~ID 445 Human-Centered Design~~

**~~History Unit~~:**

~~ADN 475 Pre-Industrial World Textiles~~
~~ARC 241 Intro. to World Architecture~~
~~ARC 242 History of Western Architecture~~
~~ARC 441 Hist Cont ARC (ARC 241,ARC 242 pre-reqs)~~
~~ARC 442 History of NC Architecture~~
~~D 492A Iconography~~
~~DS 251 History of Aesthetics~~
~~GD 342 History of Graphic Design~~
~~HA 203 History of American Art~~
~~HA 202 History of Art / Renaissance-20th Century~~
~~HA 310 History of Art & Photography~~
~~HI Any History Course from GEP Humanities List~~
~~HI 592 Advanced Museology~~
~~ID 492F / ID 582F History of Industrial Design~~
~~LAR 444 History of Landscape Architecture~~

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied~~.~~ beyond the major requirements listed above. University approved GEP course lists for each of the following units can be found at https://oucc.dasa.ncsu.edu/general-education-program-gep/gep-category-requirements/

~~University approved GEP course lists for each of the following units can be found at http://www.ncsu.edu/uap/academic-standards/gep/courselists/index.html.~~

A. **Mathematical Sciences** (6 credit hours – *Includes MA 111 and one course* ~~with MA or ST prefix)~~
*~~Choose a course~~ from the University approved GEP Mathematical Sciences course list~~. The Math requirement in the major fulfills 3 hours of this requirement.)~~.*
B. **Natural Sciences** (7 credit hours – include one laboratory course or course with a lab)
*Choose from the University approved GEP Natural Sciences course list .*
C. **Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list . The History elective in the major requirements fulfills 3 hours of this requirement.*
D. **Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Social Sciences course list .*
E. **Physical Education/Healthy Living** (2 credit hours – at least one 100-level Fitness and Wellness Course)
*Choose from the University approved GEP Physical Education/Healthy Living course list.*
F. **Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
Choose a course from the GEP Mathematical Sciences or Natural Sciences course list.
G. **Interdisciplinary Perspectives** (~~5~~-63 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*
H. **Introduction to Writing** (4 credit hours satisfied by completing ENG 101 with a C- or better )

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or* ***choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*** Only one course that satisfies this co-requisite is required.
J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or* ***choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite***. Only one course that satisfies this co-requisite is required.
K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation. **Design Studies requires 6 credit hours of FL beyond FL 102.**

**Major/Program CORE Courses Required**

D100 ..... 3
DS100 Culture/DN Context ..... 3
DS 200 Survey of Design Studies ..... 3
Art History: HA 202, 203,298,310 or 395 ..... 6
Design History: ARC 241, LAR 444, GD 331, ADN 475 or D 231 ..... 9
Design Foundations: ADN 111 2D, ADN 112 3D or ADN 414 Color & Light ..... 6
ADN 281 Basic Drawing ..... 3
ADN 219 Digital Imaging ..... 3
ADN 490 International Studio/Experience ..... 6
ADN418 Contemporary Issues ..... 3
DS 481 Design Studies Capstone Seminar ..... 3
DS 483 Design Studies Capstone Research Paper ..... 3
FL Foreign Language ..... 6
COM 110 Public Speaking ..... 3
Humanities: 3 credit hours must be (HI) History (fulfills GEP requirement) .....3
Advanced Writing: ENG 201,214, 215, 287, 288, 292, 301, 316, 323, 325,.....3

**66 total credit hours**

***GEP Requirements**

Humanities ..... 3
Mathematical Science ..... 6
Natural Sciences ..... 7
Social Sciences ..... 6
Additional Breadth (ADB) ..... 3
Interdisciplinary Perspective (IDP) ..... 5
English 101 Intro to Writing ..... 4
Health and Exercise Studies ..... 2

**36 total credit hours**

**(DS) DESIGN STUDIES ADVISED ELECTIVES: 24 CREDIT HOURS** (3 credit hours per course)
*From each of the three units select a minimum of two courses (6 credit hours) and a maximum of three courses (9 credit hours). 6 credit hours must be at the 300 level or higher.*

## Application Unit

| | | |
|---|---|---|
| ADN | 111 | 2D Design Process & Methods |
| ADN | 112 | 3D Design Process & Methods |
| ADN | 212 | Basic Photography |
| ADN | 219 | Digital Imaging |
| ARC | 232 | Structure & Materials |
| ADN | 272 | Intro to Printing & Surface Design |
| ADN | 273 | Fibers, Materials & Processes |
| ADN | 292 | Special Topics in Art+Design |
| ADN | 311 | Basic Visual Laboratories |
| ADN | 312 | Intermediate Photography |
| ADN | 386 | Basic Sculpture |
| ADN | 411 | Visual Laboratory II |
| ADN | 414 | Color and Light |
| ADN | 415 | Visualizing Narrative |
| ADN | 419 | Multimedia & Digital Imaging |
| ADN | 481 | Intermediate Drawing |
| ADN | 486 | Intermediate Sculpture |
| ID | 492 | Special Topics in Industrial Design |
| DS | 494 | Design Studies Internship |

## Theory Unit

| | | |
|---|---|---|
| GD | 200 | Graphic Design Theory & Practice |
| LAR | 221 | Intro to Environment & Behavior for Designers |
| ID | 262 | Professional Practice in Industrial Design |
| D | 292 | Special Topics in Design |
| ID | 445 | Human-Centered Design |
| D | 492 | Special Topics in Design |
| LAR | 511 | Community Design Policy |
| ADN | 571 | Fibers & Surface Design Seminar |
| LAR | 579 | Human Use of Urban Landscape |
| D | 592 | Special Topics in Design |
| ADN | 492 | Special Topics in Art + Design |
| DS | 481 | Design Studies Senior Research Seminar |
| DS | 483 | Design Studies Senior Capstone |

## History Unit

| | | |
|---|---|---|
| ARC | 241 | Introduction to World Architecture |
| ARC | 242 | History of Western Architecture |
| D | 292 | Special Topics in Design |
| GD | 342 | History of Graphic Design |
| ARC | 441 | History of Cont. Architecture (ARC 241 ADN ARC 242 Pre-Reqs) |
| LAR | 444 | History of Landscape Architecture |
| ADN | 475 | Pre-Industrial World Textiles |
| D | 492 | Special Topics in Design |
| ID | 492 | Special Topics in Industrial Design |
| ADN | 561 | Animation Seminar |
| HI | 591 | Intro to Museology |
| D | 592 | Special Topics in Design |
| HI | | Any History Course from GEP Humanities List |
| ID | 444 | History of Industrial Design |

# GEP FORMAT A
## (SEMESTER-BY-SEMESTER CURRICULUM DISPLAY)

Current: Proposed: X Proposed Effective Semester: 11/2017

DEGREE TITLE: **Bachelor of Arts Degree in Design Studies**

CONCENTRATION TITLE: N/A

| FRESHMAN YEAR | | | |
|---|---|---|---|
| FALL SEMESTER | CREDITS | SPRING SEMESTER | CREDITS |
| ENG 101 Acad Writing & Research[H] | 4 | GEP PE/Healthy Living course[E] | 1 |
| MA 111 Precalculus Algebra and Trigonometry[12, A] | 3 | GEP Mathematical Sciences requirement[12, A] | 3 |
| D100 Design Thinking I[1] | 3 | DS 100 Design, Culture and Context[1] | 3 |
| Art History Survey[8] | 3 | Art History Survey[8] | 3 |
| ADN 281 Basic Drawing[3] | 3 | COM 110 Public Speaking | 3 |
| | | ADN 219 Digital Imaging[4] | 3 |
| | Total:16 | | *Total:16* |
| SOPHOMORE YEAR | | | |
| FALL SEMESTER | CREDITS | SPRING SEMESTER | CREDITS |
| GEP PE/Healthy Living course[E] | 1 | GEP Interdisciplinary Perspectives requirement[G] | 3 |
| GEP Social Science requirement[D] | 3 | Design History[9] | 3 |
| DS 200 Survey of Design Studies[2] | 3 | FL - Foreign Language[11] | 3 |
| Advanced Writing[13] | 3 | GEP Humanities requirement[C] | 3 |
| History elective[10,C] | 3 | Design Foundations[3] | 3 |
| FL - Foreign Language[11] | 3 | | |
| | Total:16 | | *Total:15* |
| JUNIOR YEAR | | | |
| FALL SEMESTER | CREDITS | SPRING SEMESTER | CREDITS |
| Design History[9] | 3 | GEP Natural Sciences requirement (w/lab)[B] | 4 |
| GEP Natural Sciences requirement[B] | 3 | GEP Additional Breadth requirement[F] | 3 |
| GEP Social Science requirement[D] | 3 | Design Studies Elective[15] | 3 |
| ADN418 Contemporary Issues[14] | 3 | Design Studies Elective[15] | 3 |
| Art History Survey[8] | 3 | | |
| | Total:15 | | *Total:13* |
| **SUMMER** | | | |
| **ADN 490 International Studio / Experience[4]** | | | CREDITS |
| | | | *Total:6* |
| SENIOR YEAR | | | |
| FALL SEMESTER | CREDITS | SPRING SEMESTER | CREDITS |
| DS 481 Design Studies Senior Research Seminar[6] | 3 | DS 483 Capstone Seminar[7] | 3 |
| Design History[9] | 3 | Design Studies Elective[15] | 3 |
| Design Studies Elective[15] | 3 | Design Studies Elective[15] | 3 |
| Design Studies Elective[15] | 3 | Design Studies Elective[15] | 3 |
| Design Studies Elective[15] | 3 | | |
| | Total:15 | | *Total:12* |
| Minimum Credit Hours Required for Graduation: 124* | | | |

**Major/Program Footnotes:**

1. D 100 and DS 100 are required in the first year of Design Studies and part of the critical path.
2. DS 200 Survey of Design Studies is required and part of the critical path.
3. Basic Drawing ADN 281 is required fall semester first year. In addition one more course (3 credit hours) in Design Foundations is required and may be selected from the following: ADN 111, ADN 112, ADN 414.
4. Digital Imaging ADN 219 Spring semester first year
5. International Experience (6 credit hours) is required. This may be a Design Studio worth 6 credit hours (when available), or two 3-credit-hour advised electives.
6. Design Studies Senior Research Seminar is required. DS 481 - 3 hours.
7. Design Studies Capstone Seminar is required. DS 483 - 3 hours.
8. Two survey courses (6 credit hours) in Art History are required and may be selected from the following: HA 202, 203,298,310,395; Art 221, 222 from Meredith College; or Art 151, 152 with Recitation Sections from UNC-CH.
9. Three courses (9 credit hours) in Design History are required and may be selected from the following: ADN 475, ARC 242, D 231, GD 331, LAR 444, ID 444, ADN 492.
10. Choose a History course (HI) from the GEP Humanities course list.
11. Design Studies requires 6 credit hours of FL beyond FL 102 and may be selected from different language courses at the 200 level or above.
12. MA 111 is required. Choose an additional MA course from the GEP Mathematical Sciences course list.
13. Advanced Writing (3 credit hours) select one: ENG 201,214, 215, 287, 288, 292, 301, 316, 323,325
14. ADN 418 Contemporary Issues in Art and Design is required in the junior year.



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**Major Advised electives:**

15. A total number of 24 credit hours of advised electives are required when pursuing the Design Studies curriculum. The Advised electives are divided into three units: Application, History and Theory. From each of these units a minimum of two courses (6 credit hours) and a maximum of three courses (9 credit hours) can be selected. 6 credit hours must be at the 300 level or higher.

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied beyond the major requirements listed above. University approved GEP course lists for each of the following units can be found at https://ouce.dasa.ncsu.edu/general-education-program-gep/gep-category-requirements/

A. **Mathematical Sciences** (6 credit hours – *Includes MA 111 and one course from the University approved GEP Mathematical Sciences course list*.

B. **Natural Sciences** (7 credit hours – include one laboratory course or course with a lab)
*Choose from the University approved GEP Natural Sciences course list .*

C. **Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list . The History elective in the major requirements fulfills 3 hours of this requirement.*

D. **Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Social Sciences course list .*

E. **Physical Education/Healthy Living** (2 credit hours – at least one 100-level Fitness and Wellness Course)
*Choose from the University approved GEP Physical Education/Healthy Living course list.*

F. **Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
Choose a course from the GEP Mathematical Sciences or Natural Sciences course list.

G. **Interdisciplinary Perspectives** (3 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*

H. **Introduction to Writing** (4 credit hours satisfied by completing ENG 101 with a C- or better )

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or* ***choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*** Only one course that satisfies this co-requisite is required.

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or* ***choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite***. Only one course that satisfies this co-requisite is required.

K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation. **Design Studies requires 6 credit hours of FL beyond FL 102**.

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*Choose a course*

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**Major/Program CORE Courses Required**

| | |
|---|---|
| D100 | 3 |
| DS100 Culture/DN Context | 3 |
| DS 200 Survey of Design Studies | 3 |
| Art History: HA 202, 203,298,310 or 395 | 6 |
| Design History: ARC 241, LAR 444, GD 331, ADN 475 or D 231 | 9 |
| Design Foundations: ADN 111 2D, ADN 112 3D or ADN 414 Color & Light | 6 |
| ADN 281 Basic Drawing | 3 |
| ADN 219 Digital Imaging | 3 |
| ADN 490 International Studio/Experience | 6 |
| ADN418 Contemporary Issues | 3 |
| DS 481 Design Studies Capstone Seminar | 3 |
| DS 483 Design Studies Capstone Research Paper | 3 |
| FL Foreign Language | 6 |
| COM 110 Public Speaking | 3 |
| Humanities: 3 credit hours must be (HI) History (fulfills GEP requirement) | 3 |
| Advanced Writing: ENG 201,214, 215, 287, 288, 292, 301, 316, 323, 325, | 3 |
| | **66 total credit hours** |

***GEP Requirements**

| | |
|---|---|
| Humanities | 3 |
| Mathematical Science | 6 |
| Natural Sciences | 7 |
| Social Sciences | 6 |
| Additional Breadth (ADB) | 3 |
| Interdisciplinary Perspective (IDP) | 5 |
| English 101 Intro to Writing | 4 |
| Health and Exercise Studies | 2 |
| | **36 total credit hours** |

**(DS) DESIGN STUDIES ADVISED ELECTIVES: 24 CREDIT HOURS** (3 credit hours per course)
*From each of the three units select a minimum of two courses (6 credit hours) and a maximum of three courses (9 credit hours). 6 credit hours must be at the 300 level or higher.*

## Application Unit

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| | | | | | |
|---|---|---|---|---|---|
| ADN | 111 | 2D Design Process & Methods | ADN | 386 | Basic Sculpture |
| ADN | 112 | 3D Design Process & Methods | ADN | 411 | Visual Laboratory II |
| ADN | 212 | Basic Photography | ADN | 414 | Color and Light |
| ADN | 219 | Digital Imaging | ADN | 415 | Visualizing Narrative |
| ARC | 232 | Structure & Materials | ADN | 419 | Multimedia & Digital Imaging |
| ADN | 272 | Intro to Printing & Surface Design | ADN | 481 | Intermediate Drawing |
| ADN | 273 | Fibers, Materials & Processes | ADN | 486 | Intermediate Sculpture |
| ADN | 292 | Special Topics in Art+Design | ID | 492 | Special Topics in Industrial Design |
| ADN | 311 | Basic Visual Laboratories | DS | 494 | Design Studies Internship |
| ADN | 312 | Intermediate Photography | | | |

## Theory Unit

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| | | | | | |
|---|---|---|---|---|---|
| GD | 200 | Graphic Design Theory & Practice | ADN | 571 | Fibers & Surface Design Seminar |
| LAR | 221 | Intro to Environment & Behavior for Designers | LAR | 579 | Human Use of Urban Landscape |
| | | | D | 592 | Special Topics in Design |
| ID | 262 | Professional Practice in Industrial Design | ADN | 492 | Special Topics in Art + Design |
| D | 292 | Special Topics in Design | DS | 481 | Design Studies Senior Research Seminar |
| ID | 445 | Human-Centered Design | DS | 483 | Design Studies Senior Capstone |
| D | 492 | Special Topics in Design | | | |
| LAR | 511 | Community Design Policy | | | |

## History Unit

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| | | | | | |
|---|---|---|---|---|---|
| ARC | 241 | Introduction to World Architecture | D | 492 | Special Topics in Design |
| ARC | 242 | History of Western Architecture | ID | 492 | Special Topics in Industrial Design |
| D | 292 | Special Topics in Design | ADN | 561 | Animation Seminar |
| GD | 342 | History of Graphic Design | HI | 591 | Intro to Museology |
| ARC | 441 | History of Cont. Architecture (ARC 241 ADN ARC 242 Pre-Reqs) | D | 592 | Special Topics in Design |
| | | | HI | | Any History Course from GEP Humanities List |
| LAR | 444 | History of Landscape Architecture | ID | 444 | History of Industrial Design |
| ADN | 475 | Pre-Industrial World Textiles | | | |

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ADN 281 Basic Drawing[3]

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D101

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D101

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Free Elective
DS History[6,11,12]

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,11,12

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ADN 418

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ADN 418

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& Design
Design Foundations[3,11,12]

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Free Elective

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Free Elective

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DS Elective[13]
DS Elective[13]

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DS Elective[13]

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DS Elective[13]
DS Elective[13]
DS Elective[13]

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D 101
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D 101
2.

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D 101

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D 101

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taken at the Prague Institute or some other approved international program to fulfill the department's International Experience requirement. In addition,

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taken at the Prague Institute or some other approved international program to fulfill the department's International Experience requirement. In addition,

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taken at the Prague Institute or some other approved international program to fulfill the department's International Experience requirement. In addition,

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Mathematics requirement:

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Mathematics requirement:

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requirement to be chosen from

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requirement to be chosen from

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Minimum grade of C- required.
Cannot be taken pass/fail.

Design (

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*Select 3 credit hours from each unit. Check the course lists for each unit in the SIS degree audit for this program for the most up-to-date course lists.*

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ADN 111 2D Design
ADN 112 3D Design
ADN 212 Basic Photography
ADN 219 Digital Imaging
ADN 271 Intro to Printing & Surface Design
ADN 273 Fibers, Materials & Processes
ADN 292 Special Topics in Design
ADN 311 Basic Visual Laboratories
ADN 312 Intermediate Photography
ADN 384 Basic Painting
ADN 386 Basic Sculpture
ADN 411 Visual Laboratory II
ADN 414 Color and Light
ADN 419 Multimedia & Digital Imaging
ADN 472 Advanced Surface Design
ADN 481 Intermediate Drawing
ADN 484 Intermediate Painting
ADN 486 Intermediate Sculpture
ADN 492 Special Topics in Design
ARC 232 Structure & Materials
DS 494 Design Internship
ID 255 Contemporary Mfg. Process I
ID 256 Contemporary Mfg. Process II
ID 492 Digital Rendering

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ADN 418 Contemporary Issues in Art & Design
ADN 571 Fibers & Surface Design Seminar
DS 244 Material Culture & Industrial Design
DS 492 Museum Theory & Practice
GD 200 Graphic Design Theory & Practice
LAR 221 Intro to Environment & Behavior for Designers
LAR 511 Community Design Policy
LAR 579 Human Use of Urban Landscape
ID 262 Professional Practice in Industrial Design
ID 445 Human-Centered Design

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ADN 475 Pre-Industrial World Textiles
ARC 241 Intro. to World Architecture
ARC 242 History of Western Architecture
ARC 441 Hist Cont ARC (ARC 241,ARC 242 pre-reqs)
ARC 442 History of NC Architecture

D 492A Iconography
DS 251 History of Aesthetics
GD 342 History of Graphic Design
HA 203 History of American Art
HA 202 History of Art / Renaissance-20th Century
HA 310 History of Art & Photography
HI Any History Course from GEP Humanities List
HI 592 Advanced Museology
ID 492F / ID 582F History of Industrial Design
LAR 444 History of Landscape Architecture

NC STATE UNIVERSITY

College of Agriculture & Life Sciences
Department of Crop and Soil Sciences
cals.ncsu.edu/crop-and-soil-sciences

Campus Box 7620
Raleigh, NC 27695-7620
P: 919.515.2647

# Memorandum – Creation of a New Subject Area Acronym

**To:** Dr. Michael Mullen
Vice Chancellor and Dean of the Division of Academic and Student Affairs

**From:** Dr. David A. Crouse
Undergraduate Teaching Coordinator

**Date:** 10 November 2017

In July 2016, the Department of Crop Science and the Department of Soil Science merged to form the Department of Crop and Soil Sciences. Prior to the merger, both departments had a series of courses under their respective subject areas that are now duplicative in the new merged department. The Department requests the creation of a new subject area acronym, CSSC, which will allow us to consolidate duplicative courses under a single course number. Once the acronym is created, course actions will follow that rename one course (e.g., CS 492 to CSSC 492) and delete its duplicated soil science version (e.g., SSC 492). Multiple courses will be consolidated.

SIGNATURE PAGE

COURSE ACTION for Creation of CSSC Course Acronym

**Recommended By:**

Head, Department of Crop and Soil Sciences — Date

**Recommended By:**

Chair, College Curriculum Committee — 12/1/17 Date

**Endorsed By:**

College Dean — 12/1/17 Date

**Approved By:**

Chair, University Courses & Curricula Committee — Date

Chair, Council on Undergraduate Education — Date

Dean, Division of Academic and Student Affairs (DASA) — Date

*Joint Department of*
**BIOMEDICAL ENGINEERING**

UNC CHAPEL HILL | NC STATE UNIVERSITY

152 MacNider Hall
Campus Box 7575
Chapel Hill, NC 27599
919.966.1175 • bme.unc.edu

4130 Engineering Building III
Campus Box 7115
Raleigh, NC 27695
919.515.5252 • bme.ncsu.edu

**DATE:** October 31, 2017

**TO:** Office of the Dean of Academic and Student Affairs

**FROM:** Lianne Cartee, Chair, BME Undergraduate Affairs Committee

**SUBJECT:** BME Curriculum Change

Attached please find the proposed curriculum change for the Biomedical Engineering program. In an effort to better prepare our graduates for future careers and advanced studies as well as increase opportunities for students in our unique program to take advantage of additional opportunities on the UNC campus, the faculty of Biomedical Engineering, in consultation with student and industry representatives, has developed a comprehensive new curriculum. The curriculum change will impact first year students entering the university in the fall of 2018. Current first year students may opt-into the new curriculum, classroom space permitting. Curriculum changes are staggered so students following the existing curriculum can complete their current curriculum. Details of the curriculum changes are attached including the current Format A, the proposed Format A, an edited version of the online 8 semester display, and the proposed Format B. Consultations with affected departments follow.

The attached diagram and table illustrate the flow of the curriculum and the choice of specialization electives. All required courses are taught on both the UNC and NC State campus in alternate semesters (see red and blue F, S, S1 and S2 to indicate semester and campus when class is offered). Courses are scheduled to enable students to travel to the opposite campus for a half or whole day in order to take classes. This will give our students additional scheduling flexibility to incorporate study abroad, co-op and similar experiences in their education. If a student misses a required class in one semester, the class will be available on the opposite campus the following semester. Senior level electives are unique to each campus, giving students additional electives to choose from across the two campuses.

Should you need any additional information, please feel free to contact me at 919-515-6726 or lacartee@ncsu.edu.

Sincerely,

Lianne A. Cartee, Ph.D.

CURRICULUM ACTION SIGNATURE PAGE

**RECOMMENDED BY:**

Nancy Allbritton 10/31/17

HEAD, DEPARTMENT/PROGRAM | DATE | ADDITIONAL SIGNATURES (IF NEEDED)

**ENDORSED BY:**

6 Nov 17

CHAIR, COLLEGE COURSES & CURRICULA COMMITTEE | DATE | ADDITIONAL SIGNATURES (IF NEEDED)

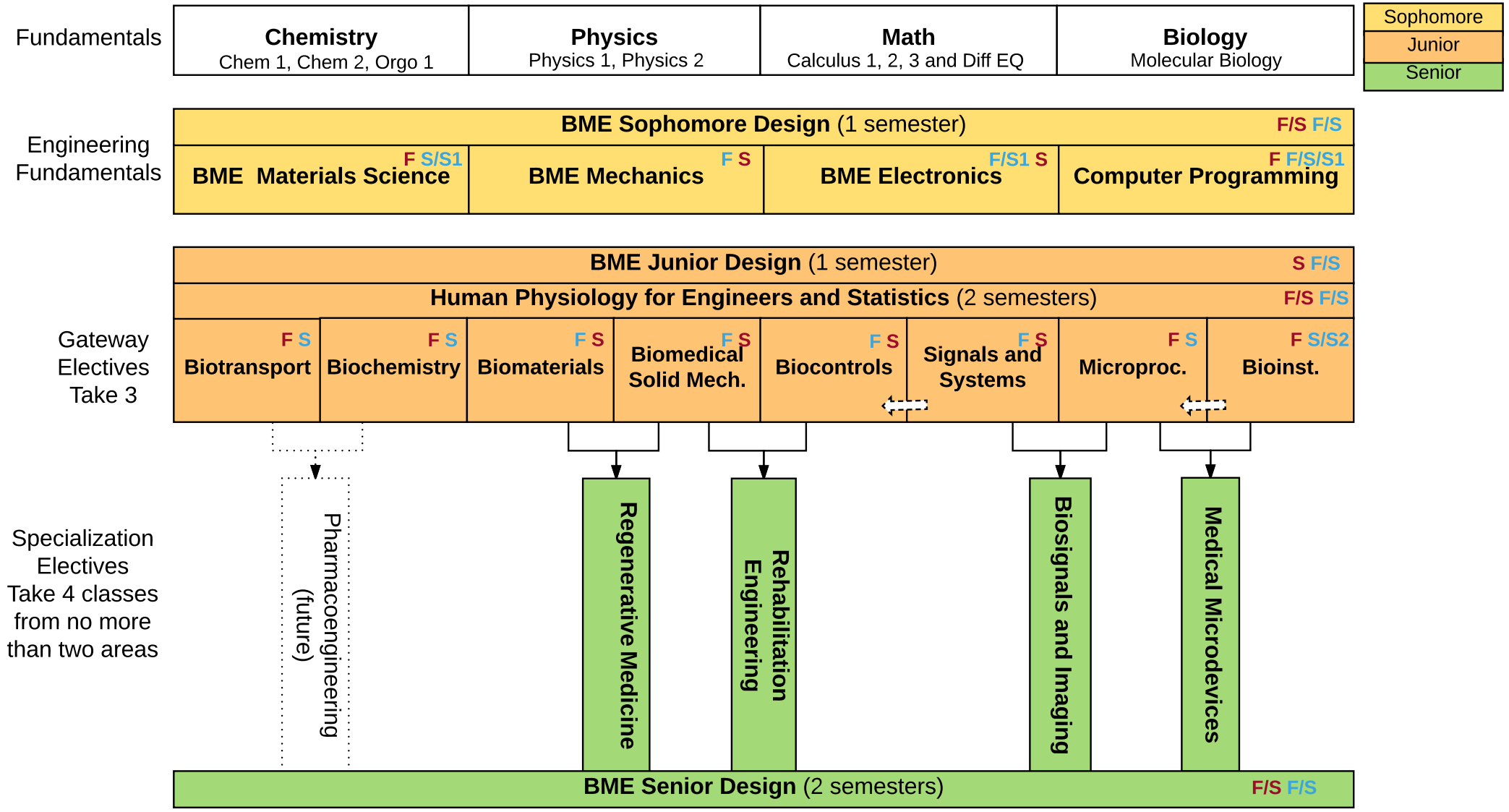
Jerome P. Lavelle 11/16/17

COLLEGE DEAN | DATE | ADDITIONAL SIGNATURES (IF NEEDED)

**APPROVED BY:**

CHAIR, UNIVERSITY COURSES & CURRICULA COMMITTEE | DATE

DEAN OF UNDERGRADUATE ACADEMIC PROGRAMS | DATE


Fundamentals
Chemistry
Chem 1, Chem 2, Orgo 1
Physics
Physics 1, Physics 2
Math
Calculus 1, 2, 3 and Diff EQ
Biology
Molecular Biology
Sophomore
Junior
Senior
Engineering Fundamentals
BME Sophomore Design (1 semester)
F/S F/S
BME Materials Science
F S/S1
BME Mechanics
F S
BME Electronics
F/S1 S
Computer Programming
F F/S/S1
Gateway Electives Take 3
BME Junior Design (1 semester)
S F/S
Human Physiology for Engineers and Statistics (2 semesters)
F/S F/S
Biotransport
F S
Biochemistry
F S
Biomaterials
F S
Biomedical Solid Mech.
F S
Biocontrols
F S
Signals and Systems
F S
Microproc.
F S
Bioinst.
F S/S2
Specialization Electives Take 4 classes from no more than two areas
Pharmacoengineering (future)
Regenerative Medicine
Rehabilitation Engineering
Biosignals and Imaging
Medical Microdevices
BME Senior Design (2 semesters)
F/S F/S

Specialization Area Electives

| | | |
|---|---|---|
| Pharmacoengineering (Group 061) | | |
| BMME 485 | Biotechnology | 3 |
| Regenerative Medicine (Group 063) | | |
| BME 462 | Biomaterials Characterization | 3 |
| BME 484 | Fundamentals of Tissue Engineering | 3 |
| BMME 455 | Biofluid Mechanics | 3 |
| ***Or*** MAE 308 | Fluid Mechanics | 3 |
| ***Or*** CE 382 | Hydraulics | 3 |
| BMME 441 | Thermal Physics | 3 |
| ***Or*** MAE 201 | Engineering Thermodyamics I | 3 |
| ***Or*** MSE 301 | Intro to Thermodynamics of Materials | 3 |
| BIT 466 | Animal Cell Culture | 2 |
| ***and*** BME 483 | Tissue Engineering Technologies | 2 |
| BMME 420 | Introduction to Synthetic Biology | 3 |
| BMME 470 | Analysis of Tissue Engineering Technologies | 3 |
| TE 463 | Polymer Engineering | 3 |
| PHYS 405 | Biological Physics | 3 |
| Rehabilitation Engineering (Group 064) | | |
| BME 418 | Wearable Biosensors | 3 |
| BME 425 | Bioelectricity | 3 |
| BME 444 | Orthopedic Biomechanics | 3 |
| BME 467 | Mechanics of Tissues and Implants Requirements | 3 |
| BMME 405 | Biomechanics of Movement | 3 |
| BMME 445 | Systems Neuroscience | 3 |
| BMME 447 | Neural Basis of Rehabilitation Engineering | 3 |
| Biosignals and Imaging (Group 066) | | |
| BME 412 | Biomedical Signal Processing | 3 |
| BMME 461 | Introduction to Medical Imaging | 3 |
| BMME 581 | Biomedical Microcontroller Applications II | 3 |
| ECE 455 | Computer Control of Robots | 3 |
| ECE 456 | Mechatronics | 3 |
| ECE 461 | Embedded Systems | 3 |
| MATH 528 | Mathematical Methods for Physical Scientists | 3 |
| Medical Microdevices (Group 067) | | |
| BME 412 | Biomedical Signal Processing | 3 |
| BME 418 | Wearable Biosensors | 3 |
| BME 522 | Medical Instrumentation | 3 |
| BME 536 | Digital Control Systems | 3 |
| BMME 455 | Biofluid Mechanics | 3 |
| ***Or*** MAE 308 | Fluid Mechanics | 3 |
| ***Or*** CE 382 | Hydraulics | 3 |
| BMME 441 | Thermal Physics | 3 |
| ***Or*** MAE 201 | Engineering Thermodyamics I | 3 |
| ***Or*** MSE 301 | Intro to Thermodynamics of Materials | 3 |
| BMME 581 | Biomedical Microcontroller Applications II | 3 |
| E 304 | Intro to Nano Science and Technology | 3 |
| ECE 505 | Neural Interface Engineering | 3 |

**Biomedical Engineering (new curriculum)**

GEP FORMAT A

(SEMESTER-BY-SEMESTER CURRICULUM DISPLAY)

Current: X Proposed: Effective Semester: 1**/2013**

DEGREE TITLE: **B. S. in Biomedical Engineering**

CONCENTRATION TITLE: **N/A**

CURRENT DEGREE KEY: **14BME2131**

**Freshman Year**

| | | *Fall Semester* | *Credits* | | | *Spring Semester* | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science (C-) | 3 | CH | 221 | Organic Chem I | 3 |
| CH | 102 | General Chemistry Lab (C-) | 1 | CH | 222 | Organic Chem I Lab | 1 |
| E | 101 | Introduction to Engr & Prob Solv | 1 | MA | 241 | Calculus II (C-) | 4 |
| E | 115 | Intro to Computing Environ | 1 | PY | 205 | Physics for Engr & Sc I (C-) | 3 |
| ENG | 101 | Academic Writing and Research (C-) | 4 | PY | 206 | Physics for Engr & Sc I Lab (C-) | 1 |
| MA | 141 | Calculus I (C-) | 4 | EC | 205 | Economics (GEP Soc Sci Req*[1]) | 3 |
| PE | 1** | Fitness and Wellness Course* | 1 | PE | *** | Physical Education / Healthy Living* | 1 |
| | | **Semester Total** | **15** | | | **Semester Total** | **16** |

**Sophomore Year**

| | | *Fall Semester* | *Credits* | | | *Spring Semester* | *Credits* |
|---|---|---|---|---|---|---|---|
| BME | 201 | Comp Meth in BME | 3 | BIO | 183 | Intro Biol: Cellular & Molecular | 4 |
| BME | 204 | Biomedical Measurements | 3 | BME | 203 | Intro Mat Sci of Biomaterials | 3 |
| MAE | 206 | Engineering Statics ***or*** | 3 | BME | 252 | Engineering Design I | 1 |
| CE | 214 | Engineering Mechanics - Statics | | BME | 210 | Analog and Digital Circuits | 4 |
| MA | 242 | Calculus III | 4 | MAE | 208 | Engineering Dynamics | 3 |
| PY | 208 | Physics for Engr & Sc II | 3 | | | | |
| PY | 209 | Physics for Engr & Sc II Lab | 1 | | | | |
| | | **Semester Total** | **17** | | | **Semester Total** | **15** |

**Junior Year**

| | | *Fall Semester* | *Credits* | | | *Spring Semester* | *Credits* |
|---|---|---|---|---|---|---|---|
| BME | 301 | Human Physiology for Engineers I | 3 | BME | 302 | Human Physiology for Engineers II | 3 |
| BME | 311 | Linear Systems in BME | 3 | *** | *** | BME Elective B[2] | 3 |
| MA | 341 | Applied Diff Equations | 3 | *** | *** | BME Elective C[2] | 3 |
| *** | *** | BME Elective A[2] | 3 | BME | 352 | Engineering Design II | 2 |
| ST | 370 | Prob and Statistics for Engrs | 3 | ENG | 331 | Comm.Engr.& Tech. ***or*** | 3 |
| | | | | ENG | 333 | Comm. Sci. & Res. | |
| | | | | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **15** | | | **Semester Total** | **17** |

**Senior Year**

| | | *Fall Semester* | *Credits* | | | *Spring Semester* | *Credits* |
|---|---|---|---|---|---|---|---|
| BME | 451 | BME Senior Design I | 3 | BME | 452 | BME Senior Design II | 3 |
| *** | *** | BME Elective D[2] | 3 | *** | *** | BME Elective F[2] | 3 |
| *** | *** | BME Elective E[2] | 3 | *** | *** | GEP Requirement* | 2-3 |
| MAE | 301 | Thermodynamics I ***or*** | 3 | *** | *** | GEP Requirement* | 3 |
| MSE | 301 | Equilibrium and Rate Processes | | *** | *** | GEP Requirement* | 3 |
| *** | *** | GEP Requirement* | 3 | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **15** | | | **Semester Total** | **17-18** |

**Minimum Total Credit Hours Required for Graduation 127[I,J,K]**

**Major/Program requirements and footnotes:**

[1] Choose from EC 201 or 205, or ARE 201.

[2] Choose from an appropriate sequence of electives. These must include at least 15 hours of engineering topics.

**No specific emphasis**: Students will work out a plan of study with their advisor that includes at least two 300- or 400-level BME electives and any other courses listed for the emphasis areas. There must be a sequence of at least three related upper-level BME electives to demonstrate an area of depth. One course can be an appropriate non-engineering course.

**Biomechanics:** (A) MAE 214 or CE 313: Solid Mechanics; (B) MAE 308 or CE 382: Fluid Mechanics; (C) BME 342: Experimental & Analytical Methods in Biomechanical Engineering Analysis; (D) BME 441: Biomechanics; (E) and (F) Any BME elective or appropriate course approved by the student's advisor. Students following this area of emphasis should take MAE 201 or MSE 301 in the spring of their junior year and delay BME Elective B until the fall of the senior year.

**Biomaterials :** (A) TE 463: Polymer Engineering; (B) MAE 214 or CE 313: Solid Mechanics; (C) BME 362: Biomaterials Characterization (D) E 304: Introduction to Nano Science and Technology or MSE 485: Biomaterials (E) Any BME elective or appropriate course approved by the student's advisor; and (F) TE/BME 467: Mechanics of Tissues and Implants. Students following this emphasis area should take MAE 201 or MSE 301 in the fall of their junior year and the technical writing course in the spring of their junior year.

**Biomedical Instrumentation:** (A) Any BME elective or appropriate course approved by the student's advisor; (B) BME 422: Fundamentals of Biomedical Instrumentation; (C) BME 412: Biomedical Signal Processing; (D) BME 425: Bioelectricity; (E) and (F) Take two from BME 480: Biomedical Microcontroller Applications; ECE 308: Elements of Control; ECE 436: Digital Control Systems: ECE 455: Computer Control of Robots; ECE 456: Mechatronics; ECE 561: Embedded Systems; and BME 522: Medical Instrumentation. Students following this emphasis area may choose to take a GEP course in the fall semester of the junior year and BME Elective A in the spring semester of the senior year.

*__General Education Program (GEP) requirements and GEP Footnotes:__

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://www.ncsu.edu/uap/academic-standards/gep/courselists/index.html.

**A. Mathematical Sciences** (6 credit hours – one course with MA or ST prefix)
*Fulfilled as part of the Major requirements.*

**B. Natural Sciences** (7 credit hours – include one laboratory course or course with a lab)
*Fulfilled as part of the Major requirements.*

**C. Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list .*

**D. Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)

**D. Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)

*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics. Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.*

**E. Physical Education/Healthy Living** (2 credit hours – at least one 100-level Fitness and Wellness Course)

*Choose from the University approved GEP Physical Education/Healthy Living course list.*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Biomedical Engineering [14BMEBS Req Term Summer 2 18] | | | | | | | |
| | | | | | | | | |
| | First Year | | | | | | | |
| *Fall Semester* | | | *Credits* | | *Spring Semester* | | | *Credits* |
| CH | 101 | Chemistry, A Molecular Science[3,1,2] | 3 | | CH | 202~~2~~1 | Chemistry: A Quantitative Science~~Organic Chem I~~ | 3 |
| CH | 102 | General Chemistry Lab[3,1,2] | 1 | | CH | 202~~2~~2 | Quantitative Chemistry Lab~~Organic Chem I Lab~~ | 1 |
| E | 101 | Introduction to Engr & Prob Solv[4,1,2] | 1 | | MA | 241 | Calculus II[3,1,2] | 4 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | | PY | 205 | Physics for Engr & Sc I[3,1,2] | 3 |
| ENG | 101 | Academic Writing and Research[4,1,3] | 4 | | PY | 206 | Physics for Engr & Sc I Lab[3,1,2] | 1 |
| MA | 141 | Calculus I[3,1,2] | 4 | | EC | 205 | Fund of Econ[D] (or EC 201 or ARE 201)~~Economics (GEP Soc Sci Req*)~~[1] | 3 |
| HESF~~_~~ | 1~~*~~*** | Health & Exercise Studies Course~~*~~[E] | 1 | | ~~HES_~~E | ~~***~~102 | Engineering in the 21st Century~~Health & Exercise Studies Course*~~ | 2~~1~~ |
| | | **Semester Total** | **15** | | | | **Semester Total** | **17~~6~~** |
| | | | | | | | | |
| Sophomore Year | | | | | | | | |
| *Fall Semester* | | | *Credits* | | *Spring Semester* | | | *Credits* |
| BME/BMME[4] | 201 | Comp Meth in BME | 3 | | BIO | 183 | Intro Biol: Cellular & Molecular | 4 |
| BME/BMME[4,5]~~BME~~ | 209~~4~~ | Introduction to the Materials Science of Biomaterials~~Biomedical Measurements~~ | 4~~3~~ | | BME/BMME[4,5] | 203~~5~~ | Intro to Biomedical Mechanics~~Intro Mat Sci of Biomaterials~~ | 4~~3~~ |
| BME/BMME[4,5]~~MAE~~ | 298~~06~~ | BME Design and Manufacturing 1 ~~Engineering Statics *or*~~ | 2~~3~~ | | ~~BME~~ | ~~252~~ | ~~Engineering Design I~~ | ~~1~~ |
| ~~CE~~ | ~~214~~ | ~~Engineering Mechanics - Statics~~ | | | BME/BMME[4,5] | 207~~10~~ | ~~Analog & Digital Circuits~~Blomedical Electronics | 4 |
| MA | 242 | Calculus III | 4 | | ~~MAE~~ | ~~208~~ | ~~Engineering Dynamics~~ | ~~3~~ |
| PY | 208 | Physics for Engr & Sc II | 3 | | CH | 221 | Organic Chem I | 3 |
| PY | 209 | Physics for Engr & Sc II Lab | 1 | | CH | 222 | Organic Chem I Lab | 1 |
| | | **Semester Total** | **17** | | | | **Semester Total** | **16~~5~~** |
| | | | | | | | | |
| Junior Year | | | | | | | | |
| *Fall Semester* | | | *Credits* | | *Spring Semester* | | | *Credits* |
| BME/BMME[4] | 301 | Human Physiology ~~for Engineers I~~: Electrical Analysis | 4~~3~~ | | BME/BMME[4] | 302 | Human Physiology ~~for Engineers II~~: Mechanical Analysis | 4~~3~~ |
| ~~BME~~ | ~~311~~ | ~~Linear Systems in BME~~ | ~~3~~ | | BME/BMME[4,6]~~***~~ | ~~***~~3*5 | BME ~~Elective B~~[2]Gateway 2 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| MA | 341 | Applied Diff Equations ***or*** | 3 | | BME/BMME[4,6] ~~***~~ | ~~***~~3*5 | BME ~~Elective C[2]~~Gateway 3 | 3 |
| MA | 331 | Differential Equations for the Life Sciences | | | BME/BMME[4] | ~~352~~398 | ~~Engineering~~ BME Design and Manufacturing II | 2 |
| BME/BMME[4,6] | ~~***~~3*5 | BME ~~Elective A[2]~~Gateway 1 | 3 | | ~~ENG~~ | ~~331~~ | ~~Comm.Engr.& Tech. *or*~~ | ~~3~~ |
| ~~ST~~*** | ~~370~~*** | ~~Prob and Statistics for Engrs~~GEP Requirement* | 3 | | ~~ENG~~ | ~~333~~ | ~~Comm. Sci. & Res.~~ | |
| *** | *** | Engineering Elective[7] | 3 | | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **16~~5~~** | | | | **Semester Total** | **15~~7~~** |
| | | | | | | | | |
| Senior Year | | | | | | | | |
| *Fall Semester* | | | *Credits* | | *Spring Semester* | | | *Credits* |
| BME | 451 | BME Senior Design I ***or*** | 3 | | BME | 452 | BME Senior Design II ***or*** | 3 |
| BMME | 697 | BME Senior Design I | | | BMME | 698 | BME Senior Design II | |
| ~~***~~ | ~~***~~ | BME ~~Elective D[2]~~Specialty Elective 1[8] | 3 | | ~~***~~ | ~~***~~ | BME Specialty Elective 3[8] ~~Elective F[2]~~ | 3 |
| ~~***~~ | ~~***~~ | BME ~~Elective E[2]~~ | 3 | | ~~***~~ | ~~***~~ | BME Specialty Elective 4[8] ~~GEP Requirement*~~ | 3 |
| ~~MAE~~ | ~~201~~ | ~~Thermodynamics I *or*~~ | ~~3~~ | | *** | *** | GEP Requirement* | 3 |
| ~~MSE~~ | ~~301~~ | ~~Equilibrium and Rate Processes~~ | | | HESF | *** | Physical Education / Healthy Living* | 1 |
| *** | *** | GEP Requirement* | 3 | | ~~***~~ | ~~***~~ | ~~GEP Requirement*~~ | ~~3~~ |
| *** | *** | GEP Requirement* | 3 | | ~~***~~ | ~~***~~ | ~~GEP Requirement*~~ | ~~2 3~~ |
| | | **Semester Total** | **15** | | | | **Semester Total** | **~~17 18~~13** |
| **Minimum Total Credit Hours Required for Graduation[*I,J,K]:** | | | | | | | | **124~~7~~** |

**Major/Program requirements and footnotes:**

~~[1]Choose from EC 201 or 205, or ARE 201.~~

[1]Required course for admission to the program

~~[2]Choose from an appropriate sequence of electives. These must include at least 15 hours of engineering topics.~~

~~[2]~~[3] Grade of C ~~(2.0)~~ or higher required.

~~[3]~~[4]~~Minimum~~ Ggrade of C- or higher required

~~**No specific emphasis**: Students will work out a plan of study with their advisor that includes at least two 300- or 400-level BME electives and any other courses listed for the emphasis areas. There must be a sequence of at least three related upper-level BME electives to demonstrate an area of depth. One course can be an appropriate non-engineering course.~~

~~**Biomechanics:** (A) MAE 314 or CE 313: Solid Mechanics; (B) MAE 308 or CE 382: Fluid Mechanics; (C) BME 342: Experimental & Analytical Methods in Biomechanical Engineering Analysis; (D) BME 441: Biomechanics; (E) and (F) Any BME elective or appropriate course approved by the student's advisor.~~

~~**Biomaterials:** (A) MAE 314 or CE 313: Solid Mechanics; (B) TE 463: Polymer Engineering; (C) PCC 471: Chemistry of Biopolymers (no engineering topics); (D) TE 466: Polymeric Biomaterials; (E) Any BME elective or appropriate course approved by the student's advisor; and (F) TE/BME 467: Mechanics of Tissues and Implants. Students following this emphasis area should take MAE 301 or MSE 301 in the fall of their junior year and the technical writing course in the spring of their junior year.~~

~~**Biomedical Instrumentation:** (A) Any BME elective or appropriate course approved by the student's advisor; (B) BME 422: Fundamentals of Biomedical Instrumentation; (C) BME 412: Biomedical Signal Processing; (D) BME 425: Bioelectricity; (E) and (F) Take two from BME 480: Biomedical Microcontroller Applications; ECE 435: Elements of Control; ECE 436: Digital Control Systems: ECE 455: Computer Control of Robots; ECE 456: Mechatronics; ECE 561: Embedded Sytems; and BME 522: Medical Instrumentation. Students following this emphasis area may choose to take a GEP course in the fall semester of the junior year and BME Elective A in the spring semester of the senior year.~~

~~3 Grade of C (2.0) or higher.~~

~~4 Minimum grade of C-~~

[4]BME/BMME indicates the class is taught BME XXX on the NC State campus in the semester shown and as BMME XXX on the UNC campus and the alternate semester.

[5]Additional options available on the degree audit for students with credit from the previous curriculum, transfer credit, double majors, study abroad credit or similar experience.

[6]Take three gateway electives to meet the pre-requisites for 2 specialization areas

[7]Any 300 or greater level engineering course

[8]Take four Specialty Electives from no more than two specialization areas

***General Education Program (GEP) requirements and GEP Footnotes**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at https://oucc.dasa.ncsu.edu/general-education-program/.

**A. Mathematical Sciences** (6 credit hours – one course with MA or ST prefix)
*Fulfilled as part of the Major requirements.*
**B. Natural Sciences** (7 credit hours – include one laboratory course or course with a lab)
*Fulfilled as part of the Major requirements.*
**C. Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list.*
**D. Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics. Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Science Requirement.*
**E. Health & Exercise Studies** (2 credit hours – at least one 100-level Health & Exercise Studies Course)
*Choose from the University approved GEP Health & Exercise Studies course list.*
**F. Additional Breadth** – (3 credit hours to be selected from the following checked University approved GEP course lists)
**XX** Humanities/Social Sciences/Visual and Performing Arts
**G. Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*
**H. Introduction to Writing** (4 credit hours satisfied by completing ENG 101 with a C- or better)

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements
**I. U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*
**J. Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*
**K. Foreign Language proficiency** – Proficiency at the FL_102 level is required for graduation.

# FORMAT A
(SEMESTER-BY-SEMESTER CURRICULUM DISPLAY)

Indicate display status: Current: Proposed: x Proposed Effective Semester: 08/2018

Degree/Plan Title: Biomedical and Health Sciences Engineering Concentration/Subplan Title:

Plan SIS Code: 14BMEBS Subplan SIS Code:

New Degree Audit required? (Y or N) Y

Critical Path Courses - Identify using the code (CP) which courses are considered critical path courses which represent specific major requirements that are predictive of student success in a given program/plan. Place the (CP) next to the credit hours for the course.

| FRESHMAN YEAR | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FALL SEMESTER | | | CREDITS | SPRING SEMESTER | | | CREDIT |
| CH | 101 | Chemistry, A Molecular Science[1,2] | 3 | CH | 201 | Chemistry: A Quantitative Science | 3 |
| CH | 102 | General Chemistry Lab[1,2] | 1 | CH | 202 | Quantitative Chemistry Lab | 1 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 (CP) | MA | 241 | Calculus II[1,2] | 4 (CP) |
| E | 115 | Intro to Computing Environ[1,2] | 1 (CP) | PY | 205 | Physics for Engr & Sc I[1,2] | 3 (CP) |
| ENG | 101 | Academic Writing and Research[1,3] | 4 (CP) | PY | 206 | Physics for Engr & Sc I Lab[1,2] | 1 (CP) |
| MA | 141 | Calculus I[1,2] | 4 (CP) | E | 102 | Engineering in the 21st Century | 2 |
| HESF | 1** | Fitness and Wellness Course[E] | 1 | EC | 205 | Fund of Econ[D] (or EC 201 or ARE 201) | 3 |
| | | | *Total:*15 | | | | *Total:*1 |

| SOPHOMORE YEAR | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FALL SEMESTER | | | CREDITS | SPRING SEMESTER | | | CREDIT |
| BME/BMME[4,5] | 201 | Comp Meth in BME | 3 (CP) | BIO | 183 | Intro Biol: Cellular & Molecular | 4 |
| BME/BMME[4,5] | 209 | Introduction to the Materials Science of Biomaterials | 4 (CP) | BME/BMME[4,5] | 205 | Intro to Biomedical Mechanics | 4 (CP) |
| BME/BMME[4,5] | 298 | BME Design and Manufacturing 1 | 2 (CP) | BME/BMME[4,5] | 207 | Biomedical Electronics | 4 (CP) |
| MA | 242 | Calculus III | 4 | CH | 221 | Organic Chem I | 3 |
| PY | 208 | Physics for Engr & Sc II | 3 (CP) | CH | 222 | Organic Chem I Lab | 1 |
| PY | 209 | Physics for Engr & Sc II Lab | 1 (CP) | | | | |
| | | | *Total:17* | | | | *Total:*1 |

| JUNIOR YEAR | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FALL SEMESTER | | | CREDITS | SPRING SEMESTER | | | CREDIT |
| BME/BMME[4] | 301 | Human Physiology: Electrical Analysis | 4 | BME/BMME[4] | 302 | Human Physiology: Mechanical Analysis | 4 |
| MA | 341 | Applied Diff Equations ***or*** | 3 | BME/BMME[4,6] | 3*5 | BME Gateway 2 | 3 |
| MA | 331 | Differential Equations for the Life Sciences | | BME/BMME[4,6] | 3*5 | BME Gateway 3 | 3 |
| | | | | BME/BMME[4,5] | 398 | BME Design and Manufacturing II | 2 |
| BME/BMME[4,6] | 3*5 | BME Gateway 1 | 3 | | | | |
| *** | *** | Engineering Elective[7] | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | GEP Requirement* | 3 | | | | |
| | | | *Total:16* | | | | *Total:*1 |

| SENIOR YEAR | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FALL SEMESTER | | | CREDITS | SPRING SEMESTER | | | CREDIT |
| BME | 451 | BME Senior Design I ***or*** | *3* | BME | 452 | BME Senior Design II ***or*** | *3* |
| BMME | 697 | BME Senior Design I | | BMME | 698 | BME Senior Design II | |
| | | BME Specialty Elective 1[8] | *3* | | | BME Specialty Elective 3[8] | *3* |
| | | BME Specialty Elective 2[8] | *3* | | | BME Specialty Elective 4[8] | *3* |
| *** | *** | GEP Requirement* | *3* | *** | *** | GEP Requirement* | *3* |
| *** | *** | GEP Requirement* | *3* | HESF | *** | Physical Education / Healthy Living* | *1* |
| | | | *Total:15* | | | | *Total:1* |

Minimum Credit Hours Required for Graduation[*I,J,K]: 124

**Major/Program Footnotes:**

[1]Required course for admission to the program

[2]Grade of C or higher required
[3]Grade of C- or higher required
[4]BME/BMME indicates the class is taught BME XXX on the NC State campus in the semester shown and as BMME XXX on the UNC campus and the alternate semester.
[5]Additional options available on the degree audit for students with credit from the previous curriculum, transfer credit, double majors, study abroad credit or similar experience.
[6]Take three gateway electives to meet the pre-requisites for 2 specialization areas
[7]Any 300 or greater level engineering course
[8]Take four Specialty Electives from no more than two specialization areas

[*]**General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied.
University approved GEP course lists for each of the following categories can be found at http://www.ncsu.edu/uap/academic-standards/gep/courselists/index.html.

A. **Mathematical Sciences** (6 credit hours – one course with MA or ST prefix)
*Choose from the University approved GEP Mathematical Sciences course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:*

B. **Natural Sciences** (7 credit hours – include one laboratory course or course with a lab)
*Choose from the University approved GEP Natural Sciences course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:*

C. **Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:*

D. **Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Social Sciences course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:* **Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics. Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.**

E. **Physical Education/Healthy Living** (2 credit hours – at least one 100-level Fitness and Wellness Course)
*Choose from the University approved GEP Physical Education/Healthy Living course list.*

F. **Additional Breadth** - (3 credit hours to be selected from the following checked University approved GEP course lists)
_____Humanities/Social Sciences/Visual and Performing Arts or _____Mathematical Sciences/Natural Sciences/Engineering

G. **Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:*

H. **Introduction to Writing** (4 credit hours satisfied by completing ENG 101 with a C- or better )

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite. The following course(s) completed as part of the Major requirements may fulfill this requirement:*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite. The following course(s) completed as part of the Major requirements may fulfill this requirement:*

K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation.

# FORMAT A
(SEMESTER-BY-SEMESTER CURRICULUM DISPLAY)

Indicate display status: Current: Proposed: x Proposed Effective Semester: 08/2018

Degree/Plan Title: Biomedical and Health Sciences Engineering Concentration/Subplan Title:

Plan SIS Code: 14BMEBS Subplan SIS Code:

New Degree Audit required? (Y or N) Y

Critical Path Courses - Identify using the code (CP) which courses are considered critical path courses which represent specific major requirements that are predictive of student success in a given program/plan. Place the (CP) next to the credit hours for the course.

## FRESHMAN YEAR

| FALL SEMESTER | | | CREDITS | SPRING SEMESTER | | | CREDIT |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1,2] | 3 | CH | 201 | Chemistry: A Quantitative Science | 3 |
| CH | 102 | General Chemistry Lab[1,2] | 1 | CH | 202 | Quantitative Chemistry Lab | 1 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 (CP) | MA | 241 | Calculus II[1,2] | 4 (CP) |
| E | 115 | Intro to Computing Environ[1,2] | 1 (CP) | PY | 205 | Physics for Engr & Sc I[1,2] | 3 (CP) |
| ENG | 101 | Academic Writing and Research[1,3] | 4 (CP) | PY | 206 | Physics for Engr & Sc I Lab[1,2] | 1 (CP) |
| MA | 141 | Calculus I[1,2] | 4 (CP) | E | 102 | Engineering in the 21st Century | 2 |
| HESF | 1** | Fitness and Wellness Course[E] | 1 | EC | 205 | Fund of Econ[D] (or EC 201 or ARE 201) | 3 |
| | | | *Total:*15 | | | | *Total:*1 |

## SOPHOMORE YEAR

| FALL SEMESTER | | | CREDITS | SPRING SEMESTER | | | CREDIT |
|---|---|---|---|---|---|---|---|
| BME/BMME[4,5] | 201 | Comp Meth in BME | 3 (CP) | BIO | 183 | Intro Biol: Cellular & Molecular | 4 |
| BME/BMME[4,5] | 209 | Introduction to the Materials Science of Biomaterials | 4 (CP) | BME/BMME[4,5] | 205 | Intro to Biomedical Mechanics | 4 (CP) |
| BME/BMME[4,5] | 298 | BME Design and Manufacturing 1 | 2 (CP) | BME/BMME[4,5] | 207 | Biomedical Electronics | 4 (CP) |
| MA | 242 | Calculus III | 4 | CH | 221 | Organic Chem I | 3 |
| PY | 208 | Physics for Engr & Sc II | 3 (CP) | CH | 222 | Organic Chem I Lab | 1 |
| PY | 209 | Physics for Engr & Sc II Lab | 1 (CP) | | | | |
| | | | *Total:17* | | | | *Total:*1 |

## JUNIOR YEAR

| FALL SEMESTER | | | CREDITS | SPRING SEMESTER | | | CREDIT |
|---|---|---|---|---|---|---|---|
| BME/BMME[4] | 301 | Human Physiology: Electrical Analysis | 4 | BME/BMME[4] | 302 | Human Physiology: Mechanical Analysis | 4 |
| MA | 341 | Applied Diff Equations ***or*** | 3 | BME/BMME[4,6] | 3*5 | BME Gateway 2 | 3 |
| MA | 331 | Differential Equations for the Life Sciences | | BME/BMME[4,6] | 3*5 | BME Gateway 3 | 3 |
| BME/BMME[4,6] | 3*5 | BME Gateway 1 | 3 | BME/BMME[4,5] | 398 | BME Design and Manufacturing II | 2 |
| *** | *** | Engineering Elective[7] | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | GEP Requirement* | 3 | | | | |
| | | | *Total:16* | | | | *Total:*1 |

## SENIOR YEAR

| FALL SEMESTER | | | CREDITS | SPRING SEMESTER | | | CREDIT |
|---|---|---|---|---|---|---|---|
| BME | 451 | BME Senior Design I ***or*** | *3* | BME | 452 | BME Senior Design II ***or*** | *3* |
| BMME | 697 | BME Senior Design I | | BMME | 698 | BME Senior Design II | |
| | | BME Specialty Elective 1[8] | *3* | | | BME Specialty Elective 3[8] | *3* |
| | | BME Specialty Elective 2[8] | *3* | | | BME Specialty Elective 4[8] | *3* |
| *** | *** | GEP Requirement* | *3* | *** | *** | GEP Requirement* | *3* |
| *** | *** | GEP Requirement* | *3* | HESF | *** | Physical Education / Healthy Living* | *1* |
| | | | *Total:15* | | | | *Total:1* |

Minimum Credit Hours Required for Graduation[*I,J,K]: 124

**Major/Program Footnotes:**

[1]Required course for admission to the program

[2]Grade of C or higher required
[3]Grade of C- or higher required
[4]BME/BMME indicates the class is taught BME XXX on the NC State campus in the semester shown and as BMME XXX on the UNC campus and the alternate semester.
[5]Additional options available on the degree audit for students with credit from the previous curriculum, transfer credit, double majors, study abroad credit or similar experience.
[6]Take three gateway electives to meet the pre-requisites for 2 specialization areas
[7]Any 300 or greater level engineering course
[8]Take four Specialty Electives from no more than two specialization areas

*__General Education Program (GEP) requirements and GEP Footnotes:__

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://www.ncsu.edu/uap/academic-standards/gep/courselists/index.html.

A. **Mathematical Sciences** (6 credit hours – one course with MA or ST prefix)
*Choose from the University approved GEP Mathematical Sciences course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:*

B. **Natural Sciences** (7 credit hours – include one laboratory course or course with a lab)
*Choose from the University approved GEP Natural Sciences course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:*

C. **Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:*

D. **Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Social Sciences course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:* **Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics. Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.**

E. **Physical Education/Healthy Living** (2 credit hours – at least one 100-level Fitness and Wellness Course)
*Choose from the University approved GEP Physical Education/Healthy Living course list.*

F. **Additional Breadth** - (3 credit hours to be selected from the following checked University approved GEP course lists)
_____Humanities/Social Sciences/Visual and Performing Arts or _____Mathematical Sciences/Natural Sciences/Engineering

G. **Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:*

H. **Introduction to Writing** (4 credit hours satisfied by completing ENG 101 with a C- or better )

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite. The following course(s) completed as part of the Major requirements may fulfill this requirement:*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite. The following course(s) completed as part of the Major requirements may fulfill this requirement:*

K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation.

# GEP FORMAT B – CURRICULUM REQUIREMENTS

| | |
|---|---|
| **Degree Title:** | **Bachelor of Science in Biomedical Engineering** |
| **Current Degree Key:** | **14BMEBS** |
| **Effective Date of Revision:** | ~~**7/2009**~~ **8/2018** |

| **MAJOR FIELD OF STUDY REQUIREMENTS:** | | |
|---|---|---|
| ***Required Courses/Groups/ Electives:*** | ***Credit Hours*** | ***GEP category, if applicable*** |
| **Indicate if course or course groupings have a C-wall or MGPA requirement** | | **List GEP category and hours satisfied by a Major requirement** |
| **Math** | | |
| MA 141 (C)-wall, MA 241 (C)-wall, MA 242 | 12 | Mathematics (6 hours) |
| (MA 341 or MA 331) | 3 | |
| ~~ST370~~ | ~~3~~ | |
| | | |
| **Sciences** | | |
| CH 101 (C)-wall, CH 102 (C)-wall, | 4 | Natural Sciences (4 hours) |
| CH 201, CH 202, CH 221, CH 222 | ~~4~~8 | Natural Sciences (4 hours) |
| PY 205 (C)-wall, PY 208 | 8 | |
| BIO 183 | 4 | |
| | | |
| **BME Major** | | |
| **GRP 010** Computer Programming (BME 201 or BMME 201 or CSC 113) | 3 | |
| ~~BME 201~~ | | |
| ~~BME 204~~ | ~~3~~ | |
| **GRP 011** BME Mechanics (BME 205, BMME 205 or (MAE 208 and (BME 215 or BMME 215)) | 4 | |
| **GRP 012** BME Electronics (BME 207 or BMME 207 or BME 210 or (ECE 331 and (BME 217 or BMME 217))) | 4 | |
| ~~BME 210~~ | | |
| **GRP 013** BME Materials Science (BME 209 or BMME 209 or ((BME 203 or MSE 203 or MSE 201) and BMME 219)) | 4 | |
| **GRP 020** Sophomore Design (BME 298 or BMME 298 or (BME 252 and BME 299)) | ~~1~~2 | |
| ~~BME 252~~ | | |
| **GRP 030** Electrical Physiology (BME 301 or BMME 301) | 4~~3~~ | Satisfies the GEP Advanced Writing and Speaking Co-requisite |
| ~~BME 301~~ | | |
| **GRP 031**: Mechanical Physiology (BME 302 or BMME 302) | ~~3~~4 | |
| ~~BME 302~~ | | |
| ~~BME 311~~ | ~~3~~ | |
| **GRP 032:** Junior Design (BME 398 or BMME 398 or BME 352) | 2 | |
| ~~BME 352~~ | | |
| **GRP 041:** Senior Design I (BME 451 or BMME 697) | 3 | |
| ~~BME 451~~ | | |
| **GRP 042:** Senior Design II (BME 452 or BMME 698)~~BME 452~~ | 3 | |
| | | |
| **Other Major** | | |
| ~~**GRP 031** (MSE 203 or BME 203)~~ | ~~3~~ | |
| ~~**GRP 032** (CE 214 or MAE 206)~~ | ~~3~~ | |
| ~~**GRP 033** (MAE 208)~~ | ~~3~~ | |
| ~~**GRP 035** (ENG 331 or ENG 333)~~ | ~~3~~ | |
| | | |
| ~~**GRP 036** (MAE 201 or MSE 301)~~ | ~~3~~ | |
| ~~**OPT 001** (SEQ 001, SEQ 002, or SEQ 003)~~ | ~~6(3) = 18~~ | |
| ~~SEQ 001 (BME 342, (BME 441 or BME 541), (MAE 214 or CE 313), (MAE 308 Or CE 382))~~ | | |
| ~~SEQ 002 ((PCC 471 or MT 471), TE 463, (TE 466, or TE 566 or BME 466 or BME 566), (MAE 214 or CE 313), and (TE~~ | | |

| | | |
|---|---|---|
| ~~467 or BME 467))~~<br>~~SEQ 003 ((BME 412 or BME 512), BME 422, (BME 425 or BME 525) and choose 2 from (BME 480, ECE 308, ECE 455, (ECE 456 or ECE 556), or (ECE 522 or BME 522)))~~<br><br>**GRP 050** BME 3x5 Gateway Electives (Pick 3 from two groups)<br>**GRP 051** ( BME 315, BME 325 ), **GRP 053** ( BME 335, BME 345),<br>**GRP 054** ( BME 345, BME 355 ), **GRP 046** ( BME 365, BME 375),<br>**GRP 057** ( BME 375, BME 385)<br><br>**GRP 060** BME 4xx Elective (Pick 4 from no more than two groups)<br>**GRP 061 Pharmacoengineering** (BMME 485)<br>**GRP 063 Regenerative Medicine**( BME 462,BME 484,GRP 070, GRP 071, GRP 072, BMME 420, BMME 470, TE 463),<br>**GRP 064 Rehabilitation Engineering** (BME 418, BME 425, BME 444, BME 467, BMME 405, BMME 445, BMME 447),<br>**GRP 066 Biosignals and Imaging** (BME 412, BMME 461, BMME 581, ECE 455, ECE456, ECE 461)<br>**GRP 067 Medical Microdevices**(BME 412, BME 418, BME 522, BME 536, GRP 070, GRP 071, BMME 581, E 304, ECE 505),<br><br>**GRP 070** Engineering Elective (Pick 1)<br>**GRP 050, GRP 060**<br><br>**GRP 070** Fluid Mechanics Electives<br>MAE 308, CE 382, BMME 455<br>**GRP 071** Thermodynamics electives<br>MAE 201, MSE 301, BMME 441<br>**GRP 072** Tissue Engineering Technologies<br>BIT 466 and BME 483 | | |
| **Concentration Courses/Groups/Electives:** | | |
| **Free Electives:** | | |
| **Total credit hours under Major Field of Study:**<br>***Minimum 27 hours required in program area.*** | ~~99~~ 96 hours | |
| **COLLEGE REQUIREMENTS:** | | |
| **Orientation Course(s):**<br>E 101 and E 115 | 2 | E115 satisfies Technology Fluency requirement |
| **Other:** **(ex: Adv Communication courses)**<br>Economics Elective (EC 205 or EC201 or ARE 201)<br>E 102 Engineering in the 21st century | 3<br>2 | Social Science |
| **Total credit hours under College Requirements:** | ~~75~~ hours | |

## NCSU GENERAL EDUCATION PROGRAM REQUIREMENTS

*Courses in the Major and/or Minor may also fulfill a General Education requirement; however, a GEP category may not be subset to require a specific course from the category list. Required courses must be listed in the Major/College requirements.*

***Specific courses should not be listed in any of the fields below other than ENG 101.***

**At least one of the following must be listed:**

[1]Choose course(s) from the University Approved GEP course list for this category.
[2]Minimum requirements are satisfied by Major/College course requirements.
[3] Major/College course requirement satisfies **X** credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.
[4]Co-requisite is satisfied by a Major/College course requirement.
[5] Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences, or Visual & Performing Arts.
[6] Choose course(s) from the University Approved GEP course lists for the Natural and Mathematical Sciences.

| **General Education Program Requirements:** *Minimum 39-40 hrs* | *Credit hours* | *How will the GEP requirement be met?* ***(choose applicable statement from 1-6 listed above)*** |
|---|---|---|
| **Mathematical Sciences** *(minimum of 6 credits)* (at least one with *MA or ST* prefix) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **Natural Sciences** *(minimum of 7 credits)* (at least *1 laboratory*) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **English 101** | 4 | ENG 101 (C-) |
| **Humanities** *(minimum of 6 credits)* (from two different disciplines) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 6 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Social Sciences** *(minimum of 6 credits)* (from two different disciplines) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 3 | *Required College course satisfies 3 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Additional Breadth** *(minimum of 3 credits)* (Choose AB course list that is different from the approach of the Major) ***Major/College requirements cannot satisfy this requirement and an AB course cannot be double-counted except in satisfying the Global Knowledge and Diversity co-requisites.*** | 3 | *Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences or Visual and Performing Arts* |
| **Interdisciplinary Perspective** *(minimum of 5-6 credits)* ***Only course(s) in the Major may double-count to satisfy this requirement.*** | ~~5~~3 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Physical Education/Healthy Living** (including one Fitness and Wellness course) | 2 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Total credit hours needed to complete GEP that are not satisfied as part of the Major/College requirements.** | ~~23~~21 hours | |
| **GEP Co-Requisites:** | | ***Courses taken in the Major, GEP, or Minor may double-count to fulfill the co-requisites. Courses that satisfy the U.S. Diversity* or Global Knowledge** co-requisite are marked on course lists with asterisks as indicated.*** |
| **U.S. Diversity co-requisite*** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Global Knowledge co-requisite**** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Foreign Language Proficiency** | n/a | FL_102 |
| **The following requirements must be satisfied within the College/Program:** | | |
| **Advanced Communication** | X | Satisfied by College/Program Requirements |
| **Technology Fluency** | X | Satisfied by College/Program Requirements |

| **Total credit hours required to complete Degree:** **Total must be within 120-128 credit hours.** | 124~~7~~ Total hours | **As applicable, indicate here the overall GPA requirement for degree completion including course completion.** |
|---|---|---|

Hatice,

After consulting with our CE382 instructors, I am pleased to confirm that BME205 will be considered an appropriate pre-req for BME students enrolling in CE382... so that we don't need to enroll students manually, we may consider adding this to the pre-req list through a minor course action.

Regards,

Rudi

Hatice,
The addition of MA331 as an option to MA341 is appropriate for BME program and the Math Department approves this curricular revision.
Alina

_____

**Alina Duca, PhD**
Director of Undergraduate Programs, Mathematics Department
College of Sciences | North Carolina State University
http://www.math.ncsu.edu/undergrad | (919) 515-1875 | SAS 2108

Thank you for informing us of the change in the BME curriculum. We understand that TE 463 and BME/TE 467 will continue to be electives in the BME curriculum but enrollment will likely decrease beginning fall of 2019 with an additional drop of enrollment in the fall of 2020.

Regards,
REG

**Russell E. Gorga, Ph.D.**
Professor
Alumni Distinguished Undergraduate Professor
Director of Undergraduate Programs and Associate Department Head

---
Hatice,

MSE has no problem with this.

Thanks,
Cheryl

**Cheryl Cass, Ph.D.**
Associate Professor, Teaching
Director of Undergraduate Programs
Department of Materials Science and Engineering
North Carolina State University
Office: 3002B Engineering Building I (Centennial Campus)
Phone: (919) 515-2479
https://www.mse.ncsu.edu/profile/caparzel

On Mon, Oct 23, 2017 at 6:37 PM, Hatice Ozturk <hoo@ncsu.edu> wrote:
Hi Cheryl,

BME is submitting a new curriculum action and offering more courses from the BME department. As a result, we are dropping MSE/BME203 requirement from the BME curriculum effective Fall 2019.

Please let us know your response.

Thank you

Hatice

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Hatice,

Chemistry is in favor of this, however, based on previous 201 enrollment during Spring semesters over the last several years, we will not be able to accommodate 50 additional students in the Spring alone. We can however accommodate that number of students over the entire academic year (Fall,Spring,Summer) and therefore we encourage your students to plan accordingly. Please let me know if you have any questions.

Jeremy

On Tue, Oct 17, 2017 at 3:05 PM, Hatice Ozturk <hoo@ncsu.edu> wrote:
Hi,

On the 8-semester display, the course will be on the Freshman Spring semester with effective date of Spring 2019.

Hatice

On Tue, Oct 17, 2017 at 2:42 PM, Jeremiah Feducia <jfeduci@ncsu.edu> wrote:
Dear Hatice,

Is there a particular semester we should expect this enrollment increase in?

On Tue, Oct 17, 2017 at 2:39 PM, Laura Sremaniak <lssreman@ncsu.edu> wrote:
Hi Hatice,

Thanks for sending this information to our department for comment. I am cc'ing our co-Directors of the undergraduate program to see if this is acceptable.

Thanks,
Laura

On Mon, Oct 16, 2017 at 11:43 AM, Hatice Ozturk <hoo@ncsu.edu> wrote:

Hi Laura,

This is Hatice, your former Women and Science team member. I am writing this note to you as the Biomedical Engineering Department Course and Curriculum Committee Co-Chair. BME department is a joint department with UNC-CH and we are in the process of creating a unified curriculum. One of the areas we are balancing is chemistry requirements on both campuses. UNC requires 2-semesters of chemistry before organic chemistry, NCSU, requires only one semester of chemistry before organic chemsitry. BME program would like to add CH 201/202 to the unified curriculum in order to balance the basic science requirements.

I am requesting Chemistry department's permission to do so. This will mean an enrollment increase of 50 students per year.

Please let me know if this is acceptable.

Thank you

Hatice

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Thanks. We're ok with your changes.

Jack

On Tue, Oct 24, 2017 at 1:30 PM, Hatice Ozturk <hoo@ncsu.edu> wrote:
Jack,

Thank you for your prompt response. BME 8 semester display is attached. MAE 308 falls under the footnote 4 - Any engineering elective 3xx or higher.

Please let me know if you have other requests.

Hatice

On Tue, Oct 24, 2017 at 9:50 AM, Jack Edwards <jredward@ncsu.edu> wrote:
Hatice - your changes with regard to 208/206/214 are fine with us. We'd like a little more information re. your use of 308 - it is an elective in your curriculum, but what are the other choices? If you have a draft copy of your new curriculum so that we understand better where it fits, that would be great.

Thanks
Jack

On Mon, Oct 23, 2017 at 6:31 PM, Hatice Ozturk <hoo@ncsu.edu> wrote:

Hi Jack,

This is Hatice, Lianne's co-chair in the BME Undergraduate Affairs Committee. BME is in the process of submitting a new curriculum and more courses are offered from the BME department. I am writing this note to consult with MAE on the following changes:

We are dropping MAE 206 and MAE 208 as requirements, but some students may choose; dropping MAE 214 as emphasis area elective, but some students may choose.

We are keeping MAE 308 as an elective. A new Biomedical Mechanics course ( Statics and dynamics combo plus biomedical applications lab) has been created to take place of statics and dynamics requirements in the BME curriculum and we hope that it will be an acceptable prerequisite to MAE 308.

Hatice

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Rudi,

Thank you for your prompt response. BME 205 Biomedical Mechanics Course Syllabus is attached. This is the UNC version but the NCSU version is identical.

Please let me know if you have other requests.

Hatice

May you please send me the syllabus for the new BME course so that we can make sure the topics required for CE382 are included?

Thanks,

Rudi

On Mon, Oct 23, 2017 at 6:19 PM, Hatice Ozturk <hoo@ncsu.edu> wrote:

Hi Rudi,

This is Hatice, Lianne's co-chair in the BME Undergraduate Affairs Committee. BME is in the process of submitting a new curriculum and more courses are offered from the BME department. I am writing this note to consult with CE on the following changes:

We are dropping CE 214 as requirement, but some students may choose; dropping CE 313 as emphasis area elective, but some students may choose.

We are keeping CE 382 as an elective. A new Biomedical Mechanics course ( Old CE 213 plus biomedical applications lab) has been created to take place of statics and dynamics requirements in the BME curriculum and we hope that it will be an acceptable prerequisite to CE 382.

Please let us know your response .

Hatice O. Ozturk

Biomedical Engineering

NC STATE UNIVERSITY

College of Engineering
Office of Academic Affairs

www.engr.ncsu.edu

Campus Box 7904
21 Current Drive, Page Hall
Raleigh, NC 27695-7904
P: 919.515.3263

**DATE:** September 28, 2017

**TO:** Dr. Michael D. Mullen, Vice Provost and Dean of Academic and Student Affairs
**FROM:** Dr. Lisa Bullard, Departmental Curriculum Chair, Chemical Engineering Department

**RE:** Curriculum Revision for 14CHEBS to specify the GEP (IP) Course, E102: Engineering In the 21st Century

By means of this memorandum and the attached documents, the Chemical Engineering Department proposes to modify the 2nd semester of their engineering curriculum to add the GEP (Interdisciplinary) course E102: Engineering in the 21st Century.

This revision specifies a 2-hour, interdisciplinary perspective, general education elective in the second semester. The course, E102: Engineering in the 21st Century, is designed as an early exploration class intended to introduce students to the Engineering Grand Challenges. The course will be open to the campus. There is no change in the number of credit hours. Resources are being allocated from the college to accomplish this change. Attached is a semester-by-semester display with the revision shown in blue. The course was approved by UCCC and officially added to all of the Engineering First Year curricula (EFY) in 2017.

**SIGNATURES**

**RECOMMENDED BY:** Carla S. Eudkins — HEAD, DEPARTMENT/PROGRAM — Nov 15, 2017 — DATE

**ENDORSED BY:** [signature] — CHAIR, COLLEGE COURSES & CURRICULA COMMITTEE — 5 Nov 17 — DATE

Jerome P. Gaulle — COLLEGE DEAN — 12/04/17 — DATE

**APPROVED BY:** _____ — CHAIR, UNIVERSITY COURSES & CURRICULA COMMITTEE — DATE

_____ — DEAN OF UNDERGRADUATE ACADEMIC PROGRAMS — DATE

APPROVAL DATE _____

## Chemical Engineering [14CHEBS Req Term Spring 13]

### Freshman Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | CH | 201 | Chemistry – Quantitative Sci. | 3 |
| CH | 102 | General Chemistry Lab[1] | 1 | CH | 202 | Quantitative Chem Lab | 1 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | MA | 241 | Calculus II[1] | 4 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | PY | 206 | Physics for Engr & Sc I Lab[1] | 1 |
| MA | 141 | Calculus I[1] | 4 | EC | 205 | Economics (or EC 201 or ARE 201)* | 3 |
| HESF | 1** | Health & Exercise Studies | 1 | HES | *** | Health & Exercise Studies | 1 |
| | | **Semester Total** | **15** | | | **Semester Total** | **16** |

### Sophomore Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 221 | Organic Chemistry I (or CH 225) | 3 | CH | 223 | Organic Chemistry II (or CH 227) | 3 |
| CH | 222 | Organic Chemistry I Lab (or CH 226) | 1 | CH | 224 | Organic Chemistry II Lab (or CH 228) | 1 |
| CHE | 205 | Chemical Proc Prin[2] | 4 | CHE | 225 | Chemical Proc Systems[2] | 3 |
| MA | 242 | Calculus III[2] | 4 | MA | 341 | Applied Differential Eq[2] | 3 |
| *** | *** | GEP Requirement* | 3 | PY | 208 | Physics Engr & Scientists II | 3 |
| | | | | PY | 209 | Physics Engr & Scientists II Lab | 1 |
| | | | | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **15** | | | **Semester Total** | **17** |

### Junior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 315 | Quantitative Analysis | 4 | CH | *** | Chemistry Elective[3] | 4 |
| CHE | 311 | Transport Processes I[2] | 3 | CHE | 312 | Transport Processes II | 3 |
| CHE | 315 | Chem Process Thermo | 3 | CHE | 316 | Thermo of Chem & Phase Eq | 3 |
| ECE | 331 | Prin Electrical Engr ***or*** | | CHE | 330 | Chem Engr Lab I | 4 |
| MSE | 201 | Struct & Prop Engr Mat | 3 | *** | *** | Free Elective | 3 |
| *** | *** | GEP Requirement* | 3 | | | | |
| CHE | 395 | Professional Dev Seminar | 1 | | | | |
| | | **Semester Total** | **17** | | | **Semester Total** | **17** |

### Senior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CHE | 331 | Chem Engr Lab II | 2 | CHE | 435 | Proc System Analy & Control | 3 |
| CHE | 446 | Des & Analy Chem Reactors | 3 | CHE | 451 | CHE Design II | 3 |
| CHE | 450 | CHE Design I | 3 | *** | *** | Technical Elective[4] | 3 |
| *** | *** | Technical Elective[4] | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | GEP Requirement* | 3 | *** | *** | GEP Requirement (Interdisc Persp)* | 2-3 |
| | | **Semester Total** | **14** | | | **Semester Total** | **14-15** |

**Minimum Total Credit Hours Required for Graduation** **125**

**Major/Program requirements and footnotes:**

[1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.

[2]Grade of C- or better required, E 115 requires satisfactory completion (S).

[3]Chemistry electives include: BCH 351, BCH 451, CH 335, CH 437, CH 610, FS 402, FS 502, PCC 461, PCC 464, PSE 335.

[4]Technical Electives: BAE 322, BEC 462, BEC 463, BEC 488, BEC 562, BEC 577, BIT 464, BIT 563, BME 466, CE 373, CE 476, CE 477, CE 479, CE 484, E 304, ECE 331, ECE 468, ECE 568, ISE 311, ISE 443, CHE 460 and higher electives, MAE 206, MAE 208, MAE 314, MAE 406, MAE 421, MSE 201, MEA 479, NE 404, NE 419, PSE 425, TE 466

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://oucc.ncsu.edu/gep-courses.

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list.*

**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics. Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.*

**Health & Exercise Studies** (2 credit hours – must include one HESF 100-level course)
*Choose from the University approved GEP Health & Exercise Studies course list.*

**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities/Social Sciences/Visual and Performing Arts*

**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*

K. **Foreign Language proficiency** - Proficiency at the FL 102 level is required for graduation.

# Chemical Engineering [14CHEBS Req Term Spring 2018]

## Freshman Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | CH | 201 | Chemistry – Quantitative Sci. | 3 |
| CH | 102 | General Chemistry Lab[1] | 1 | CH | 202 | Quantitative Chem Lab | 1 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | MA | 241 | Calculus II[1] | 4 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | PY | 206 | Physics for Engr & Sc I Lab[1] | 1 |
| MA | 141 | Calculus I[1] | 4 | E | 102 | Engr in the 21st Century (GEP IP) | 2 |
| HESF | 1** | Health & Exercise Studies | 1 | HES | *** | Health & Exercise Studies | 1 |
| | | **Semester Total** | **15** | | | **Semester Total** | **15** |

## Sophomore Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 221 | Organic Chemistry I (or CH 225) | 3 | CH | 223 | Organic Chemistry II (or CH 227) | 3 |
| CH | 222 | Organic Chemistry I Lab (or CH 226) | 1 | CH | 224 | Organic Chemistry II Lab (or CH 228) | 1 |
| CHE | 205 | Chemical Proc Prin[2] | 4 | CHE | 225 | Chemical Proc Systems[2] | 3 |
| MA | 242 | Calculus III[2] | 4 | MA | 341 | Applied Differential Eq[2] | 3 |
| EC | 205 | Economics (or EC 201 or ARE 201)* | 3 | PY | 208 | Physics Engr & Scientists II | 3 |
| | | | | PY | 209 | Physics Engr & Scientists II Lab | 1 |
| | | | | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **15** | | | **Semester Total** | **17** |

## Junior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 315 | Quantitative Analysis | 4 | CH | *** | Chemistry Elective[3] | 4 |
| CHE | 311 | Transport Processes I[2] | 3 | CHE | 312 | Transport Processes II | 3 |
| CHE | 315 | Chem Process Thermo | 3 | CHE | 316 | Thermo of Chem & Phase Eq | 3 |
| ECE | 331 | Prin Electrical Engr ***or*** | | CHE | 330 | Chem Engr Lab I | 4 |
| MSE | 201 | Struct & Prop Engr Mat | 3 | *** | *** | Free Elective | 3 |
| *** | *** | GEP Requirement* | 3 | | | | |
| CHE | 395 | Professional Dev Seminar | 1 | | | | |
| | | **Semester Total** | **17** | | | **Semester Total** | **17** |

## Senior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CHE | 331 | Chem Engr Lab II | 2 | CHE | 435 | Proc System Analy & Control | 3 |
| CHE | 446 | Des & Analy Chem Reactors | 3 | CHE | 451 | CHE Design II | 3 |
| CHE | 450 | CHE Design I | 3 | *** | *** | Technical Elective[4] | 3 |
| *** | *** | Technical Elective[4] | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | GEP Requirement* | 3 | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **14** | | | **Semester Total** | **15** |

**Minimum Total Credit Hours Required for Graduation** **125**

**Major/Program requirements and footnotes:**

[1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.

[2]Grade of C- or better required, E 115 requires satisfactory completion (S).

[3]Chemistry electives include: BCH 351, BCH 451, CH 335, CH 437, CH 610, FS 402, FS 502, PCC 461, PCC 464, PSE 335.

[4]Technical Electives: BAE 322, BEC 462, BEC 463, BEC 488, BEC 562, BEC 577, BIT 464, BIT 563, BME 466, CE 373, CE 476, CE 477, CE 479, CE 484, E 304, ECE 331, ECE 468, ECE 568, ISE 311, ISE 443, CHE 460 and higher electives, MAE 206, MAE 208, MAE 314, MAE 406, MAE 421, MSE 201, MEA 479, NE 404, NE 419, PSE 425, TE 466

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://ouce.ncsu.edu/gep-courses.

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list .*

**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics. Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.*

**Health & Exercise Studies** (2 credit hours – must include one HESF 100-level course)
*Choose from the University approved GEP Health & Exercise Studies course list.*

**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities/Social Sciences/Visual and Performing Arts*

**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*

K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation.

# GEP FORMAT B – CURRICULUM REQUIREMENTS

| | |
|---|---|
| **Degree Title:** | **Bachelor of Science in Chemical Engineering** |
| **Current Degree Key:** | **14CHEBS** |
| **Effective Date of Revision:** | **1/2018** |

| **MAJOR FIELD OF STUDY REQUIREMENTS:** | | |
|---|---|---|
| ***Required Courses/Groups/ Electives:*** | ***Credit Hours*** | ***GEP category, if applicable*** |
| **Indicate if course or course groupings have a C-wall or MGPA requirement** | | **List GEP category and hours satisfied by a Major requirement** |
| **Math** | | |
| MA 141 (C-), MA 241(C-), MA 242 | 12 | Mathematics (6 hours) |
| **GRP 030** Differential Equations (MA 341 or MA 301) (C-) | 3 | |
| **Sciences** | | |
| CH 101(C-), CH 102(C-) | 4 | Natural Sciences (4 hours) |
| PY 205(C-), PY 208 | 8 | Natural Sciences (4 hours) |
| CH 201(C-), CH 202 | 4 | |
| **GRP 020** Organic Chemistry 1 with Lab (CH 221 and CH 222) | 4 | |
| **GRP 025** Organic Chemistry 2 with Lab (CH 223 and CH 224) CH 315 | 4 | |
| **GRP 032** Chemistry Elective (BCH 451; CH 437; TC 461; CH 401and 402; CH 415 and (CH 230 or CH 232); CH 461; CH 610; CH 615); FS 402 | 4<br>4 | |
| **CHE Major** | | |
| CHE 205 (C-) | 4 | |
| CHE 225 (C-) | 3 | |
| CHE 311 (C-) | 3 | |
| CHE 312 | 3 | |
| CHE 315 (C-) | 3 | |
| CHE 316 | 3 | |
| CHE 330 | 4 | |
| CHE 331 | 2 | |
| CHE 395 | 1 | |
| CHE 435 | 3 | |
| CHE 446 | 3 | |
| CHE 450 | 3 | |
| CHE 451 | 3 | |
| **Other Major** | | |
| **GRP 031** (ECE 331 or MSE 201) | 3 | |
| **GRP 034** Technical Electives (BAE 422; CE 213, 214, 215, 373, 456, 476, 477, 484; CHE 460, 462; ECE 331; ISE 311, 443; MAE 206, 208, 314, 406, 421; MSE 201, NE 404, 419; TC 401; TE 466; WPS 425 | 6 | |
| **Concentration Courses/Groups/Electives:** | | |
| **Free Electives:** EXC 901 Free Elective EXCEPT NOT (CH 111, ECI 105, ENG 110, FLC 1**, FLE 1**, FLF 1**, FLG 1**, FLH 1**, FLI 1**, FLJ 1**, FLK 1**, FLN 1**, FLP 1**, FLR 1**, FLS 1**,GRK 1**, LAT 1**, MA 100, MA 101, MA 103, | 3 | |

| | | |
|---|---|---|
| MA 107, MA 108, MA 111, MA 121, MA 131, MA 231, PY 211, PY 212) | | |
| **Total credit hours under Major Field of Study:** ***Minimum 27 hours required in program area.*** | 97 hours | |
| **COLLEGE REQUIREMENTS:** | | |
| **Orientation Course(s):** E 101, E 115 and E102 | 4 | Technology Fluency Requirement |
| **Other:** (ex: Adv Communication courses) Economics Elective (EC 205, 201; ARE 201) | 3 | Social Science |
| **Total credit hours under College Requirements:** | 7 hours | |

| **NCSU GENERAL EDUCATION PROGRAM REQUIREMENTS** *Courses in the Major and/or Minor may also fulfill a General Education requirement; however, a GEP category may not be subset to require a specific course from the category list. Required courses must be listed in the Major/College requirements.* ***Specific courses should not be listed in any of the fields below other than ENG 101.*** | | **At least one of the following must be listed:** [1]Choose course(s) from the University Approved GEP course list for this category. [2]Minimum requirements are satisfied by Major/College course requirements. [3] Major/College course requirement satisfies **X** credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category. [4]Co-requisite is satisfied by a Major/College course requirement. [5] Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences, or Visual & Performing Arts. [6] Choose course(s) from the University Approved GEP course lists for the Natural and Mathematical Sciences. |
|---|---|---|
| **General Education Program Requirements:** *Minimum 39-40 hrs* | *Credit hours* | *How will the GEP requirement be met?* ***(choose applicable statement from 1-6 listed above)*** |
| **Mathematical Sciences** *(minimum of 6 credits)* (at least one with *MA or ST* prefix) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **Natural Sciences** *(minimum of 7 credits)* (at least *1 laboratory*) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **English 101 (C-)** | 4 | ENG 101 |
| **Humanities** *(minimum of 6 credits)* (from two different disciplines) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 6 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Social Sciences** *(minimum of 6 credits)* (from two different disciplines) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 3 | *Required College course satisfies 3 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Additional Breadth** *(minimum of 3 credits)* (Choose AB course list that is different from the approach of the Major) ***Major/College requirements cannot satisfy this requirement and an AB course cannot be double-counted except in satisfying the Global Knowledge and Diversity co-requisites.*** | 3 | *Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences or Visual and Performing Arts* |
| **Interdisciplinary Perspective** *(minimum of 5-6 credits)* ***Only course(s) in the Major may double-count to satisfy this requirement.*** | 3 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Physical Education/Healthy Living** (including one Fitness and Wellness course) | 2 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Total credit hours needed to complete GEP that are not satisfied as part of the Major/College requirements.** | 21 hours | |
| **GEP Co-Requisites:** | | ***Courses taken in the Major, GEP, or Minor may double-count to fulfill the co-requisites. Courses that satisfy the U.S. Diversity* or Global Knowledge** co-requisite are marked on course lists with asterisks as indicated.*** |

| | | |
|---|---|---|
| **U.S. Diversity co-requisite*** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Global Knowledge co-requisite**** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Foreign Language Proficiency** | n/a | FL_102 |
| **The following requirements must be satisfied within the College/Program:** | | |
| **Advanced Communication** | X | Satisfied by College/Program Requirements |
| **Technology Fluency** | X | Satisfied by College/Program Requirements |

| | | |
|---|---|---|
| **Total credit hours required to complete Degree:**<br>**Total must be within 120-128 credit hours.** | 125 Total hours | **Graduation requirements include: (1) 2.0 overall GPA or higher in all courses attempted at NCSU and (b) 2.0 GPA or higher in all CHE designated courses, or a (C-) or higher in all CHE designated courses.** |

NC STATE UNIVERSITY

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Campus Box 7904
21 Current Drive, Page Hall
Raleigh, NC 27695-7904
P: 919.515.3263

**DATE:** September 28, 2017

**TO:** Dr. Michael D. Mullen, Vice Provost and Dean of Academic and Student Affairs
**FROM:** Dr. Lisa Bullard, Departmental Curriculum Chair, Chemical Engineering Department

**RE:** Curriculum Revision for 14CHE-14CHEBMF to specify the GEP (IP) Course, E102: Engineering In the 21st Century.

By means of this memorandum and the attached documents, the Chemical Engineering Department proposes to modify the 2nd semester of their engineering curriculum to add the GEP (Interdisciplinary) course E102: Engineering in the 21st Century.

This revision specifies a 2-hour, interdisciplinary perspective, general education elective in the second semester. The course, E102: Engineering in the 21st Century, is designed as an early exploration class intended to introduce students to the Engineering Grand Challenges. The course will be open to the campus. There is no change in the number of credit hours. Resources are being allocated from the college to accomplish this change. Attached is a semester-by-semester display with the revision shown in blue. The course was approved by UCCC and officially added to all of the Engineering First Year curricula (EFY) in 2017.

**SIGNATURES**

**RECOMMENDED BY:**

Lisa S. Bullard — Nov 15, 2017
HEAD, DEPARTMENT/PROGRAM — DATE

**ENDORSED BY:**

15 Nov 17
CHAIR, COLLEGE COURSES & CURRICULA COMMITTEE — DATE

Jerome P. Lavelle — 12/04/17
COLLEGE DEAN — DATE

**APPROVED BY:**

CHAIR, UNIVERSITY COURSES & CURRICULA COMMITTEE — DATE

DEAN OF UNDERGRADUATE ACADEMIC PROGRAMS — DATE

APPROVAL DATE _____

# Chemical Engineering (BS): Biomanufacturing Sciences (14CHEBMF)

## Freshman Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 101 Chemistry, A Molecular Science[4, 6] | 3 | CH 201 Chemistry – Quantitative Sci.[1, 6] | 3 |
| CH 102 General Chemistry Lab[4, 6] | 1 | CH 202 Quantitative Chem Lab[6] | 1 |
| E 101 Introduction to Engr & Prob Solv[1] | 1 | MA 241 Calculus II[4] | 4 |
| E 115 Intro to Computing Environ | 1 | PY 205 Physics for Engr & Sc I[4] | 3 |
| ENG 101 Academic Writing and Research[1] | 4 | PY 206 Physics for Engineer & Scientists I Lab[4] | 1 |
| MA 141 Calculus I[4] | 4 | EC 205 Economics (**or** EC 201 **or** ARE 201)* | 3 |
| HES_*** Health & Exercise Studies Course | 1 | HES_*** Health & Exercise Studies Course | 1 |
| | 15 | | 16 |

## Sophomore Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| BEC 220 Intro Biomanufacturing | 1 | BIO 183 Intro Biology: Cellular & Molecular | 4 |
| CH 221 Organic Chemistry I[5, 1] | 3 | CH 223 Organic Chemistry II[5] | 3 |
| CH 222 Organic Chemistry I Lab[5] | 1 | CH 224 Organic Chemistry II Lab[5] | 1 |
| CHE 205 Chemical Proc Prin[1] | 4 | CHE 225 Chemical Proc Systems[1] | 3 |
| MA 242 Calculus III[1] | 4 | MA 341 Applied Differential Eq[1] | 3 |
| PY 208 Physics Engr & Scientists II | 3 | GEP Requirement* | 3 |
| PY 209 Physics for Engineer & Scientists II Lab | 1 | | |
| | 17 | | 17 |

## Junior Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| BCH 451 Intro Biochemistry | 4 | BBS 426 Industrial Microbiology & Bioman Lab | 4 |
| BEC 363 Found. of Recomb Microorg for Biomanuf. | 2 | BEC 330 Prin & Applications of Biosparations | 3 |
| BEC 463 Ferm. of Recomb Microorg | 2 | CHE 312 Transport Processes II | 1 |
| CHE 311 Transport Processes I[1] | 3 | CHE 316 Thermo of Chem & Phase Eq | 3 |
| CHE 315 Chem Process Thermo[1] | 3 | Free Elective | 3 |
| GEP Requirement* | 3 | GEP Requirement* | 3 |
| | 17 | | 17 |

## Senior Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| BEC 436 Downstream Proc of Biomaterials | 2 | Biomanufacturing Elective[2] | 2 |
| BEC 480 Large Scale Fermentation OR BEC 485 Large Scale Recovery & Purification | 2 | CHE 435 Proc System Analy & Control | 3 |
| CHE 395 Professional Dev Seminar | 1 | CHE 451 CHE Design II | 3 |
| CHE 447 Bioreactor Engineering | 3 | Bioethics Course (GEP IP Req*)[3] | 3 |
| CHE 450 CHE Design I | 3 | GEP Requirement* | 2-3 |
| GEP Requirement* | 3 | | |
| | 14 | | 13-14 |

Minimum Credit Hours Required for Graduation*[I,J,K]: 125

**Major/Program requirements and footnotes**

[1] Minimum grade of (C-) required.

[2] The Biomanufacturing elective course must be selected from the following list: BEC 440, 441, 462, 475, 480, 483, 485, 488, 497, 541. NOTE: Course selected from the choice of either BEC 480/485 cannot be used to satisfy this requirement (i.e. counted twice).

[3] The bioethics course must be selected from: IDS 201, 303; STS 302, 304, 320; STS(PHI) 325

[4] Grade of C (2.0) or higher required.

[5] CH 225/226 may substitute for CH 221/222 and CH 227/228 may substitute for CH 223/224.

[6] CH 103/104 may substitute for CH 101/102 and CH 203/204 may substitute for CH 201/202.

***General Education Program (GEP) requirements and GEP Footnotes**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at https://oucc.dasa.ncsu.edu/general-education-program/.

**A. Mathematical Sciences** (6 credit hours – one course with MA or ST prefix)
*Choose from the University approved GEP Mathematical Sciences course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:*

**B. Natural Sciences** (7 credit hours – include one laboratory course or course with a lab)
*Choose from the University approved GEP Natural Sciences course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:*

**C. Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:*

**D. Social Sciences** (3 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Social Sciences course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:* EC 205, EC 201, or ARE 201

**E. Health & Exercise Studies** (2 credit hours – at least one 100-level Health & Exercise Studies Course)
*Choose from the University approved GEP Health & Exercise Studies course list.*

**F. Additional Breadth** – (3 credit hours to be selected from the following checked University approved GEP course lists)
__X__ Humanities/Social Sciences/Visual and Performing Arts or ___ Mathematical Sciences/Natural Sciences/Engineering

**G. Interdisciplinary Perspectives** (5-6 credit hours)
*2 credits to be selected from the approved GEP Interdisciplinary Perspectives list. Course chosen to meet the Biotech Minor Group E requirement in the Major satisfies 3 credit hours of the 5 credit hours needed to fulfill the GEP Interdisciplinary Perspectives requirement.*

**H. Introduction to Writing** (4 credit hours satisfied by completing ENG 101 with a C- or better)

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements

**I. U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite. The following course(s) completed as part of the Major requirements may fulfill this*

*requirement:*

**J. Global Knowledge** (GK)

*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite. The following course(s) completed as part of the Major requirements may fulfill this requirement:*

**K. Foreign Language proficiency** – Proficiency at the FL_102 level is required for graduation.

## B. S. in Chemical Engineering
## Biomanufacturing Sciences Concentration

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 101 (or 103) General Chemistry I[1a] | 3 | CH 201 (or 203) General Chemistry II[1b] | 3 |
| CH 102 (or 104) General Chemistry I Lab[1a] | 1 | CH 202 (or 204) General Chemistry II Lab | 1 |
| E 101 Introduction to Engr & Prob Solv[1a] | 1 | MA 241 Calculus II[1a] | 4 |
| E 115 Intro to Computing Environ | 1 | PY 205 Physics for Engr & Sc I[1a] | 3 |
| ENG 101 Academic Writing & Research[1a] | 4 | PY 206 Physics for Engr & Sc I Lab[1a] | 1 |
| MA 141 Calculus I[1a] | 4 | EC 205 Econ (**or** EC 201 **or** ARE 201)* | 3 |
| HESx 1** Fitness & Wellness Course* | 1 | HESx (100 or 200 level) Elective* | 1 |
| | **15** | E 102 Engr in the 21st century (GEP IP) | **3** |
| | | | **18** |

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| BEC 220 Intro Biomanufacturing | 1 | BIO 183 Intro Bio: Cellular & Molecular | 4 |
| CH 221 (or 225) Organic Chemistry I[1b] | 3 | CH 223 (or 227) Organic Chemistry II | 3 |
| CH 222 (or 226) Organic Chemistry I Lab | 1 | CH 224 (or 228) Organic Chemistry II Lab | 1 |
| CHE 205 Chemical Proc Prin[1b] | 4 | CHE 225 Chemical Proc Systems[1b] | 3 |
| MA 242 Calculus III[1b] | 4 | MA 341 Applied Differential Eq[1b] | 3 |
| PY 208 Physics Engr & Scientists II | 3 | Removed GEP | 3 |
| PY 209 Physics Engr & Scientists II Lab | 1 | | **14** |
| | **17** | | |

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| BCH 451 Intro Biochemistry | 4 | BEC 426 Industrial Micro & Bioman Lab | 2 |
| BEC 363 Found Recomb Micro for Biom | 2 | BEC 330 Prin & Applications of Biosep | 2 |
| BEC 463 Ferm of Recomb Microorg | 2 | CHE 312 Transport Processes II | 3 |
| CHE 311 Transport Processes I[1] | 3 | CHE 316 Thermo of Chem & Phase Eq | 3 |
| CHE 315 Chem Process Thermo[1] | 3 | Free Elective | 3 |
| GEP Requirement* | 3 | GEP Requirement* | 3 |
| | **17** | | **16** |

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| BEC 436 Downstream Proc of Biomat | 2 | Biomanufacturing Elective[2] | 2 |
| BEC 480 Large Scale Fermentation **OR** | 2 | CHE 435 Proc System Analy & Control | 3 |
| BEC 485 Large Scale Recov & Purif | | CHE 451 CHE Design II | 3 |
| CHE 395 Professional Dev Seminar | 1 | Bioethics Course (GEP IP Req*)[3] | 3 |
| CHE 447 Bioreactor Engineering | 3 | GEP Requirement* | 2-3 |
| CHE 450 CHE Design I | 3 | | **13-14** |
| GEP Requirement* | 3 | | |
| | **14** | | |

Minimum Credit Hours Required for Graduation*: **125**

**Major/Program requirements and footnotes:**

[1a] Must be completed with grade of (C) or higher.

[1b] Must be completed with grade of (C-) or higher.

[2] The Biomanufacturing elective course must be selected from the following list: BEC 440/540, BEC 441/541, BEC/CHE 462, BEC 475/575, BEC 480/580, BEC/BME 483, BEC 485/585, BEC/CHE 488, BEC 497, BIT 466. NOTE: Course selected from the choice of either BEC 480/485 cannot be used to satisfy this requirement (i.e. counted twice).

[3] The bioethics course must be selected from: IDS 201, 303; STS 302, 304; STS(PHI) 325

*** General Education Program (GEP) requirements:**

To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at http://www.ncsu.edu/uap/academic-standards/gep/courselists/index.html .

*PHYSICAL EDUCATION* - 2 hours to be selected from the approved GEP Physical Education list.
a. One fitness and wellness course (any PE 100-level course).
b. One additional credit hour of PE activity courses.
*HUMANITIES* - 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
*SOCIAL SCIENCES* - 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
*ADDITIONAL BREADTH* - 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
*INTERDISCIPLINARY PERSPECTIVES* - 2 credits to be selected from the approved GEP Interdisciplinary Perspectives list. Course chosen to meet the Bioethics course requirement in the Major satisfies 3 credit hours of the 5 credit hours needed to fulfill the GEP Interdisciplinary Perspectives requirement.

Co-requisites:
U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.
Foreign Language proficiency at the FL_102 level will be required for graduation.

# GEP FORMAT B – CURRICULUM REQUIREMENTS

| |
|---|
| Degree Title: Bachelor of Science in Chemical Engineering, Biomanufacturing Sciences Concentration |
| Current Degree Key: 14CHEBS-14CHEBMF |
| Effective Date of Revision: 1/2018 |

| MAJOR FIELD OF STUDY REQUIREMENTS: | | |
|---|---|---|
| *Required Courses/Groups/ Electives:* | *Credit Hours* | *GEP category, if applicable* |
| Indicate if course or course groupings have a C-wall or MGPA requirement | | List GEP category and hours satisfied by a Major requirement |
| Math | | |
| MA 141(C-), MA 241(C-), MA 242 | 12 | Mathematics (6 hours) |
| MA 341 (C-) | 3 | |
| Sciences | | |
| CH 101(C-), CH 102(C-) | 4 | Natural Sciences (4 hours) |
| PY 205(C-), PY 208 | 8 | Natural Sciences (4 hours) |
| CH 201(C-), CH 202 | 4 | |
| GRP 020 Organic Chemistry 1 with Lab (CH 221 and CH 222) | 4 | |
| GRP 025 Organic Chemistry 2 with Lab (CH 223 and CH 224) | 4 | |
| GRP 035 BIO 183 or ZO 160 | 4 | |
| BCH 451 | 4 | |
| CHE Major | | |
| CHE 205(C-) | 4 | |
| CHE 225(C-) | 3 | |
| CHE 311(C-) | 3 | |
| CHE 312 | 3 | |
| CHE 315(C-) | 3 | |
| CHE 316 | 3 | |
| CHE 395 | 1 | |
| CHE 435 | 3 | |
| CHE 447 | 3 | |
| CHE 450 | 3 | |
| CHE 451 | 3 | |
| Other Major | | |
| BEC 220 | 1 | |
| BEC 320 | 2 | |
| BEC 330 | 2 | |
| BEC 420 | 2 | |
| BEC 426 | 2 | |
| BBS 426 | 2 | |
| GRP 037 Bioethics Elective (IDS 201, IDS/NR 303; PHI 325; STS 302, 304, 320, 325) | 3 | GEP Interdisciplinary Perspectives category |
| GRP 038 BEC 480 or 485 | 2 | |
| GRP 039 Biomanufacturing Elective (BEC 440, 442, 480, 485, 495, 497; CHE 463; BME 495; BIT 466, 470) | 2 | |
| Concentration Courses/Groups/Electives: | | |
| Free Electives: EXC 901 Free Elective EXCEPT NOT (CH 111, ECI 105, ENG 110, FLC 1**, FLE 1**, FLF 1**, FLG 1**, FLH 1**, FLI 1**, FLJ 1**, FLK 1**, FLN 1**, FLP 1**, FLR 1**, FLS 1**,GRK 1**, LAT 1**, MA 100, MA 101, MA 103, | 3 | |

| | | |
|---|---|---|
| MA 107, MA 108, MA 111, MA 121, MA 131, MA 231, PY 211, PY 212) | | |
| **Total credit hours under Major Field of Study:** *Minimum 27 hours required in program area.* | 100 hours | |
| **COLLEGE REQUIREMENTS:** | | |
| **Orientation Course(s):** E 101, E 115 and E102 | 4 | Technology Fluency Requirement |
| **Other:** (ex: Adv Communication courses) Economics Elective (EC 205, 201; ARE 201) | 3 | Social Science |
| **Total credit hours under College Requirements:** | 7 hours | |

| **NCSU GENERAL EDUCATION PROGRAM REQUIREMENTS** | **At least one of the following must be listed:** |
|---|---|
| *Courses in the Major and/or Minor may also fulfill a General Education requirement; however, a GEP category may not be subset to require a specific course from the category list. Required courses must be listed in the Major/College requirements.* | [1]Choose course(s) from the University Approved GEP course list for this category. |
| ***Specific courses should not be listed in any of the fields below other than ENG 101.*** | [2]Minimum requirements are satisfied by Major/College course requirements. |
| | [3]Major/College course requirement satisfies X credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category. |
| | [4]Co-requisite is satisfied by a Major/College course requirement. |
| | [5]Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences, or Visual & Performing Arts. |
| | [6]Choose course(s) from the University Approved GEP course lists for the Natural and Mathematical Sciences. |

| **General Education Program Requirements:** *Minimum 39-40 hrs* | *Credit hours* | *How will the GEP requirement be met? (choose applicable statement from 1-6 listed above)* |
|---|---|---|
| **Mathematical Sciences** *(minimum of 6 credits)* (at least one with *MA or ST* prefix) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements ore satisfied by Major course requirements* |
| **Natural Sciences** *(minimum of 7 credits)* (at least *1 lobaratory*) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements ore satisfied by Major course requirements* |
| **English 101 (C-)** | 4 | ENG 101 |
| **Humanities** *(minimum of 6 credits)* (from two different disciplines) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 6 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Social Sciences** *(minimum of 6 credits)* (from two different disciplines) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 3 | *Required College course satisfies 3 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Additional Breadth** *(minimum of 3 credits)* (Choose AB course list that is different from the approach of the Major) ***Major/College requirements cannot satisfy this requirement and an AB course cannot be double-counted except in satisfying the Global Knowledge and Diversity co-requisites.*** | 3 | *Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences or Visual and Performing Arts* |
| **Interdisciplinary Perspective** *(minimum of 5-6 credits)* ***Only course(s) in the Major may double-count to satisfy this requirement.*** | 3 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Physical Education/Healthy Living** (including one Fitness and Wellness course) | 2 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Total credit hours needed to complete GEP that are not satisfied as part of the Major/College requirements.** | 21 hours | **** Required Departmental course in Bioethics will satisfy 3 hours of Humanities, Additional Breadth, or Interdisciplinary Perspectives category.*** |
| **GEP Co-Requisites:** | | ***Courses taken in the Major, GEP, or Minor may double-count to fulfill the co-requisites. Courses that satisfy the U.S. Diversity* or Global Knowledge** co-requisite are marked on course lists with asterisks as indicated.*** |

| | | |
|---|---|---|
| **U.S. Diversity co-requisite*** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Global Knowledge co-requisite**** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Foreign Language Proficiency** | n/a | FL_102 |
| **The following requirements must be satisfied within the College/Program:** | | |
| **Advanced Communication** | X | Satisfied by College/Program Requirements |
| **Technology Fluency** | X | Satisfied by College/Program Requirements |

| | | |
|---|---|---|
| **Total credit hours required to complete Degree:**<br>**Total must be within 120-128 credit hours.** | 125 Total hours | **Graduation requirements include: (1) 2.0 overall GPA or higher in all courses attempted at NCSU and (b) 2.0 GPA or higher in all CHE designated courses, or a (C-) or higher in all CHE designated courses.** |

NC STATE UNIVERSITY

College of Engineering
Office of Academic Affairs

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**DATE:** September 28, 2017

**TO:** Dr. Michael D. Mullen, Vice Provost and Dean of Academic and Student Affairs
**FROM:** Dr. Lisa Bullard, Departmental Curriculum Chair, Chemical Engineering Department

**RE:** Curriculum Revision for 14CHE-14CHEBIO to specify the GEP (IP) Course, E102: Engineering In the 21st Century

By means of this memorandum and the attached documents, the Chemical Engineering Department proposes to modify the 2nd semester of their engineering curriculum to add the GEP (Interdisciplinary) course E102: Engineering in the 21st Century.

This revision specifies a 2-hour, interdisciplinary perspective, general education elective in the second semester. The course, E102: Engineering in the 21st Century, is designed as an early exploration class intended to introduce students to the Engineering Grand Challenges. The course will be open to the campus. There is no change in the number of credit hours. Resources are being allocated from the college to accomplish this change. Attached is a semester-by-semester display with the revision shown in blue. The course was approved by UCCC and officially added to all of the Engineering First Year curricula (EFY) in 2017.

**SIGNATURES**

**RECOMMENDED BY:** Carla S. Eudkins — HEAD, DEPARTMENT/PROGRAM — Nov 15, 2017 — DATE

**ENDORSED BY:** [signature] — CHAIR, COLLEGE COURSES & CURRICULA COMMITTEE — 15 Nov 17 — DATE

Jerome P. Lavelle — COLLEGE DEAN — 12/04/17 — DATE

**APPROVED BY:** _____ — CHAIR, UNIVERSITY COURSES & CURRICULA COMMITTEE — DATE

_____ — DEAN OF UNDERGRADUATE ACADEMIC PROGRAMS — DATE

APPROVAL DATE _____

## 6. FORMAT B – CURRICULUM REQUIREMENTS

| | |
|---|---|
| **Degree Title:** | **Bachelor of Science in Chemical Engineering, Biomolecular Concentration** |
| **Current Degree Key:** | **14CHEBS- 14CHEBIO** |
| **Effective Date of Revision:** | **01/2018** |

| **MAJOR FIELD OF STUDY REQUIREMENTS:** | | |
|---|---|---|
| ***Required Courses/Groups/ Electives:*** | ***Credit Hours*** | ***GEP category, if applicable*** |
| **Indicate if course or course groupings have a C-wall or MGPA requirement** | | **List GEP category and hours satisfied by a Major requirement** |
| **Math** | | |
| MA 141 (C-), MA 241 (C-), MA 242 (C-) | 12 | Mathematics (6 hours) |
| **GRP 031** Differential Equations (MA 341 or MA 301)(C-) | 3 | |
| **Sciences** | | |
| CH 101 (C-), CH 102(C-) | 4 | Natural Sciences (4 hours) |
| PY 205(C-), PY 208 | 8 | Natural Sciences (4 hours) |
| CH 201(C-), CH 202 | 4 | |
| **GRP 020** Organic Chemistry 1 with Lab (CH 221 and CH 222) | 4 | |
| **GRP 025** Organic Chemistry 2 with Lab (CH 223 and CH 224) | 4 | |
| **GRP 030** BIO 183 | 4 | |
| **GRP 032** BIT 410 | 4 | |
| **GRP 033** BIT Laboratory Modules (BIT 462, 464, 466, 467, 468, 481, 569) | 4 | |
| BCH 451 | 4 | |
| **CHE Major** | | |
| CHE 205(C-) | 4 | |
| CHE 225(C-) | 3 | |
| CHE 311(C-) | 3 | |
| CHE 312 | 3 | |
| CHE 315(C-) | 3 | |
| CHE 316 | 3 | |
| CHE 330 | 4 | |
| CHE 395 | 1 | |
| CHE 435 | 3 | |
| CHE 447 | 3 | |
| CHE 450 | 3 | |
| CHE 451 | 3 | |
| CHE 497 | 3 | |
| CHE 551 | 3 | |
| **GRP 037** Bioethics Elective (IDS 201, 303; PHI 325; STS 302, 304, 320, 325) | 3 | |
| **Concentration Courses/Groups/Electives:** | | |
| **Technical Elective:** BEC 330, BEC (CHE) 462, BEC (CHE) 463, BEC 480, BEC 485, BEC 488, BBS 426, BIT 464, PSE 425, CE 373, ECE 331, MSE 201, NE 419, TE 466. | 2 | |

| | | |
|---|---|---|
| **Total credit hours under Major Field of Study:**<br>*Minimum 27 hours required in program area.* | 102 hours | |
| **COLLEGE REQUIREMENTS:** | | |
| **Orientation Course(s):** E 101,<br>E 115 and E102 | 4 | Technology Fluency Requirement |
| **Other:** (ex: Adv Communication courses)<br>Economics Elective (EC 205, EC201, or ARE 201) | 3 | Social Science |
| **Total credit hours under College Requirements:** | 7 hours | |

| **NCSU GENERAL EDUCATION PROGRAM REQUIREMENTS**<br><br>*Courses in the Major and/or Minor may also fulfill a General Education requirement; however, a GEP category may not be subset to require a specific course from the category list. Required courses must be listed in the Major/College requirements.*<br><br>***Specific courses should not be listed in any of the fields below other than ENG 101.*** | | **At least one of the following must be listed:**<br>[1]Choose course(s) from the University Approved GEP course list for this category.<br>[2]Minimum requirements are satisfied by Major/College course requirements.<br>[3]Major/College course requirement satisfies X credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.<br>[4]Co-requisite is satisfied by a Major/College course requirement.<br>[5] Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences, or Visual & Performing Arts.<br>[6] Choose course(s) from the University Approved GEP course lists for the Natural and Mathematical Sciences. |
|---|---|---|
| **General Education Program Requirements:**<br>*Minimum 39-40 hrs* | *Credit hours* | ***How will the GEP requirement be met?***<br>***(choose applicable statement from 1-6 listed above)*** |
| **Mathematical Sciences** *(minimum of 6 credits)*<br>(at least one with *MA or ST* prefix)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **Natural Sciences** *(minimum of 7 credits)* (at least *1 laboratory*)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **English 101 (C-)** | 4 | ENG 101 |
| **Humanities** *(minimum of 6 credits)* (from two different disciplines)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 6 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Social Sciences** *(minimum of 6 credits)* (from two different disciplines)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Required College course satisfies 3 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Additional Breadth** *(minimum of 3 credits)*<br>(Choose AB course list that is different from the approach of the Major)<br>***Major/College requirements cannot satisfy this requirement and an AB course cannot be double-counted except in satisfying the Global Knowledge and Diversity co-requisites.*** | 3 | *Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences or Visual and Performing Arts* |
| **Interdisciplinary Perspective** *(minimum of 5-6 credits)*<br>***Only course(s) in the Major may double-count to satisfy this requirement.*** | 3 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Physical Education/Healthy Living**<br>(including one Fitness and Wellness course) | 2 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Total credit hours needed to complete GEP that are not satisfied as part of the Major/College requirements.** | 18 hours | **** Required Departmental course in Bioethics will satisfy 3 hours of Humanities, Additional Breadth, or Interdisciplinary Perspectives category.*** |

| GEP Co-Requisites: | | *Courses taken in the Major, GEP, or Minor may double-count to fulfill the co-requisites. Courses that satisfy the U.S. Diversity* or Global Knowledge** co-requisite are marked on course lists with asterisks as indicated.* |
|---|---|---|
| U.S. Diversity co-requisite* | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| Global Knowledge co-requisite** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| Foreign Language Proficiency | n/a | FL_102 |
| The following requirements must be satisfied within the College/Program: | | |
| Advanced Communication | X | Satisfied by College/Program Requirements |
| Technology Fluency | X | Satisfied by College/Program Requirements |

| Total credit hours required to complete Degree: Total must be within 120-128 credit hours. | 127 Total hours | Graduation requirements include: (1) 2.0 overall GPA or higher in all courses attempted at NCSU and (b) 2.0 GPA or higher in all CHE designated courses, or a (C-) or higher in all CHE designated courses. |
|---|---|---|

# Chemical Engineering (BS): Biomolecular (14CHEBS-14CHEBIO)

## Freshman Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 101 Chemistry A Molecular Sci.[1] | 3 | CH 201 Chemistry – Quantitative Sci.[5] | 3 |
| CH 102 General Chemistry Lab[1] | 1 | CH 202 Quantitative Chem. Lab | 1 |
| E 101 Intro to Engr & Prob Solv[1] | 1 | MA 241 Calculus II [1] | 4 |
| E 115 Intro to Computing Environ. | 1 | PY 205 Physics for Engineers & Scientists I[1] | 3 |
| ENG 101 Acad. Writing & Research [1] | 4 | PY 206 Physics for Engineer & Scientists I Lab | 1 |
| MA 141 Calculus I [1] | 4 | EC 205 Economics (or EC 201 or ARE 201*) | 3 |
| HES_*** Health & Exercise Studies Course* | 1 | HES_*** Health & Exercise Studies Course* | 1 |
| | 15 | | 16 |

## Sophomore Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 221 Organic Chemistry I[6] | 3 | CH 223 Organic Chemistry II[6] | 3 |
| CH 222 Organic Chemistry I Lab[6] | 1 | CH 224 Organic Chemistry II Lab[6] | 1 |
| CHE 205 Chemical Proc. Princ[5] | 4 | CHE 225 Chem. Proc. Systems[5] | 3 |
| MA 242 Calculus III[5] | 4 | MA 341 Applied Differential Equations[5] | 3 |
| PY 208 Physics Engineers & Scientists II | 3 | BIO 183 Intro Biology: Cellular & Molecular Bio. | 4 |
| PY 209 Physics for Engineer & Scientists II Lab | 1 | GEP Requirement* | 3 |
| | 16 | | 17 |

## Junior Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| BCH 451 Intro Biochemistry | 4 | BIT Lab Modules[2] | 4 |
| CHE 311 Transport Processes I[5] | 3 | CHE 312 Transport Processes II | 3 |
| CHE 315 Chem. Process Thermo[5] | 3 | CHE 316 Thermo of Chem & Phase Eq | 3 |
| BIT 410 Manipulation ReDNA (4 cr.) | 4 | CHE 330 Chem Engr Lab I | 4 |
| GEP Requirement* | 3 | GEP Requirement * | 2-3 |
| CH 395 Professional Dev. Seminar | 1 | | |
| | 18 | | 16-17 |

## Senior Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CHE 447 Bioreactor Engineering | 3 | CHE 435 Proc. System Analy & Control | 3 |
| CHE 450 CHE Design I | 3 | CHE 451 CHE Design II | 3 |
| CHE 497 CHE Engr Projects I | 3 | CHE 551 Biochemical Engineering | 3 |
| GEP Requirement* | 3 | Technical Elective[4] | 2-3 |
| Biotech Minor Group E (GEP IP req*)[3] | 3 | GEP Requirement* | 3 |
| | 15 | | 14-15 |

Minimum Credit Hours Required for Graduation[*,I,J,K]: 127

**Major/Program requirements and footnotes**

[1] Minimum grade of C- required.
[2] Students must take two 2-hour BIT lab modules from the following lists. In addition, selected BIT 495 Special Topics Courses may be approved by the Biotechnology advisor.

- BIT Lab Module – Group 1 (2 cr): BIT/CHE 464, BIT 467/567, BIT 474/574, BIT/CH 572
- BIT Lab Module – Group 2 (2 cr): Any course in Group 1 + BIT 466/566, BIT 471/571

[3] Biotech Minor Group E must be selected from: IDS 201, 303; STS 302, 304, 320; STS/PHI 325
[4] Technical Elective must be selected from: BEC 330; BEC(CHE) 462, BEC(CHE) 463; BEC 480, 485, 488; BBS 426; CHE/BIT 464; PSE 425; CE 373, ECE 331, MSE 210, NE 419, PSE 425, TE 466.
[5] Grade of C (2.0) or higher required.
[6] CH 225/226 may substitute for CH 221/222 and CH 227/228 may substitute for CH 223/224.

***General Education Program (GEP) requirements and GEP Footnotes**
To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at https://oucc.dasa.ncsu.edu/general-education-program/.

**A. Mathematical Sciences** (6 credit hours – one course with MA or ST prefix)
*Course(s) completed as part of the Major requirements may fulfill part or all of this requirement.*
**B. Natural Sciences** (7 credit hours – include one laboratory course or course with a lab)
*Course(s) completed as part of the Major requirements may fulfill part or all of this requirement.*
**C. Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:*
**D. Social Sciences** (3 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Social Sciences course list or the following course(s) if completed as part of the Major requirements may fulfill part or all of this requirement:* EC 205, EC 201, or ARE 201
**E. Health & Exercise Studies** (2 credit hours – at least one 100-level Health & Exercise Studies Course)
*Choose from the University approved GEP Health & Exercise Studies course list.*
**F. Additional Breadth** – (3 credit hours to be selected from the following checked University approved GEP course lists)
X Humanities/Social Sciences/Visual and Performing Arts
**G. Interdisciplinary Perspectives** (5-6 credit hours)
*2 credits to be selected from the approved GEP Interdisciplinary Perspectives list. Course chosen to meet the Biotech Minor Group E requirement in the Major satisfies 3 credit hours of the 5 credit hours needed to fulfill the GEP Interdisciplinary Perspectives requirement.*
**H. Introduction to Writing** (4 credit hours satisfied by completing ENG 101 with a C- or better)

The following **Co-Requisites** must be satisfied to complete the General Education Program

requirements

**I. U.S. Diversity** (USD)

*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite. The following course(s) completed as part of the Major requirements may fulfill this requirement:*

**J. Global Knowledge** (GK)

*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite. The following course(s) completed as part of the Major requirements may fulfill this requirement:*

**K. Foreign Language proficiency** – Proficiency at the FL_102 level is required for graduation.

## Bachelor of Science in Chemical Engineering
## Biomolecular Engineering Concentration

| Fall Semester | Credit |
|---|---|
| CH 101 (or 103) General Chemistry I[1a] | 3 |
| CH 102 (or 104) General Chemistry I Lab[1a] | 1 |
| E 101 Introduction to Engr & Prob Solv[1a] | 1 |
| E 115 Intro to Computing Environ | 1 |
| ENG 101 Academic Writing & Research[1a] | 4 |
| MA 141 Calculus I[1a] | 4 |
| HESx 1** Fitness & Wellness Course* | 1 |
| | **15** |

| Spring Semester | Credit |
|---|---|
| CH 201 (or 203) General Chemistry II[1b] | 3 |
| CH 202 (or 204) General Chemistry II Lab | 1 |
| MA 241 Calculus II[1a] | 4 |
| PY 205 Physics for Engr & Sc I[1a] | 3 |
| PY 206 Physics for Engr & Sc I Lab[1a] | 1 |
| EC 205 Econ (or EC 201 or ARE 201)* | 3 |
| HESx (100 or 200 level) Elective* | 1 |
| E102 Engr in the 21st century (GEP IP) | **3** |
| | **18** |

| Fall Semester | Credit |
|---|---|
| CH 221 (or 225) Organic Chemistry I[1b] | 3 |
| CH 222 (or 226) Organic Chemistry I Lab | 1 |
| CHE 205 Chemical Proc Prin[1b] | 4 |
| MA 242 Calculus III[1b] | 4 |
| PY 208 Physics Engr & Scientists II | 3 |
| PY 209 Physics Engr & Scientists II Lab | 1 |
| | **16** |

| Spring Semester | Credit |
|---|---|
| CH 223 (or 227) Organic Chemistry II | 3 |
| CH 224 (or 228) Organic Chemistry II Lab | 1 |
| CHE 225 Chemical Proc Systems[1b] | 3 |
| MA 341 Applied Differential Eq[1b] | 3 |
| BIO 183 Intro Biol: Cellular & Molecular | 4 |
| GEP Requirement* | 3 |
| | **17** |

| Fall Semester | Credit |
|---|---|
| BCH 451 Intro Biochemistry | 4 |
| CHE 311 Transport Processes I[1b] | 3 |
| CHE 315 Chem Process Thermo[1b] | 3 |
| BIT 410 Manipulation ReDNA (4 cr.) | 4 |
| GEP Requirement* | 3 |
| CHE 395 Professional Dev Seminar | 1 |
| | **18** |

| Spring Semester | Credit |
|---|---|
| BIT *** BIT Lab Module – Group 1[2] * | 2 |
| BIT *** BIT Lab Module – Group 2[2] * | 2 |
| CHE 312 Transport Processes II | 3 |
| CHE 316 Thermo of Chem & Phase Eq | 3 |
| CHE 330 Chem Engr Lab I | 4 |
| GEP Requirement* | 2-3 |
| | **16-17** |

| Fall Semester | Credit |
|---|---|
| CHE 447 Bioreactor Engineering | 3 |
| CHE 450 CHE Design I | 3 |
| CHE 497 Chemical Engr Projects | 3 |
| GEP Requirement* | 3 |
| Biotech Minor Grp E (GEP IP req*)[3] | 3 |
| | **15** |

| Spring Semester | Credit |
|---|---|
| CHE 435 Proc System Analy & Control | 3 |
| CHE 451 CHE Design II | 3 |
| CHE 551 Biochemical Engineering | 3 |
| Technical Elective[4] | **3** |
| | **12** |

Minimum Credit Hours Required for Graduation*: **127**

**Major/Program requirements and footnotes:**

[1a] Must be completed with grade of (C) or higher.

[1b] Must be completed with grade of (C-) or higher.

[2] Students must take two 2-hour BIT lab modules from the following list:

Group 1 (Engineering-Based Elective): BIT 464, 467, 477, 495 (from the group of: Genetic Engineering of Yeast and Fungi, Genome Engineering, Virus Biotechnology, Yeast Metabolic Engineering, Immunology Methods, Confocal Microscopy, Next Generation DNA Forensics, High Level Throughput Discovery, or CRISPR Tech.), 572, 574

Group 2: Any course in Group 1 above + BIT 466, 471, 478, 495 (from the group of: Computational Biology, mRNA, Gene Manipulation in Zebrafish, Mapping the Brain, Epigenetics, Insect Genomes or Stem Cells).

[3] Biotech Minor Group E must be selected from: IDS 201, 303; STS 302, 304; STS(PHI) 325. If another IP GEP course has already been taken, BIT 501 (1 hr) can satisfy the Biotech Minor Group E requirement.
[4] Technical Elective must be selected from: any CHE course numbered CHE 460 or above, including CHE 596 special topics; BEC 330, BEC(CHE) 462, BEC(CHE) 463, BEC 480, BEC 485, BEC 488, BBS 426, any Group I BIT course, PSE 425, CE 373, ECE 331, MSE 201, NE 419, TE 466.

***General Education Program (GEP) requirements:**

To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at http://www.ncsu.edu/uap/academic-standards/gep/courselists/index.html

*PHYSICAL EDUCATION* - 2 hours to be selected from the approved GEP Physical Education list.
a. One fitness and wellness course (any PE 100-level course).
b. One additional credit hour of PE activity courses.
*HUMANITIES* - 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
*SOCIAL SCIENCES* - 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
*ADDITIONAL BREADTH* - 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
*INTERDISCIPLINARY PERSPECTIVES* - 2 credits to be selected from the approved GEP Interdisciplinary Perspectives list. Course chosen to meet the Biotech Minor Grp E requirement in the Major satisfies 3 credit hours of the 5 credit hours needed to fulfill the GEP Interdisciplinary Perspectives requirement.

**Co-requisites:**

U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.
Foreign Language proficiency at the FL_102 level will be required for graduation.

College of Engineering
Office of Academic Affairs

www.engr.ncsu.edu

Campus Box 7904
21 Current Drive, Page Hall
Raleigh, NC 27695-7904
P: 919.515.3263

**DATE:** September 28, 2017

**TO:** Dr. Michael D. Mullen, Vice Provost and Dean of Academic and Student Affairs
**FROM:** Dr. Lisa Bullard, Departmental Curriculum Chair, Sustainable Engineering, Energy and Environment

**RE:** Curriculum Revision for 14CHEBS-14CHEHON to specify the GEP (IP) Course, E102: Engineering In the 21st Century

By means of this memorandum and the attached documents, the Chemical Engineering Department proposes to modify the 2nd semester of their engineering curriculum to add the GEP (Interdisciplinary) course E102: Engineering in the 21st Century.

This revision specifies a 2-hour, interdisciplinary perspective, general education elective in the second semester. The course, E102: Engineering in the 21st Century, is designed as an early exploration class intended to introduce students to the Engineering Grand Challenges. The course will be open to the campus. There is no change in the number of credit hours. Resources are being allocated from the college to accomplish this change. Attached is a semester-by-semester display with the revision shown in blue. The course was approved by UCCC and officially added to all of the Engineering First Year curricula (EFY) in 2017.

**SIGNATURES**

**RECOMMENDED BY:**

Carla S. Eudkins — Nov 15, 2017
HEAD, DEPARTMENT/PROGRAM — DATE

**ENDORSED BY:**

15 Nov 17
CHAIR, COLLEGE COURSES & CURRICULA COMMITTEE — DATE

Jerome P. Lavelle — 12/04/17
COLLEGE DEAN — DATE

**APPROVED BY:**

CHAIR, UNIVERSITY COURSES & CURRICULA COMMITTEE — DATE

DEAN OF UNDERGRADUATE ACADEMIC PROGRAMS — DATE

APPROVAL DATE _____

# Chemical Engineering (BS): Honors Program (14CHEBS-14CHEHON)

## Freshman Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 101 Chemistry, A Molecular Science[7, 9] | 3 | CH 201 Chem.- Quantitative Science[1, 9] | 3 |
| CH 102 General Chemistry Lab[7, 9] | 1 | CH 202 Quantitative Chem. Lab[9] | 1 |
| E 101 Introduction to Engr & Prob Solv[1] | 1 | MA 241 Calculus II[7] | 4 |
| E 115 Intro to Computing Envir | 1 | PY 205 Physics for Engineering & Scientists I[7] | 4 |
| ENG 101 Academic Writing and Research[1] | 4 | PY 206 Physics for Engineers & Scientists I Lab[7] | 1 |
| MA 141 Calculus I[7] | 4 | EC 205 Economics (or EC 201 or ARE 201) | 3 |
| HES_***Health & Exercise Studies Course* | 1 | *HES_***Health & Exercise Studies Course* | 1 |
| | 15 | | 16 |

## Sophomore Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 221 Organic Chemistry I[8, 1] | 3 | CH 223 Organic Chemistry II[8] | 3 |
| CH 222 Organic Chemistry I Lab[8] | 1 | CH 224 Organic Chemistry II Lab[8] | 1 |
| CHE 205 Chemical Process Prin[1] | 4 | PY 208 Physics for Engineers & Scientists II | 3 |
| MA 242 Calculus III[1] | 4 | PY 209 Physics for Engineers & Scientists II Lab | 1 |
| GEP Requirement* | 3 | CHE 225 Chemical Proc Systems[1] | 3 |
| | | MA 341 Applied Differential Eqns[1] | 4 |
| | | GEP Requirement* | 3 |
| | 15 | | 17 |

## Junior Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 315 Quantitative Analysis | 3 | CH *** Chemistry Elective[3] | 4 |
| CH 316 Quantitative Analysis Lab | 1 | CHE 312H Transport Processes II | 3 |
| CHE 311H Transport Processes I | 3 | CHE 316 Thermo of Chem & Phase Eq | 3 |
| CHE 315 Chem. Process Thermo | 3 | CHE 330 Chem Engr Lab I | 4 |
| MA *** Mathematics Elective[2] | 3 | ENG 333 Comm for Science and Research | 3 |
| GEP Requirement* | 3 | | |
| CHE 395 Professional Dev Seminar | 1 | | |
| | 17 | | 17 |

## Senior Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CHE 497 Chem Engr Projects | 3 | CHE 435 Proc Sys Analy & Control | 3 |
| CHE 446 Des & Analy Chem. React | 3 | CHE 451 CHE Design II | 3 |
| CHE 450 CHE Design I | 3 | CHE *** Honors Electives[5] | 3 |
| CHE 7** CHE Elective[4] | 3 | GEP Requirement* | 3 |
| GEP Requirement* | 3 | GEP IP Requirement | 2-3 |
| | | CHE 495 Honors Thesis Prep[6] | 1 |
| | 15 | | 15-16 |

Minimum Credit Hours Required for Graduation: **127**

**Major/Program Requirements and footnotes**

[1] Minimum grade of (C-) required.

[2] Math electives include: MA 401, 402, 405, 427, 501.

[3] Chemistry electives include: PCC 464: Chemistry of Polymeric Materials; CH 437: Physical Chemistry; BCH 351 General Biochemistry; BCH 451: Principles of Biochemistry; FS 402: Chemistry of Food and Bioprocessed Materials; CH 610: Special Topics in Chemistry

[4] CHE 7xx includes CHE 711, 713, 715, 717.

[5] Honors electives include CHE 460 and above, CHE 5xx, CHE 7xx.

[6] An honors thesis is required for completion of the Honors Program.

[7] Grade of C (2.0) or higher required.

[8] CH 225/226 may substitute for CH 221/222 and CH 227/228 may subsitute for CH 223/224.

[9] CH 103/104 may substitute for CH 101/102 and CH 203/204 may substitute for CH 201/202

***General Education Program (GEP) requirements**

To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at https://oucc.dasa.ncsu.edu/general-education-program/.

**Health & Exercise Studies** – 2 hours to be selected from the approved GEP Health & Exercise Studies list.

1. One fitness and wellness course (any Health & Exercise Studies 100-level course).
2. One additional credit hour of Health & Exercise Studies activity courses.

**HUMANITIES**– 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.

**SOCIAL SCIENCES** – 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.

**ADDITIONAL BREADTH** – 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.

**INTERDISCIPLINARY PERSPECTIVES** – 5 credits to be selected from the approved GEP Interdisciplinary Perspectives list.

**Co-requisites**

U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.

Foreign Language proficiency at the FL_102 level will be required for graduation.

## Bachelor of Science in Chemical Engineering
## Honors Program 14CHEBS-14CHEHON [Req Term Spring 2018]

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 101 (or 103) General Chemistry I[1a] | 3 | CH 201 (or 203) General Chemistry II[1b] | 3 |
| CH 102 (or 104) General Chemistry I Lab[1a] | 1 | CH 202 (or 204) General Chemistry II Lab | 1 |
| E 101 Introduction to Engr & Prob Solv[1a] | 1 | MA 241 Calculus II[1a] | 4 |
| E 115 Intro to Computing Environ | 1 | PY 205 Physics for Engr & Sc I[1a] | 3 |
| ENG 101 Academic Writing and Research[1a] | 4 | PY 206 Physics for Engr & Sc I Lab[1a] | 1 |
| MA 141 Calculus I[1a] | 4 | EC 205 Econ (or EC 201 or ARE 201)* | 3 |
| HESx 1** Fitness & Wellness Course* | 1 | HESx (100 or 200 level) Elective* | 1 |
| | **15** | E102 Engr in the 21st Century | 2 |
| | | | **18** |

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 221 (or 225) Organic Chemistry I[1b] | 3 | CH 223 (or 227) Organic Chemistry II | 3 |
| CH 222 (or 226) Organic Chemistry I Lab | 1 | CH 224 (or 228) Organic Chemistry II Lab | 1 |
| CHE 205 Chemical Proc Prin[1b] | 4 | CHE 225 Chemical Proc Systems[1b] | 3 |
| MA 242 Calculus III[1b] | 4 | MA 341 Applied Differential Eq[1b] | 3 |
| GEP Requirement* | 3 | PY 208 Physics Engr & Scientists II | 3 |
| | **15** | PY 209 Physics Engr & Scientists II Lab | 1 |
| | | GEP Requirement* | 3 |
| | | | **17** |

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH *** Chemistry Elective[3] | 4 | CH 315 Quantitative Analysis | 3 |
| CHE 311H Transport Processes I[1b] | 1 | CH 316 Quantitative Analysis Lab | 1 |
| CHE 315 Chem Process Thermo[1b] | 3 | CHE 312H Transport Processes II | 3 |
| Mathematics Elective[2] | 3 | CHE 316 Thermo of Chem & Phase Eq | 3 |
| GEP Requirement* | 3 | CHE 330 Chem Engr Lab I | 4 |
| CHE 395 Professional Dev Seminar | 3 | ENG 333 Comm for Science and Research | 3 |
| | 1 | | **17** |
| | **17** | | |

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CHE 446 Des & Analy Chem Reactors | 3 | CHE 435 Proc System Analy & Control | 3 |
| CHE 450 CHE Design I | 3 | CHE 451 CHE Design II | 3 |
| CHE 497 Chemical Engr Projects | 3 | CHE *** Honors Electives[5] | 3 |
| CHE 7** CHE Elective[4] | 3 | GEP Requirement* | 3 |
| GEP Requirement* | 3 | Remove IP GEP requirement | |
| | **15** | CHE 495 Honors Thesis Prep[6] | 1 |
| | | | **13** |

Minimum Credit Hours Required for Graduation: **127**

**Requirements:**

Students must have a total GPA of 3.5 and a major GPA (CHE 205 + CHE 225) of 3.5 to enroll in the departmental Honors Program. The Honors Program requirements can also be combined with another concentration (see Dr. Bullard for course planning).

**Major/Program requirements and footnotes:**

[1a] Must be completed with grade of (C) or higher.

[1b] Must be completed with grade of (C-) or higher.

[2] Math electives include: MA 401, 402, 405, 427, 501.

[3] Chemistry electives include: PCC 461/464: Chemistry of Polymeric Materials (fall only): BCH 451: Principles of Biochemistry; BCH 351, General Biochemistry; CH 437: Physical Chemistry; FS 402: Chemistry of Food and Bioprocessed Materials (fall only); PSE 335: Green Chemistry

[4] CHE 7xx includes CHE 711, 713, 715, 717.

[5] Honors electives include CHE 455 and above, CHE 5xx, CHE 7xx.

[6] An honors thesis is required for completion of the Honors Program.

*** General Education Program (GEP) requirements:**
To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at http://www.ncsu.edu/uap/academic-standards/ .

*PHYSICAL EDUCATION* - 2 hours to be selected from the approved GEP Physical Education list.
**a**. One fitness and wellness course (any PE 100-level course).
**b.** One additional credit hour of PE activity courses.
*HUMANITIES* - 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
*SOCIAL SCIENCES* - 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
*ADDITIONAL BREADTH* - 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
*INTERDISCIPLINARY PERSPECTIVES* - 5 credits to be selected from the approved GEP Interdisciplinary Perspectives list.

**Co-requisites:**
U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.

Foreign Language proficiency at the FL_102 level will be required for graduation.

# GEP FORMAT B – CURRICULUM REQUIREMENTS

**Degree Title:** Bachelor of Science in Chemical Engineering, Honors Concentration

**Current Degree Key:** 14CHEBS-14CHEHON

**Effective Date of Revision:** 1/2018

| MAJOR FIELD OF STUDY REQUIREMENTS: | | |
|---|---|---|
| ***Required Courses/Groups/ Electives:*** | ***Credit Hours*** | ***GEP category, if applicable*** |
| **Indicate if course or course groupings have a C-wall or MGPA requirement** | | **List GEP category and hours satisfied by a Major requirement** |
| **Math** | | |
| MA 141 (C-), MA 241(C-), MA 242 | 12 | Mathematics (6 hours) |
| **GRP 030** Differential Equations (MA 341 or MA 301)(C-) | 3 | |
| **GRP 031** Mathematics Elective (MA 401, 402, 405, 427, 501; CSC 427) | 3 | |
| **Sciences** | | |
| CH 101(C-), CH 102(C-) | 4 | Natural Sciences (4 hours) |
| PY 205(C-), PY 208 | 8 | Natural Sciences (4 hours) |
| CH 201(C-), CH 202 | 4 | |
| **GRP 020** Organic Chemistry 1 with Lab (CH 221 and CH 222) | 4 | |
| **GRP 025** Organic Chemistry 2 with Lab (CH 223 and CH 224) | 4 | |
| CH 315 | 4 | |
| **GRP 032** Chemistry Elective (BCH 451; CH 437; TC 461; CH 401and 402; CH 415 and (CH 230 or CH 232); CH 461; CH 610; CH 615); FS 402 | 4 | |
| **CHE Major** | | |
| CHE 205(C-) | 4 | |
| CHE 225(C-) | 3 | |
| CHE 311H(C-) | 3 | |
| CHE 312H | 3 | |
| CHE 315(C-) | 3 | |
| CHE 316 | 3 | |
| CHE 330 | 4 | |
| CHE 395 | 1 | |
| CHE 435 | 3 | |
| CHE 446 | 3 | |
| CHE 450 | 3 | |
| CHE 451 | 3 | |
| CHE 495 | 1 | |
| CHE 497 | 3 | |
| CHE 7** | 3 | |
| **GRP 033** Honors Elective (CHE 460, 461, 465, 467, 469, 475, 485, 498, 5**, 7**) | 3 | GEP Advanced Communication co-requisite |
| **Other Major** ENG 333 | 3 | 3 credit hours of the GEP Humanities requirement |
| **Concentration Courses/Groups/Electives:** | | |
| **Total credit hours under Major Field of Study:** ***Minimum 27 hours required in program area.*** | 95 hours | |
| **COLLEGE REQUIREMENTS:** | | |

| | | |
|---|---|---|
| **Orientation Course(s):** E 101 , E102 and E115 | 4 | Technology Fluency Requirement |
| **Other:** (ex: Adv Communication courses) Economics Elective (EC 205, 201; ARE 201) | 3 | Social Science |
| **Total credit hours under College Requirements:** | 7 hours | |
| | | |

| **NCSU GENERAL EDUCATION PROGRAM REQUIREMENTS**<br><br>*Courses in the Major and/or Minor may also fulfill a General Education requirement; however, a GEP category may not be subset to require a specific course from the category list. Required courses must be listed in the Major/College requirements.*<br><br>***Specific courses should not be listed in any of the fields below other than ENG 101.*** | | **At least one of the following must be listed:**<br>[1]Choose course(s) from the University Approved GEP course list for this category.<br>[2]Minimum requirements are satisfied by Major/College course requirements.<br>[3] Major/College course requirement satisfies X credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.<br>[4]Co-requisite is satisfied by a Major/College course requirement.<br>[5] Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences, or Visual & Performing Arts.<br>[6]Choose course(s) from the University Approved GEP course lists for the Natural and Mathematical Sciences. |
|---|---|---|
| **General Education Program Requirements:**<br>*Minimum 39-40 hrs* | *Credit hours* | ***How will the GEP requirement be met?***<br>***(choose applicable statement from 1-6 listed above)*** |
| **Mathematical Sciences** *(minimum of 6 credits)*<br>(at least one with *MA or ST* prefix)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **Natural Sciences** *(minimum of 7 credits)* (at least *1 laboratory*)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **English 101 (C-)** | 4 | ENG 101 |
| **Humanities** *(minimum of 6 credits)* (from two different disciplines)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 6 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Social Sciences** *(minimum of 6 credits)* (from two different disciplines)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 3 | *Required College course satisfies 3 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Additional Breadth** *(minimum of 3 credits)*<br>(Choose AB course list that is different from the approach of the Major)<br>***Major/College requirements cannot satisfy this requirement and an AB course cannot be double-counted except in satisfying the Global Knowledge and Diversity co-requisites.*** | 3 | *Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences or Visual and Performing Arts* |
| **Interdisciplinary Perspective** *(minimum of 5-6 credits)*<br>***Only course(s) in the Major may double-count to satisfy this requirement.*** | 3 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Physical Education/Healthy Living**<br>(including one Fitness and Wellness course) | 2 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Total credit hours needed to complete GEP that are not satisfied as part of the Major/College requirements.** | 21 hours | |
| **GEP Co-Requisites:** | | ***Courses taken in the Major, GEP, or Minor may double-count to fulfill the co-requisites. Courses that satisfy the U.S. Diversity* or Global Knowledge** co-requisite are marked on course lists with asterisks as indicated.*** |
| **U.S. Diversity co-requisite*** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Global Knowledge co-requisite**** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Foreign Language Proficiency** | n/a | FL_102 |

| The following requirements must be satisfied within the College/Program: | | |
|---|---|---|
| Advanced Communication | X | Satisfied by College/Program Requirements |
| Technology Fluency | X | Satisfied by College/Program Requirements |

| | | |
|---|---|---|
| **Total credit hours required to complete Degree:**<br>**Total must be within 120-128 credit hours.** | 127<br>Total hours | **Graduation requirements include: (1) 2.0 overall GPA or higher in all courses attempted at NCSU and (b) 2.0 GPA or higher in all CHE designated courses, or a (C-) or higher in all CHE designated courses.** |

College of Engineering
Office of Academic Affairs

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21 Current Drive, Page Hall
Raleigh, NC 27695-7904
P: 919.515.3263

**DATE:** September 28, 2017

**TO:** Dr. Michael D. Mullen, Vice Provost and Dean of Academic and Student Affairs

**FROM:** Dr. Lisa Bullard, Departmental Curriculum Chair, Chemical Engineering Department

**RE:** Curriculum Revision for 14CHEBS-14CHENAN to specify the GEP (IP) Course, E102: Engineering In the 21st Century.

By means of this memorandum and the attached documents, the Chemical Engineering Department proposes to modify the 2nd semester of their engineering curriculum to add the GEP (Interdisciplinary) course E102: Engineering in the 21st Century.

This revision specifies a 2-hour, interdisciplinary perspective, general education elective in the second semester. The course, E102: Engineering in the 21st Century, is designed as an early exploration class intended to introduce students to the Engineering Grand Challenges. The course will be open to the campus. There is no change in the number of credit hours. Resources are being allocated from the college to accomplish this change. Attached is a semester-by-semester display with the revision shown in blue. The course was approved by UCCC and officially added to all of the Engineering First Year curricula (EFY) in 2017.

**SIGNATURES**

**RECOMMENDED BY:**

Carla S. Eudkins — Nov 15, 2017
HEAD, DEPARTMENT/PROGRAM — DATE

**ENDORSED BY:**

15 Nov 17
CHAIR, COLLEGE COURSES & CURRICULA COMMITTEE — DATE

Jerome P. Lavelle — 12/04/17
COLLEGE DEAN — DATE

**APPROVED BY:**

CHAIR, UNIVERSITY COURSES & CURRICULA COMMITTEE — DATE

DEAN OF UNDERGRADUATE ACADEMIC PROGRAMS — DATE

APPROVAL DATE _____

# Chemical Engineering (BS): Nanoscience (14CHEBS-14CHENAN)

## Freshman Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 101 Chemistry, A Molecular Science[4, 6] | 3 | CH 201 Chemistry – Quantitative Sci. [1, 6] | 3 |
| CH 102 General Chemistry Lab[4,6] | 1 | CH 202 Quantitative Chem Lab[6] | 1 |
| E 101 Introduction to Engr & Prob Solv[1] | 1 | MA 241 Calculus II[4] | 4 |
| E 115 Intro to Computing Environ | 1 | PY 205 Physics for Engineers & Scientists I[4] | 3 |
| ENG 101 Academic Writing and Research[1] | 4 | PY 206 Physics for Engineers & Scientists I Lab[4] | 1 |
| MA 141 Calculus I[4] | 4 | EC 205 Economics (or EC 201 or ARE 201)* | 3 |
| HES_*** Health & Exercise Studies Course* | 1 | HES_*** Health & Exercise Studies Course* | 1 |
| | 15 | | 16 |

## Sophomore Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 221 Organic Chemistry I[5, 1] | 3 | CH 223 Organic Chemistry II[5] | 3 |
| CH 222 Organic Chemistry I Lab[5] | 1 | CH 224 Organic Chemistry II Lab[5] | 1 |
| CHE 205 Chemical Proc Prin[1] | 4 | CHE 225 Chemical Proc Systems[1] | 3 |
| MA 242 Calculus III[1] | 4 | MA 341 Applied Differential Eq[1] | 3 |
| PY 208 Physics for Engineers & Scientists II | 3 | MSE 201 Struct & Prop Engr Mat | 3 |
| PY 209 Physics for Engineers & Scientists II Lab | 1 | GEP Requirement* | 3 |
| | 16 | | 16 |

## Junior Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH *** Chemistry Elective[2] | 4 | CH 437 Phys Chem for Engrs | 4 |
| CHE 311 Transport Processes I[1] | 3 | CHE 312 Transport Processes II | 3 |
| CHE 315 Chem Process Thermo[1] | 3 | CHE 316 Thermo of Chem & Phase Eq | 3 |
| GEP Requirement* | 3 | CHE 330 Chem Engr Lab I | 4 |
| GEP Requirement* | 3 | Free Elective | 3 |
| CHE 395 Professional Dev Seminar | 1 | | |
| | 17 | | 17 |

## Senior Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CHE 331 Chem Engr Lab II | 2 | CHE 435 Proc System Analy & Control | 3 |
| CHE 446 Des & Analy Chem Reactors | 3 | CHE 451 CHE Design II | 3 |
| CHE 450 CHE Design I | 3 | Nanoscience Elective[3] | 3 |
| Nanoscience Elective[3] | 3 | GEP Requirement* | 3 |
| GEP Requirement* | 3 | GEP IP Requirement* | 2-3 |
| | 14 | | 14-15 |

Minimum Credit Hours Required for Graduation: 125

**Major/Program requirements and footnotes**

[1] Minimum grade of (C-) required.

[2] Chemistry electives include: CH 316: Quantitative Analysis; BCH 451: Principles of Biochemistry; CH 610: Special Topics in Chemistry; FS 402: Chemistry of Food and Bioprocesses Materials; PCC 464: Chemistry of Polymeric Materials; BCH 351 General Biochemistry

[3] Nanosciences Electives include: CHE/MSE 455: Polymer Technology and Engineering, CH 460: Chemical Properties of Electronic Materials, CHE 461: Polymer Sciences and Technology, CHE 462: Colloid Science and Macromolecular Physics, CHE 467: Rheology, CHE 597D: Colloidal and Macromolecular Physics, CHE 597J: Polymers at Interfaces and in Confined Geometries, E 304 Introduction to Nanoscience, ECE 331: Principles of Electrical Engineering I, CH 795M: Special Topics in Chemistry, MSE 425: Polymer Science & Technology, MSE 331: Elec Properties of Materials, MSE 460: Microelectronic Materials, PY 407: Introduction to Modern Physics, BEC 462: Bio-Nanotechnology. Additional nanoscience electives may be approved on a case-by-case basis as new courses are introduced.

[4] Grade of C (2.0) or higher required.

[5] CH 225/226 may substitute for CH 221/222 and CH 227/228 may substitute for CH 223/224.

[6] CH 103/104 may substitute for CH 101/102 and CH 203/204 may substitute for CH 201/202.

***General Education Program (GEP) requirements**

To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at https://oucc.dasa.ncsu.edu/general-education-program/.

**Health & Exercise Studies** – 2 hours to be selected from the approved GEP Health & Exercise Studies list.

a. One fitness and wellness course (any Health & Exercise Studies 100-level course).

b. One additional credit hour of Health & Exercise Studies activity courses.

**HUMANITIES** – 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.

**SOCIAL SCIENCES** – 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.

**ADDITIONAL BREADTH** – 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.

**INTERDISCIPLINARY PERSPECTIVES** – 5-6 credits to be selected from the approved GEP Interdisciplinary Perspectives list.

**Co-requisites**

U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.

Foreign Language proficiency at the FL_102 level will be required for graduation.

## Bachelor of Science in Chemical Engineering
## Nanoscience concentration

[14CHEBS-14CHENAN Req Term Spring 2018]

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 101 (or 103) General Chemistry I[1a] | 3 | CH 201 (or 203) General Chemistry II[1b] | 3 |
| CH 102 (or 104) General Chemistry I Lab[1a] | 1 | CH 202 (or 204) General Chemistry II Lab | 1 |
| E 101 Introduction to Engr & Prob Solv[1a] | 1 | MA 241 Calculus II[1a] | 4 |
| E 115 Intro to Computing Environ | 1 | PY 205 Physics for Engr & Sc I[1a] | 3 |
| ENG 101 Academic Writing and Research[1a] | 4 | PY 206 Physics for Engr & Sc I Lab[1a] | 1 |
| MA 141 Calculus I[1a] | 4 | EC 205 Econ (or EC 201 or ARE 201)* | 3 |
| HESx 10* Fitness & Wellness Course* | 1 | HESx (100 or 200 level) Elective* | 1 |
| | **15** | E102 Engr in the 21st Century | **2** |
| | | | **18** |

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 221 (or 225) Organic Chemistry I[1b] | 3 | CH 223 (or 227) Organic Chemistry II | 3 |
| CH 222 (or 226) Organic Chemistry I Lab | 1 | CH 224 (or 228) Organic Chemistry II Lab | 1 |
| CHE 205 Chemical Proc Prin[1b] | 4 | CHE 225 Chemical Proc Systems[1b] | 3 |
| MA 242 Calculus III[1b] | 4 | MA 341 Applied Differential Eq[1b] | 3 |
| PY 208 Physics Engr & Scientists II | 3 | MSE 201 Struct & Prop Engr Mat | 3 |
| PY 209 Physics Engr & Scientists II Lab | 1 | GEP Requirement* | 3 |
| | **16** | | **16** |

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH *** Chemistry Elective[2] | 4 | CH 437 Phys Chem for Engrs | 4 |
| CHE 311 Transport Processes I[1b] | 3 | CHE 312 Transport Processes II | 3 |
| CHE 315 Chem Process Thermo[1b] | 3 | CHE 316 Thermo of Chem & Phase Eq | 3 |
| GEP Requirement* | 3 | CHE 330 Chem Engr Lab I | 4 |
| GEP Requirement* | 3 | Free Elective | 3 |
| CHE 395 Professional Dev Seminar | 1 | | **17** |
| | **17** | | |

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CHE 331 Chem Engr Lab II | 2 | CHE 435 Proc System Analy & Control | 3 |
| CHE 446 Des & Analy Chem Reactors | 3 | CHE 451 CHE Design II | 3 |
| CHE 450 CHE Design I | 3 | Nanoscience Elective[3] | 3 |
| Nanoscience Elective[3] | 3 | GEP Requirement* | 3 |
| GEP Requirement* | 3 | Remove GEP | |
| | **14** | | **12** |

Minimum Credit Hours Required for Graduation: **125**

**Major/Program requirements and footnotes:**

[1a] Must be completed with grade of (C) or higher.

[1b] Must be completed with grade of (C-) or higher.

[2] Chemistry electives include: PCC 461/464: Chemistry of Polymeric Materials (fall only): BCH 451: Principles of Biochemistry; BCH 351, General Biochemistry; CH 315/316: Quantitative Analysis, FS 402: Chemistry of Food and Bioprocessed Materials (fall only); PSE 335: Green Chemistry

[3] Nanosciences Electives include: E304: Introduction to Nano Science and Technology; CHE(ECE) 468: Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems; MSE 455: Polymer Technology and Engineering, CH 460: Nano-Electronic Materials, CHE 461: Polymer Sciences and Technology, CHE 462: Fundamentals of Bio-Nanotechnology, CHE 467: Rheology, CHE 470: Colloidal and Nanoscale Engineering, CHE 597D: Colloidal and Macromolecular Physics, CHE 597J: Polymers at Interfaces and in Confined Geometries, ECE 331: Principles of Electrical Engineering I, MSE 425: Polymer Science & Technology, MSE 331: Elec Properties of Materials, MSE 460: Microelectronic Materials, PY 407: Introduction to Modern Physics. Additional nanoscience electives may be approved on a case-by-case basis as new courses are introduced.

***General Education Program (GEP) requirements:**
To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at http://www.ncsu.edu/uap/academic-standards/ .

*PHYSICAL EDUCATION* - 2 hours to be selected from the approved GEP Physical Education list.
**a**. One fitness and wellness course (any PE 100-level course).
**b**. One additional credit hour of PE activity courses.
*HUMANITIES* - 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
*SOCIAL SCIENCES* - 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
*ADDITIONAL BREADTH* - 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
*INTERDISCIPLINARY PERSPECTIVES* - 5 credits to be selected from the approved GEP Interdisciplinary Perspectives list.

**Co-requisites:**
U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.

Foreign Language proficiency at the FL_102 level will be required for graduation.

# GEP FORMAT B – CURRICULUM REQUIREMENTS

| | |
|---|---|
| **Degree Title:** | Bachelor of Science in Chemical Engineering, Nanoscience Concentration |
| **Current Degree Key:** | 14CHEBS-14CHENAN |
| **Effective Date of Revision:** | 1/2018 |

| MAJOR FIELD OF STUDY REQUIREMENTS: | | |
|---|---|---|
| ***Required Courses/Groups/ Electives:*** | ***Credit Hours*** | ***GEP category, if applicable*** |
| Indicate if course or course groupings have a C-wall or MGPA requirement | | List GEP category and hours satisfied by a Major requirement |
| **Math** | | |
| MA 141(C-), MA 241(C-), MA 242 | 12 | Mathematics (6 hours) |
| **GRP 030** Differential Equations (MA 341 or MA 301) (C-) | 3 | |
| **Sciences** | | |
| CH 101 (C-), CH 102 (C-) | 4 | Natural Sciences (4 hours) |
| PY 205(C-), PY 208 | 8 | Natural Sciences (4 hours) |
| CH 201(C-), CH 202 | 4 | |
| **GRP 020** Organic Chemistry 1 with Lab (CH 221 and CH 222) | 4 | |
| **GRP 025** Organic Chemistry 2 with Lab (CH 223 and CH 224) | 4 | |
| **GRP 031** Chemistry Elective (BCH 451; TC 461; CH 315,401 and 402, 415 and 416, 437, 461, 610, 615; FS 402) | 4 | |
| **CHE Major** | | |
| CHE 205(C-) | 4 | |
| CHE 225(C-) | 3 | |
| CHE 311(C-) | 3 | |
| CHE 312 | 3 | |
| CHE 315(C-) | 3 | |
| CHE 316 | 3 | |
| CHE 330 | 4 | |
| CHE 331 | 2 | |
| CHE 395 | 1 | |
| CHE 435 | 3 | |
| CHE 446 | 3 | |
| CHE 450 | 3 | |
| CHE 451 | 3 | |
| **Other Major** | | |
| MSE 201 | 3 | |
| **GRP 034** Nanoscience Electives (CH 795M; CHE 455, 460, 461, 462, 467, 543, 596I, 597D, 597J; ECE 331; MSE 331, 425, 455, 460; PY 407) | 6 | |
| **Concentration Courses/Groups/Electives:** | | |
| **Free Electives:** EXC 901 Free Elective EXCEPT NOT (CH 111, ECI 105, ENG 110, FLC 1**, FLE 1**, FLF 1**, FLG 1**, FLH 1**, FLI 1**, FLJ 1**, FLK 1**, FLN 1**, FLP 1**, FLR 1**, FLS 1**,GRK 1**, LAT 1**, MA 100, MA 101, MA 103, MA 107, MA 108, MA 111, MA 121, MA 131, MA 231, PY 211, PY 212) | 3 | |

| | | |
|---|---|---|
| **Total credit hours under Major Field of Study:** *Minimum 27 hours required in program area.* | 97 hours | |
| **COLLEGE REQUIREMENTS:** | | |
| **Orientation Course(s):** E 101 , E115 and E102 | 4 | Technology Fluency Requirement |
| **Other:** (ex: Adv Communication courses) Economics Elective (EC 205, 201; ARE 201) | 3 | Social Science |
| **Total credit hours under College Requirements:** | 7 Hours | |

| **NCSU GENERAL EDUCATION PROGRAM REQUIREMENTS** *Courses in the Major and/or Minor may also fulfill a General Education requirement; however, a GEP category may not be subset to require a specific course from the category list. Required courses must be listed in the Major/College requirements.* *Specific courses should not be listed in any of the fields below other than ENG 101.* | | **At least one of the following must be listed:** [1]Choose course(s) from the University Approved GEP course list for this category. [2]Minimum requirements are satisfied by Major/College course requirements. [3] Major/College course requirement satisfies X credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category. [4]Co-requisite is satisfied by a Major/College course requirement. [5] Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences, or Visual & Performing Arts. [6]Choose course(s) from the University Approved GEP course lists for the Natural and Mathematical Sciences. |
|---|---|---|
| **General Education Program Requirements:** *Minimum 39-40 hrs* | *Credit hours* | *How will the GEP requirement be met? (choose applicable statement from 1-6 listed above)* |
| **Mathematical Sciences** *(minimum of 6 credits)* (at least one with *MA or ST* prefix) *Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.* | X | *Minimum requirements are satisfied by Major course requirements* |
| **Natural Sciences** *(minimum of 7 credits)* (at least *1 laboratory*) *Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.* | X | *Minimum requirements are satisfied by Major course requirements* |
| **English 101 (C-)** | 4 | ENG 101 |
| **Humanities** *(minimum of 6 credits)* (from two different disciplines) *Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.* | 6 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Social Sciences** *(minimum of 6 credits)* (from two different disciplines) *Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.* | 3 | *Required College course satisfies 3 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Additional Breadth** *(minimum of 3 credits)* (Choose AB course list that is different from the approach of the Major) *Major/College requirements cannot satisfy this requirement and an AB course cannot be double-counted except in satisfying the Global Knowledge and Diversity co-requisites.* | 3 | *Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences or Visual and Performing Arts* |
| **Interdisciplinary Perspective** *(minimum of 5-6 credits)* *Only course(s) in the Major may double-count to satisfy this requirement.* | 3 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Physical Education/Healthy Living** (including one Fitness and Wellness course) | 2 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Total credit hours needed to complete GEP that are not satisfied as part of the Major/College requirements.** | 21 hours | |
| **GEP Co-Requisites:** | | *Courses taken in the Major, GEP, or Minor may double-count to fulfill the co-requisites. Courses that satisfy the U.S. Diversity* or Global Knowledge** co-requisite are marked on course lists with asterisks as indicated.* |
| **U.S. Diversity co-requisite*** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Global Knowledge co-requisite**** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |

| | | |
|---|---|---|
| **Foreign Language Proficiency** | n/a | FL_102 |
| **The following requirements must be satisfied within the College/Program:** | | |
| **Advanced Communication** | X | Satisfied by College/Program Requirements |
| **Technology Fluency** | X | Satisfied by College/Program Requirements |

| | | |
|---|---|---|
| **Total credit hours required to complete Degree:**<br>**Total must be within 120-128 credit hours.** | 125 Total hours | **Graduation requirements include: (1) 2.0 overall GPA or higher in all courses attempted at NCSU and (b) 2.0 GPA or higher in all CHE designated courses, or a (C-) or higher in all CHE designated courses.** |

NC STATE UNIVERSITY

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Office of Academic Affairs

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P: 919.515.3263

**DATE:** September 28, 2017

**TO:** Dr. Michael D. Mullen, Vice Provost and Dean of Academic and Student Affairs
**FROM:** Dr. Lisa Bullard, Departmental Curriculum Chair, Chemical Engineering Department

**RE:** Curriculum Revision for 14CHEBS - 14 CHETE to specify the GEP (IP) Course, E102: Engineering In the 21st Century

By means of this memorandum and the attached documents, the Chemical Engineering Department proposes to modify the 2nd semester of their engineering curriculum to add the GEP (Interdisciplinary) course E102: Engineering in the 21st Century.

This revision specifies a 2-hour, interdisciplinary perspective, general education elective in the second semester. The course, E102: Engineering in the 21st Century, is designed as an early exploration class intended to introduce students to the Engineering Grand Challenges. The course will be open to the campus. There is no change in the number of credit hours. Resources are being allocated from the college to accomplish this change. Attached is a semester-by-semester display with the revision shown in blue. The course was approved by UCCC and officially added to all of the Engineering First Year curricula (EFY) in 2017.

**SIGNATURES**

**RECOMMENDED BY:** Carla S. Eudkins — HEAD, DEPARTMENT/PROGRAM — Nov 15, 2017 — DATE

**ENDORSED BY:** [signature] — CHAIR, COLLEGE COURSES & CURRICULA COMMITTEE — 15 Nov 17 — DATE

Jerome P. Lavelle — COLLEGE DEAN — 12/04/17 — DATE

**APPROVED BY:** _____ — CHAIR, UNIVERSITY COURSES & CURRICULA COMMITTEE — DATE

_____ — DEAN OF UNDERGRADUATE ACADEMIC PROGRAMS — DATE

APPROVAL DATE _____

# Chemical Engineering & Textile Engineering (BS): Dual Major (14CHEBS-14CHETE)

## Freshman Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 101 Chemistry, A Molecular Science[1, 6] | 3 | CH 201 Chemistry – Quantitative Sci.[2, 6] | 3 |
| CH 102 General Chemistry Lab[1, 6] | 1 | CH 202 Quantitative Chem Lab[6] | 1 |
| E 101 Introduction to Engr & Prob Solv[2] | 1 | MA 241 Calculus II[1] | 4 |
| E 115 Intro to Computing Environ | 1 | PY 205 Physics for Engineers & Scientists I[1] | 3 |
| ENG 101 Academic Writing and Research[2] | 4 | PY 206 Physics for Engineers & Scientists I Lab[1] | 1 |
| MA 141 Calculus I[1] | 4 | TE 110 Comp Based Model Engineers | 3 |
| HES_*** Health & Exercise Studies Course* | 1 | HES_*** Health & Exercise Studies Course* | 1 |
| | 15 | | 16 |

## Sophomore Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 221 Organic Chemistry I[3,2,7] | 3 | TE 201 Textile Engr. Sci. | 4 |
| CH 222 Organic Chemistry I Lab[7] | 1 | MAE 206 Engr Statics OR CE 214 Engr Statics | 3 |
| CHE 205 Chemical Proc Prin[2] | 4 | MA 341 Applied Differential Eq[2] | 3 |
| MA 242 Calculus III[2] | 4 | CH 223 Organic Chemistry II[7] | 3 |
| PY 208 Physics Engineers & Scientists II | 3 | CH 224 Organic Chemistry II Lab[7] | 1 |
| PY 209 Physics for Engineers & Scientists II Lab | 1 | CHE 225 Chemical Proc Systems[2] | 3 |
| | 16 | | 17 |

## Junior Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 315 Quantitative Analysis | 3 | TE 302 Textile Mfg Proc II | 4 |
| CH 316 Quantitative Analysis Lab | 1 | ST 370 Prob & Stat for Engineers | 3 |
| TE 301 Engr Textile Structures I | 3 | CHE 312 Transport Processes II | 3 |
| GC 120 Found of Graphics | 3 | CHE 316 Thermo of Chem & Phase Eq | 3 |
| CHE 311 Transport Processes I[2] | 3 | TE 205 Analog & Digital Cirguits[5] | 4 |
| CHE 315 Chem Process Thermo[2,4] | 3 | | |
| CHE 395 Professional Dev Seminar | 1 | | |
| | 17 | | 17 |

## Senior Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CHE 446 Des & Analy Chem Reactors | 3 | TE 402 Textile Engr Des II[6] | 4 |
| CHE 450 CHE Design I | 3 | TE 404 Six Sigma Quality | 3 |
| GEP IP Requirement* | 3 | TE 424 Tex Engr Qual Impr Lab | 1 |
| TE 401 Textile Engr Des I | 4 | GEP Requirement* | 3 |
| EC 205 Economics* OR<br>EC 201 Economics* OR<br>ARE 201 Economics* | 3 | GEP Requirement* | 3 |
| | | GEP Requirement* | 3 |
| | 16 | | 17 |

## Fifth Year

| Fall Semester | Credit |
|---|---|
| CHE 330 Chem Engr Lab I | 4 |
| CHE 435 Proc System Analy & Control | 3 |
| PCC 301 Tech of Dyeing & Finish | 3 |
| GEP IP Requirement* | 1 |
| GEP IP Requirement* | 2-3 |
| | 16 |

**Minimum Credit Hours Required for Graduation*:** **147**

**Major/Program requirements and footnotes**

[1] Grade of C (2.0) or higher required.

[2] Minimum grade of C- required.

[3] CH 221 will replace TE 200 (in the Textile Engineering curriculum)

[4] CHE 315/ 316 will replace TE 303 (in the Textile Engineering curriculum)

[5]TE 402 will replace CHE 451 (in the Chemical Engineering curriculum)[6] CH 225/226 may substitute for CH 221/222 and CH 227/228 may substitute for CH 223/224.

[6]CH 103/104 may substitute for CH 101/102 and CH 203/204 may substitute for CH 201/202.

[7]CH 225/226 may substitute for CH 221/222 and CH 227/228 may substitute for CH 223/224.

***General Education Program (GEP) requirements**

To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at https://oucc.dasa.ncsu.edu/general-education-program/.

*Health & Exercise Studies* – 2 hours to be selected from the approved GEP Health & Exercise Studies list.
a. One Health & Exercise Studies course (any HES 100-level course).
b. One additional credit hour of Health & Exercise Studies activity courses.
*Humanities* – 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
*Social Sciences* – 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205, 201 or ARE 201 taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
*Additional Breadth* – 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
*Interdisciplinary Perspectives* – 5 credits to be selected from the approved GEP Interdisciplinary Perspectives list.

**Co-requisites**

U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.
Foreign Language proficiency at the FL_102 level will be required for graduation.

# CURRICULUM IN CHEMICAL ENGINEERING & TEXTILE ENGINEERING
## (Degrees Earned: B.S. Chemical Engineering and B.S. Textile Engineering)
**[14CHEBS-CHETE Req Term Spring 2018]**

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 101 (or 103) General Chemistry I[1] | 3 | CH 201 (or 203) General Chemistry II[2] | 3 |
| CH 102 (or 104) General Chemistry I Lab[1] | 1 | CH 202 (or 204) General Chemistry II Lab | 1 |
| E 101 Introduction to Engr & Prob Solv[1] | 1 | MA 241 Calculus II[1] | 4 |
| E 115 Intro to Computing Environ | 1 | PY 205 Physics for Engr & Sc I[1] | 3 |
| ENG 101 Academic Writing and Research[1] | 4 | PY 206 Physics for Engr & Sc I Lab[1] | 1 |
| MA 141 Calculus I[1] | 4 | TE 110 Comp Based Model Engineers | 3 |
| HESx 1** Fitness & Wellness Course* | 1 | HESx (100 or 200 level) Elective* | 1 |
| | **15** | E102 Engr in the 21st Century | **2** |
| | | | **18** |
| CH 221 (or 225) Organic Chemistry I [2,3] | 3 | TE 201 Textile Engr. Sci. | 4 |
| CH 222 (or 226) Organic Chemistry I Lab | 1 | MAE 206 Engr Statics OR | |
| CHE 205 Chemical Proc Prin[2] | 4 | CE 214 Engr Statics | 3 |
| MA 242 Calculus III[2] | 4 | MA 341 Applied Differential Eq[2] | 3 |
| PY 208 Physics Engr & Scientists II | 3 | CH 223 (or 227) Organic Chemistry II | 3 |
| PY 209 Physics Engr & Scientists II Lab | 1 | CH 224 (or 228) Organic Chemistry II Lab | 1 |
| | **16** | CHE 225 Chemical Proc Systems[2] | 3 |
| | | | **17** |
| CH 315 Quantitative Analysis | 3 | TE 302 Textile Mfg Proc II | 4 |
| CH 316 Quantitative Analysis Lab | 1 | ST 370 Prob & Stat for Engineers | 3 |
| TE 301 Engr Textile Structures I | 3 | CHE 312 Transport Processes II | 3 |
| GC 120 Found of Graphics | 3 | CHE 316 Thermo of Chem & Phase Eq | 3 |
| CHE 311 Transport Processes I[2] | 3 | TE 205 Analog & Digital Circuits[5] | 4 |
| CHE 315 Chem Process Thermo[2,4] | 3 | | **17** |
| CHE 395 Professional Dev Seminar | 1 | | |
| | **17** | | |
| CHE 446 Des & Analy Chem Reactors | 3 | TE 402 Textile Engr Des II[6] | 4 |
| CHE 450 CHE Design I | 3 | TE 404 Six Sigma Quality | 3 |
| GEP IP Requirement* | 3 | TE 424 Tex Engr Qual Impr Lab | 1 |
| TE 401 Textile Engr Des I | 4 | GEP Requirement* | 3 |
| EC 205 Econ (or EC 201 or ARE 201) | 3 | GEP Requirement* | 3 |
| | **16** | GEP Requirement* | 3 |
| | | | **17** |
| CHE 330 Chem Engr Lab I | 4 | | |
| CHE 435 Proc System Analy & Control | 3 | | |
| PCC 301 Tech of Dyeing & Finish | 4 | | |
| GEP Requirement* | 3 | | |
| Remove GEP Requirement | | | |
| | **14** | | |

Minimum Credit Hours Required for Graduation*: **147**

**Major/Program requirements and footnotes:**

[1] Must be completed with grade of C or higher for CODA.
[2] Must be completed with grade of C-or higher for major requirements.
[3] CH 221 will replace TE 200 (in the Textile Engineering curriculum)
[4] CHE 315 will replace TE 303 (in the Textile Engineering curriculum)
[5] TE 402 will replace CHE 451 (in the Chemical Engineering curriculum)
[6] TE 110 is eliminated (TE program) due to similar content embedded in CHE 205 & 225.

*** General Education Program (GEP) requirements:**

To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at http://www.ncsu.edu/uap/academic-standards/gep/courselists/index.html .

*PHYSICAL EDUCATION* - 2 hours to be selected from the approved GEP Physical Education list.
a. One fitness and wellness course (any PE 100-level course).
b. One additional credit hour of PE activity courses.
*HUMANITIES* – 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
*SOCIAL SCIENCES*- 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205, 201 or ARE 201 taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
*ADDITIONAL BREADTH* - 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
*INTERDISCIPLINARY PERSPECTIVES*- 5 credits to be selected from the approved GEP Interdisciplinary Perspectives list.

**Co-requisites:**

U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.
Foreign Language proficiency at the FL_102 level will be required for graduation.

# GEP FORMAT B – CURRICULUM REQUIREMENTS

| |
|---|
| **Degree Title:** Bachelor of Science in CHE/TE Double Major |
| **Current Degree Key:** 14CHEBS-14CHETE |
| **Effective Date of Revision:** 1/2018 |

| **MAJOR FIELD OF STUDY REQUIREMENTS:** | | |
|---|---|---|
| ***Required Courses/Groups/ Electives:*** | ***Credit Hours*** | P category, if applicable |
| **Indicate if course or course groupings have a C-wall or MGPA requirement** | | **List GEP category and hours satisfied by a Major requirement** |
| **Math** | | |
| MA 141 (C-), MA 241 (C-), MA 242 | 12 | Mathematics (6 hours) |
| **GRP 031** Differential Equations (MA 341 or MA 301) | 3 | |
| **Sciences** | | |
| CH 101 (C-), CH 102 (C-) | 4 | Natural Sciences (3 hours) |
| PY 205 (C-), PY 208 | 8 | Natural Sciences (4 hours) |
| CH 201, CH 202 | 4 | |
| **GRP 020** Organic Chemistry 1 with Lab (CH 221 and CH 222) | 4 | |
| **GRP 025** Organic Chemistry 2 with Lab (CH 223 and CH 224) | 4 | |
| CH 315 | 4 | |
| **CHE/TE Major** | | |
| CHE 205 | 4 | |
| CHE 225 | 3 | |
| CHE 311 | 3 | |
| CHE 312 | 3 | |
| CHE 315 | 3 | |
| CHE 316 | 3 | |
| CHE 330 | 4 | |
| CHE 395 | 1 | |
| CHE 446 | 3 | |
| CHE 450 | 3 | |
| TE 110 | 3 | |
| TE 201 | 4 | |
| TE 205 | 4 | |
| TE 301 | 3 | |
| TE 302 | 4 | |
| TE 401 | 4 | |
| TE 402 | 4 | |
| TE 404 | 3 | |
| TE 424 | 1 | |
| TE/CHE 435 | 3 | |
| **Other Major** | | |
| **GRP 030** (CE 214 or MAE 206) | 3 | |
| GC 120 | 3 | |
| ST 370 | 3 | |
| PCC 301 | *3 | |
| PCC 304 | 1 | |

| | | |
|---|---|---|
| **Concentration Courses/Groups/Electives:** | | |
| **Free Electives:** | | |
| **Total credit hours under Major Field of Study:** *Minimum 27 hours required in program area.* | 119 hours | |
| **COLLEGE REQUIREMENTS:** | | |
| **Orientation Course(s):** E 101 (C-), E 115 (C-) AND E102 | 4 | E115 satisfies Technology Fluency Requirement |
| **Other:** (ex: Adv Communication courses) Economics Elective (EC 205, 201; ARE 201) | 3 | Social Science (3 hours) |
| **Total credit hours under College Requirements:** | 7HOURS | |

| **NCSU GENERAL EDUCATION PROGRAM REQUIREMENTS**<br><br>*Courses in the Major and/or Minor may also fulfill a General Education requirement; however, a GEP category may not be subset to require a specific course from the category list. Required courses must be listed in the Major/College requirements.*<br><br>***Specific courses should not be listed in any of the fields below other than ENG 101.*** | | At least one of the following must be listed:<br>[1]Choose course(s) from the University Approved GEP course list for this category.<br>[2]Minimum requirements are satisfied by Major/College course requirements.<br>[3] Major/College course requirement satisfies X credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.<br>[4]Co-requisite is satisfied by a Major/College course requirement.<br>[5] Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences, or Visual & Performing Arts.<br>[6] Choose course(s) from the University Approved GEP course lists for the Natural and Mathematical Sciences. |
|---|---|---|
| **General Education Program Requirements:** *Minimum 39-40 hrs* | *Credit hours* | *How will the GEP requirement be met? (choose applicable statement from 1-6 listed above)* |
| **Mathematical Sciences** *(minimum of 6 credits)* (at least one with *MA or ST* prefix) *Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.* | X | *Minimum requirements are satisfied by Major course requirements* |
| **Natural Sciences** *(minimum of 7 credits)* (at least *1 laboratory*) *Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.* | X | *Minimum requirements are satisfied by Major course requirements* |
| **English 101** | 4 | ENG 101 |
| **Humanities** *(minimum of 6 credits)* (from two different disciplines) *Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.* | 6 | *Required Department course satisfies 3 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Social Sciences** *(minimum of 6 credits)* (from two different disciplines) *Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.* | 3 | *Required College course satisfies 3 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Additional Breadth** *(minimum of 3 credits)* (Choose AB course list that is different from the approach of the Major) *Major/College requirements cannot satisfy this requirement and an AB course cannot be double-counted except in satisfying the Global Knowledge and Diversity co-requisites.* | 3 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Interdisciplinary Perspective** *(minimum of 5-6 credits)* *Only course(s) in the Major may double-count to satisfy this requirement.* | 3 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Physical Education/Healthy Living** (including one Fitness and Wellness course) | 2 | *Choose course(s) from the University Approved GEP course list for this category* |

| | | |
|---|---|---|
| **Total credit hours needed to complete GEP that are not satisfied as part of the Major/College requirements.** | **21 hours** | |
| **GEP Co-Requisites:** | | ***Courses taken in the Major, GEP, or Minor may double-count to fulfill the co-requisites. Courses that satisfy the U.S. Diversity* or Global Knowledge** co-requisite are marked on course lists with asterisks as indicated.*** |
| **U.S. Diversity co-requisite*** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Global Knowledge co-requisite**** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Foreign Language Proficiency** | n/a | FL_102 |
| **The following requirements must be satisfied within the College/Program:** | | |
| **Advanced Communication** | X | Satisfied by College/Program Requirements |
| **Technology Fluency** | X | Satisfied by College/Program Requirements |

| | | |
|---|---|---|
| **Total credit hours required to complete Degree:** **Total must be within 120-128 credit hours.** | **147 Total hours** | **As applicable, indicate here the overall GPA requirement for degree completion including course completion.** |

NC STATE UNIVERSITY

College of Engineering
Office of Academic Affairs

www.engr.ncsu.edu

Campus Box 7904
21 Current Drive, Page Hall
Raleigh, NC 27695-7904
P: 919.515.3263

**DATE:** September 28, 2017

**TO:** Dr. Michael D. Mullen, Vice Provost and Dean of Academic and Student Affairs
**FROM:** Dr. Lisa Bullard, Departmental Curriculum Chair, Sustainable Engineering, Energy and Environment

**RE:** Curriculum Revision for 14CHE-14CHESEE to specify the GEP (IP) Course, E102: Engineering In the 21st Century

By means of this memorandum and the attached documents, the Chemical Engineering Department proposes to modify the 2nd semester of their engineering curriculum to add the GEP (Interdisciplinary) course E102: Engineering in the 21st Century.

This revision specifies a 2-hour, interdisciplinary perspective, general education elective in the second semester. The course, E102: Engineering in the 21st Century, is designed as an early exploration class intended to introduce students to the Engineering Grand Challenges. The course will be open to the campus. There is no change in the number of credit hours. Resources are being allocated from the college to accomplish this change. Attached is a semester-by-semester display with the revision shown in blue. The course was approved by UCCC and officially added to all of the Engineering First Year curricula (EFY) in 2017.

**SIGNATURES**

**RECOMMENDED BY:** Carla S. Fedkiw — HEAD, DEPARTMENT/PROGRAM — Nov 15, 2017 — DATE

**ENDORSED BY:** [signature] — CHAIR, COLLEGE COURSES & CURRICULA COMMITTEE — 15 Nov 17 — DATE

Jerome P. Lavelle — COLLEGE DEAN — 12/04/17 — DATE

**APPROVED BY:** _____ — CHAIR, UNIVERSITY COURSES & CURRICULA COMMITTEE — DATE

_____ — DEAN OF UNDERGRADUATE ACADEMIC PROGRAMS — DATE

APPROVAL DATE _____

# Chemical Engineering (BS): Sustainable Engineering, Energy and the Environment (14CHEBS-14CHESEE)

## Freshman Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 101 Chemistry, A Molecular Science[4, 7] | 3 | CH 201 Chemistry – Quantitative Sci.[1, 7] | 3 |
| CH 102 General Chemistry Lab[4, 7] | 1 | CH 202 Quantitative Chem Lab[7] | 1 |
| E 101 Introduction to Engr & Prob Solv[1] | 1 | MA 241 Calculus II[4] | 4 |
| E 115 Intro to Computing Environ | 1 | PY 205 Physics for Engineers & Scientists I[4] | 3 |
| ENG 101 Academic Writing and Research[1] | 4 | PY 206 Physics for Engineers & Scientists I Lab[4] | 1 |
| MA 141 Calculus I[4] | 4 | EC 205 Economics (or EC 201 or ARE 201)* | 3 |
| HESF 1**Health & Exercise Studies Course* | 1 | HES_***Health & Exercise Studies Course* | 1 |
| | 15 | | 16 |

## Sophomore Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 221 Organic Chemistry I[6] | 3 | CH 223 Organic Chemistry II[6, 1] | 3 |
| CH 222 Organic Chemistry I Lab[6] | 1 | CH 224 Organic Chemistry II Lab[6] | 1 |
| CHE 205 Chemical Proc Prin[1] | 4 | CHE 225 Chemical Proc Systems[1] | 3 |
| MA 242 Calculus III[1] | 4 | MA 341 Applied Differential Eq[1] | 3 |
| GEP Requirement* | 3 | PY 208 Physics for Engineers & Scientists II | 3 |
| | | PY 209 Physics for Engineers & Scientists II Lab | 1 |
| | | GEP Requirement* | |
| | 15 | | 17 |

## Junior Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| PSE 335 Principles of Green Chemistry | 4 | CH *** Chemistry Elective[2] | 4 |
| CHE 311 Transport Processes I[1] | 3 | CHE 312 Transport Processes II | 3 |
| CHE 315 Chem Process Thermo[1] | 3 | CHE 316 Thermo of Chem & Phase Eq | 3 |
| CHE 497 Chem Engr Project I | 3 | CHE 330 Chem Engr Lab I | 4 |
| Free Elective | 3 | GEP Requirement* | 3 |
| | 16 | | 17 |

## Senior Year

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CHE 331 Chem Engr Lab II | 2 | CHE 435 Proc System Analy & Control | 3 |
| CHE 446 Des & Analy Chem Reactors | 3 | CHE 451 CHE Design II | 3 |
| CHE 450 CHE Design I | 3 | Concentration Elective[3] | 3 |
| Concentration Elective[3] | 3 | GEP Requirement* | 3 |
| GEP Requirement* | 3 | Restricted Elective[5] | 2-3 |
| CHE 395 Professional Dev Seminar | 1 | | |
| | 15 | | 14-15 |

Minimum Credit Hours Required for Graduation*: 125

**Major/Program requirements and footnotes**

[1] Minimum grade of (C-) required.

[2] Chemistry electives include: CH 316 Quantitative Analysis, CH 437 Physical Chemistry; BCH 351 General Biochemistry; BCH 451 Princ of Biochemistry; FS 402 Chem of Food & Bioprocessed Materials; PCC 461/464 Chem of Polymeric Materials

[3] Concentration electives include: CE 373; Principles of Environmental Engineering; CE 476: Air Pollution Control; CE 484: Water and Waste Systems; CE 456: Air Quality; CE 477: Solid Waste Management; CE 478: Energy and Climate; PSE 425 Bioenergy and Biomaterials Engineering; FB/PSE 476: Environmental Life Cycle Analysis; BAE 528: Biomass to Renewable Energy Processes.

[4] Grade of C (2.0) or higher required.

[5] Choose a course from the following restricted electives list. This requirement will count toward satisfying the GEP Interdisciplinary Perspectives requirement. Some courses may also count in fulfilling the GEP Global Knowledge co-requisite as indicated (GK). Please consult with your advisor.

- ES 100 Introduction to Environmental Sciences (GK)
- ES 200 Climate Change and Sustainability (GK)
- ES 300 Energy and Environment (GK)
- IDS 201 Environmental Ethics (GK)
- SMT 231 Sustainable Manufacturing
- SMT 232 Recycling to Create a Sustainable Environment
- PCC 401 Impact of Industry on the Environment and Society

[6] CH 225/226 may substitute for CH 221/222 and CH 227/228 may substitute for CH 223/224.
[7]CH 103/104 may substitute for CH 101/102, and CH 203/204 may substitute for CH 201/202.

***General Education Program (GEP) requirements**

To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at https://oucc.dasa.ncsu.edu/general-education-program/.

*Health and Exercise Studies*– 2 hours to be selected from the approved GEP Health & Exercise Studies list.

**a.** One Health and Exercise Studies course (any Health and Exercise Studies 100-level course).

**b.** One additional credit hour of Health and Exercise Studies activity courses.

*HUMANITIES* – 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.

*SOCIAL SCIENCES* – 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.

*ADDITIONAL BREADTH* – 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.

*INTERDISCIPLINARY PERSPECTIVES* – 3 credits to be selected from the approved GEP Interdisciplinary Perspectives list. *Courses taken to satisfy the restricted elective requirement will fulfill 2-3 hours of IP.*

**Co-requisites**

U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as

meeting the U.S. Diversity and Global Knowledge co-requisites.
Foreign Language proficiency at the FL_102 level will be required for graduation.

## B.S. in Chemical Engineering
## Sustainable Engineering, Energy and the Environment
### 14CHEBS-CHESEE [Req Term Spring 2018]

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 101 (or 103) General Chemistry I[1a] | 3 | CH 201 (or 203) General Chemistry II[1b] | 3 |
| CH 102 (or 104) General Chemistry I Lab[1a] | 1 | CH 202 (or 204) General Chemistry II Lab | 1 |
| E 101 Introduction to Engr & Prob Solv[1] | 1 | MA 241 Calculus II[1a] | 4 |
| E 115 Intro to Computing Environ | 1 | PY 205 Physics for Engr & Sc I[1a] | 3 |
| ENG 101 Academic Writing and Research[1] | 4 | PY 206 Physics for Engr & Sc I Lab[1a] | 1 |
| MA 141 Calculus I[1a] | 4 | EC 205 Economics (or EC 201 or ARE 201)* | 3 |
| HESx 1** Fitness & Wellness Course* | 1 | HESx (100 or 200 level) Elective* | 1 |
| | **15** | E102 Engr in the 21st century | 2 |
| | | | 18 |

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CH 221 (or 225) Organic Chemistry I[1b] | 3 | CH 223 (or 227) Organic Chemistry II | 3 |
| CH 222 (or 226) Organic Chemistry I Lab | 1 | CH 224 (or 228) Organic Chemistry II Lab | 1 |
| CHE 205 Chemical Proc Prin[1b] | 4 | CHE 225 Chemical Proc Systems[1b] | 3 |
| MA 242 Calculus III[1b] | 4 | MA 341 Applied Differential Eq[1b] | 3 |
| GEP Requirement* | 3 | PY 208 Physics Engr & Scientists II | 3 |
| | **15** | PY 209 Physics Engr & Scientists II | 1 |
| | | GEP Requirement* | 3 |
| | | | **17** |

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| PSE 335 Principles of Green Chemistry | 4 | CH *** Chemistry Elective[2] | 4 |
| CHE 311 Transport Processes I[1b] | 3 | CHE 312 Transport Processes II | 3 |
| CHE 315 Chem Process Thermo[1b] | 3 | CHE 316 Thermo of Chem & Phase Eq | 3 |
| CHE 497 Chem Engr. Proj. | 3 | CHE 330 Chem Engr Lab I | 4 |
| Free Elective | 3 | GEP Requirement* | 3 |
| | **16** | | **17** |

| Fall Semester | Credit | Spring Semester | Credit |
|---|---|---|---|
| CHE 331 Chem Engr Lab II | 2 | CHE 435 Proc System Analy & Control | 3 |
| CHE 446 Des & Analy Chem Reactors | 3 | CHE 451 CHE Design II | 3 |
| CHE 450 CHE Design I | 3 | Concentration Elective[3] | 3 |
| Concentration Elective[3] | 3 | GEP Requirement * | 3 |
| GEP Requirement* | 3 | Remove GEP Requirement, Enn | |
| CHE 395 Professional Dev Seminar | 1 | | **12** |
| | **15** | | |

Minimum Credit Hours Required for Graduation*: **125**

**Major/Program requirements and footnotes:**

[1a] Must be completed with grade of (C) or higher.

[1b] Must be completed with grade of (C-) or higher.

[2] Chemistry electives include: CH 437 Physical Chemistry; BCH 351 General Biochemistry; BCH 451 Princ of Biochemistry; FS 402 Chem of Food & Bioprocessed Materials; WPS 301: Introduction to Wood Chemistry; PCC 461/464 Chem of Polymeric Materials

[3] Concentration electives include: CE 373; Principles of Environmental Engineering; CE 476: Air Pollution Control; CE 484: Water and Waste Systems; CE 456: Air Quality; CE 477: Solid Waste Management; CE 478: Energy and Climate; PSE 425 Bioenergy and Biomaterials Engineering; PSE(WPS) 476: Environmental Life Cycle Analysis; BAE 528: Biomass to Renewable Energy Processes; CHE 596 special topics courses (Emerging Energy Frontiers; Biofuels; Green Engineering; as offered and approved by advisor)

***General Education Program (GEP) requirements:**
To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at http://oucc.ncsu.edu/gep-courses.

[4]The GEP Interdisciplinary Perspectives requirement must be satisfied from this list:

- ES 100 Introduction to Environmental Sciences; (Global Knowledge, GK)
- ES 200 Climate Change and Sustainability; (GK)
- ES 300 Energy and Environment; (GK)
- IDS 201 Environmental Ethics; (GK)
- SMT 201 Sustainable Materials for Green Housing (fall only)
- SMT 232 Recycling to Create a Sustainable Environment (spring only)
- PCC 401 Impact of Industry on the Environment and Society

*PHYSICAL EDUCATION* - 2 hours to be selected from the approved GEP Physical Education list.
**a.** One fitness and wellness course (any PE 100-level course).
**b**. One additional credit hour of PE activity courses.
*HUMANITIES* - 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
*SOCIAL SCIENCES* - 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
*ADDITIONAL BREADTH* - 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
*INTERDISCIPLINARY PERSPECTIVES* - 5 credits to be selected from the approved GEP Interdisciplinary Perspectives list.

**Co-requisites:**
U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.
Foreign Language proficiency at the FL_102 level will be required for graduation.

# GEP FORMAT B – CURRICULUM REQUIREMENTS

**Degree Title:** Bachelor of Science in Chemical Engineering, Sustainable Engineering, Energy & the Environment

**Current Degree Key:** 14CHEBS-14CHESEE

**Effective Date of Revision:** 1/2018

| MAJOR FIELD OF STUDY REQUIREMENTS: | | |
|---|---|---|
| ***Required Courses/Groups/ Electives:*** | ***Credit Hours*** | ***GEP category, if applicable*** |
| **Indicate if course or course groupings have a C-wall or MGPA requirement** | | **List GEP category and hours satisfied by a Major requirement** |
| **Math** | | |
| MA 141 (C-), MA 241(C-), MA 242 | 12 | Mathematics (6 hours) |
| **GRP 030** Differential Equations (MA 341 or MA 301)(C-) | 3 | |
| **Sciences** | | |
| CH 101(C-), CH 102(C-) | 4 | Natural Sciences (4 hours) |
| PY 205(C-), PY 208 | 8 | Natural Sciences (4 hours) |
| CH 201(C-), CH 202 | 4 | |
| **GRP 020** Organic Chemistry 1 with Lab (CH 221 and CH 222) | 4 | |
| **GRP 025** Organic Chemistry 2 with Lab (CH 223 and CH 224) CH 315 | 4 | |
| **GRP 033** Chemistry Elective (BCH 451; CH 437; TC 461; CH 401and 402; CH 415 and (CH 230 or CH 232); CH 461; CH 610; CH 615); FS 402 | 4 | |
| **CHE Major** | | |
| CHE 205(C-) | 4 | |
| CHE 225(C-) | 3 | |
| CHE 311(C-) | 3 | |
| CHE 312 | 3 | |
| CHE 315(C-) | 3 | |
| CHE 316 | 3 | |
| CHE 330 | 4 | |
| CHE 331 | 2 | |
| CHE 395 | 1 | |
| CHE 435 | 3 | |
| CHE 446 | 3 | |
| CHE 450 | 3 | |
| CHE 451 | 3 | |
| CHE 475 | 3 | |
| **GRP 032** (ECE 331 or MSE 201) | 3 | |
| **GRP 034** Concentration Electives (CE 373, 456, 476, 477, 484; PCC 401; BAE (BBS) 425, WPS 425) | 3 | |
| **Concentration Courses/Groups/Electives:** | | |
| **Free Electives:** EXC 901 Free Elective EXCEPT NOT (CH 111, ECI 105, ENG 110, FLC 1**, FLE 1**, FLF 1**, FLG 1**, FLH 1**, FLI 1**, FLJ 1**, FLK 1**, FLN 1**, FLP 1**, FLR 1**, FLS 1**,GRK 1**, LAT 1**, MA 100, MA 101, MA 103, MA 107, MA 108, MA 111, MA 121, MA 131, MA 231, PY 211, PY 212) | 3 | |
| **Total credit hours under Major Field of Study:** ***Minimum 27 hours required in program area.*** | 97 hours | |

| COLLEGE REQUIREMENTS: | | |
|---|---|---|
| **Orientation Course(s):**<br>E 101 , E102 and E115 | 4 | Technology Fluency Requirement |
| **Other:** (ex: Adv Communication courses)<br>Economics Elective (EC 205, 201; ARE 201) | 3 | Social Science |
| **Total credit hours under College Requirements:** | 7 hours | |

| **NCSU GENERAL EDUCATION PROGRAM REQUIREMENTS**<br><br>*Courses in the Major and/or Minor may also fulfill a General Education requirement; however, a GEP category may not be subset to require a specific course from the category list. Required courses must be listed in the Major/College requirements.*<br><br>***Specific courses should not be listed in any of the fields below other than ENG 101.*** | | **At least one of the following must be listed:**<br>[1]Choose course(s) from the University Approved GEP course list for this category.<br>[2]Minimum requirements are satisfied by Major/College course requirements.<br>[3] Major/College course requirement satisfies X credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.<br>[4]Co-requisite is satisfied by a Major/College course requirement.<br>[5] Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences, or Visual & Performing Arts.<br>[6] Choose course(s) from the University Approved GEP course lists for the Natural and Mathematical Sciences. |
|---|---|---|
| **General Education Program Requirements:**<br>*Minimum 39-40 hrs* | *Credit hours* | *How will the GEP requirement be met?*<br>***(choose applicable statement from 1-6 listed above)*** |
| **Mathematical Sciences** *(minimum of 6 credits)*<br>(at least one with *MA or ST* prefix)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **Natural Sciences** *(minimum of 7 credits)* (at least *1 laboratory*)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **English 101 (C-)** | 4 | ENG 101 |
| **Humanities** *(minimum of 6 credits)* (from two different disciplines)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 6 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Social Sciences** *(minimum of 6 credits)* (from two different disciplines)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 3 | *Required College course satisfies 3 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Additional Breadth** *(minimum of 3 credits)*<br>(Choose AB course list that is different from the approach of the Major)<br>***Major/College requirements cannot satisfy this requirement and an AB course cannot be double-counted except in satisfying the Global Knowledge and Diversity co-requisites.*** | 3 | *Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences or Visual and Performing Arts* |
| **Interdisciplinary Perspective** *(minimum of 5-6 credits)*<br>***Only course(s) in the Major may double-count to satisfy this requirement.*** | 3 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Physical Education/Healthy Living**<br>(Including one Fitness and Wellness course) | 2 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Total credit hours needed to complete GEP that are not satisfied as part of the Major/College requirements.** | 21 hours | |
| **GEP Co-Requisites:** | | ***Courses taken in the Major, GEP, or Minor may double-count to fulfill the co-requisites. Courses that satisfy the U.S. Diversity* or Global Knowledge** co-requisite are marked on course lists with asterisks as indicated.*** |
| **U.S. Diversity co-requisite*** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Global Knowledge co-requisite**** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Foreign Language Proficiency** | n/a | FL_102 |

| The following requirements must be satisfied within the College/Program: | | |
|---|---|---|
| Advanced Communication | X | Satisfied by College/Program Requirements |
| Technology Fluency | X | Satisfied by College/Program Requirements |

| | | |
|---|---|---|
| **Total credit hours required to complete Degree:** Total must be within 120-128 credit hours. | 125 Total hours | Graduation requirements include: (1) 2.0 overall GPA or higher in all courses attempted at NCSU and (b) 2.0 GPA or higher in all CHE designated courses, or a (C-) or higher in all CHE designated courses. |

NC STATE UNIVERSITY

**College of Engineering**
Office of Academic Affairs

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21 Current Drive, Page Hall
Raleigh, NC 27695-7904
P: 919.515.3263

**DATE:** September 28, 2017

**TO:** Dr. Michael D. Mullen, Vice Provost and Dean of Academic and Student Affairs
**FROM:** Dr. Rudi Seracino, Departmental Curriculum Chair, Civil Engineering Department

**RE:** Curriculum Revision for 14CEBS to specify the GEP (IP) Course, E102: Engineering In the 21st Century

By means of this memorandum and the attached documents, the Civil Engineering Department proposes to modify the 2nd semester of their engineering curriculum to add the GEP (Interdisciplinary) course E102: Engineering in the 21st Century.

This revision specifies a 2-hour, interdisciplinary perspective, general education elective in the second semester. The course, E102: Engineering in the 21st Century, is designed as an early exploration class intended to introduce students to the Engineering Grand Challenges. The course will be open to the campus. There is no change in the number of credit hours. Resources are being allocated from the college to accomplish this change. Attached is a semester-by-semester display with the revision shown in blue. The course was approved by UCCC and officially added to all of the Engineering First Year curricula (EFY) in 2017.

**SIGNATURES**

**RECOMMENDED BY:**

Rudi Seracino — 12/06/17
HEAD, DEPARTMENT/PROGRAM — DATE

**ENDORSED BY:**

7 Dec 17
CHAIR, COLLEGE COURSES & CURRICULA COMMITTEE — DATE

Jerome P. Lavelle — 12/07/17
COLLEGE DEAN — DATE

**APPROVED BY:**

CHAIR, UNIVERSITY COURSES & CURRICULA COMMITTEE — DATE

DEAN OF UNDERGRADUATE ACADEMIC PROGRAMS — DATE

APPROVAL DATE _____

## Civil Engineering [14CEBS Req Term Spring 13]

### Freshman Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | CSC | 112 | Intro to Comp - Fortran | 3 |
| CH | 102 | General Chemistry Lab[1] | 1 | EC | 205 | Economics (GEP Soc Sci Req*) | 3 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | MA | 241 | Calculus II[1] | 4 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | PY | 206 | Physics for Engr & Sc I Lab[1] | 1 |
| MA | 141 | Calculus I[1] | 4 | HES | *** | Health & Exercise Studies | 1 |
| HESF | 1** | Fitness & Wellness | 1 | | | | |
| | | **Semester Total** | **15** | | | **Semester Total** | **15** |

### Sophomore Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CE | 214 | Engr Mech - Statics[2] | 3 | CE | 313 | Mechanics of Solids | 3 |
| TDE | 220 | Civil Engineering Graphics (or GC 120) | 3 | CE | 382 | Hydraulics | 3 |
| MA | 242 | Calculus III | 4 | MA | 341 | Appl Differential Eq ***or*** | |
| PY | 208 | Physics for Engr & Sc II | 3 | MA | 305 | Elem Linear Algebra | 3 |
| PY | 209 | Physics for Engr & Sc II Lab | 1 | MSE | 200 | Mech Prop of Struct Mat | 3 |
| *** | *** | GEP Requirement* | 3 | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **17** | | | **Semester Total** | **15** |

### Junior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CE | *** | CE Area Intro Elective[3] | 3 | CE | *** | CE Area Intro Elective[3] | 3 |
| CE | *** | CE Area Intro Elective[3] | 3 | CE | *** | CE Area Intro Elective[3] | 3 |
| CE | *** | CE Area Intro Elective[3] | 3 | CE | *** | CE Elective I[4] | 3 |
| CE | 390 | Engineering Economics | 1 | *** | *** | Basic Science Elect[5] | 3 |
| ST | 370 | Prob & Stat for Engr | 3 | CE | *** | CE Lab, if needed (CE 324 or CE 381) | 0 |
| *** | *** | GEP Requirement* | 3 | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **16** | | | **Semester Total** | **15** |

### Senior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CE | *** | CE Elective[4] | 3 | CE | *** | CE Elective[4] | 3 |
| CE | *** | CE Elective[4] | 3 | CE | *** | CE Elective[4] | 3 |
| CE | *** | CE Elective[4] | 3 | *** | *** | CE Elective[4] | 3 |
| *** | *** | CE/MA/Science Elective | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | COM 110 or ENG 331 | 3 | *** | *** | GEP Requirement* | 2-3 |
| *** | *** | ECE 331 or MAE 301 | 3 | | | | |
| | | **Semester Total** | **18** | | | **Semester Total** | **14-15** |

**Minimum Total Credit Hours Required for Graduation 125-126**

**Major/Program requirements and footnotes:**

[1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.

[2]Minimum grade of C-, E 115 requires satisfactory completion (S).

[3]CE Area Intro Electives to be selected following approved list: CE 305, CE 327, CE 332, CE 339, CE 342, CE 367, CE 373, CE 383, CE 426, CE 437, CE 463, CE 466, CE 487

[4]CE Electives to be selected following approved list: CE 215, CE 261, CE 305, CE 324, CE 327, CE 367, CE 381, CE 383, CE 413, CE 426, CE 44[illegible] CE 466, CE 476, CE 477, CE 484, CE 488, CE 400, CE 402, CE 403, CE 413, CE 420, CE 421, CE 440, CE 476, CE 477, CE 480, CE 484, CE 488 CE 301, CE 235, CE 401, CE 425, CE 435, CE 479, CE 487, CE 504, CE 509, CE 537, CE 305, CE 327, CE 332, CE 337, CE 339, CE 342, CE 373 CE 367, CE 383, CE 426, CE 463, CE 466, CE 487

[5]Basic Science elective - Select one: BIO 181, BIO 183 or MEA 101.

One CE elective must be a capstone design from the list: CE 400, CE 420, CE 421, CE 440, CE 480.

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://oucc.ncsu.edu/gep-courses.

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list.*

**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics. Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.*

**Health & Exercise Studies** (2 credit hours – must include one HESF 100-level course)
*Choose from the University approved GEP Health & Exercise Studies course list.*

**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities/Social Sciences/Visual and Performing Arts*

**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*

K. **Foreign Language proficiency** - Proficiency at the FL 102 level is required for graduation.

# Civil Engineering [14CEBS Req Term Spring 2018]

## Freshman Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | CSC | 111 | Intro to Comp - Python | 3 |
| CH | 102 | General Chemistry Lab[1] | 1 | E | 102 | Engr in the 21st Century (GEP IP) | 2 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | EC | 205 | Economics (GEP Soc Sci Req*) | 3 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | MA | 241 | Calculus II[1] | 4 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| MA | 141 | Calculus I[1] | 4 | PY | 206 | Physics for Engr & Sc I Lab[1] | 1 |
| HESF | 1** | Fitness & Wellness | 1 | HES | *** | Health & Exercise Studies | 1 |
| | | **Semester Total** | **15** | | | **Semester Total** | **17** |

## Sophomore Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CE | 214 | Engr Mech - Statics[2] | 3 | CE | 313 | Mechanics of Solids | 3 |
| TDE | 220 | Civil Engineering Graphics | 3 | CE | 382 | Hydraulics | 3 |
| MA | 242 | Calculus III | 4 | MA | 341 | Appl Differential Eq ***or*** | |
| PY | 208 | Physics for Engr & Sc II | 3 | MA | 305 | Elem Linear Algebra | 3 |
| PY | 209 | Physics for Engr & Sc II Lab | 1 | MSE | 200 | Mech Prop of Struct Mat | 3 |
| *** | *** | GEP Requirement* | 3 | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **17** | | | **Semester Total** | **15** |

## Junior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CE | *** | CE Area Intro Elective[3] | 3 | CE | *** | CE Area Intro Elective[3] | 3 |
| CE | *** | CE Area Intro Elective[3] | 3 | CE | *** | CE Area Intro Elective[3] | 3 |
| CE | *** | CE Area Intro Elective[3] | 3 | CE | *** | CE Elective I[4] | 3 |
| CE | 390 | Engineering Economics | 1 | *** | *** | Basic Science Elect[5] | 3 |
| ST | 370 | Prob & Stat for Engr | 3 | CE | *** | CE Lab, if needed (CE 324 or CE 381) | 0 |
| *** | *** | GEP Requirement* | 3 | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **16** | | | **Semester Total** | **15** |

## Senior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CE | *** | CE Elective[4] | 3 | CE | *** | CE Elective[4] | 3 |
| CE | *** | CE Elective[4] | 3 | CE | *** | CE Elective[4] | 3 |
| *** | *** | CE/MA/Science Elective | 3 | CE | *** | CE Elective[4] | 3 |
| *** | *** | COM 110 or ENG 331 | 3 | *** | *** | CE Elective[4] | 3 |
| *** | *** | ECE 331 or MAE 201 | 3 | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **15** | | | **Semester Total** | **15** |

**Minimum Total Credit Hours Required for Graduation** **125**

**Major/Program requirements and footnotes:**

[1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.

[2]Minimum grade of C-, E 115 requires satisfactory completion (S).

[3]CE Area Intro Electives to be selected following approved list: CE 263, CE 305, CE 327, CE 332, CE 339, CE 342, CE 367, CE 373, CE 383, CE 426, CE 487

[4]CE Electives to be selected following approved list: CE 215, CE 301, CE 305, CE 324, CE 325, CE 327, CE 332, CE 339, CE 342, CE 367, CE 37: CE 381, CE 383, CE 400, CE 401, CE 402, CE 403, CE 413, CE 420, CE 421, CE 425, CE 426, CE 435, CE 437, CE 440, CE 443, CE 444, CE 45( CE 463, CE 466, CE 476, CE 477, CE 479, CE 480, CE 484, CE 487, CE 488

[5]Basic Science elective - Select one: BIO 181, BIO 183 or MEA 101.

One CE elective must be a capstone design from the list: CE 400, CE 420, CE 421, CE 450, CE 480.

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://oucc.ncsu.edu/gep-courses.

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list .*

**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics. Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.*

**Health & Exercise Studies** (2 credit hours – must include one HESF 100-level course)
*Choose from the University approved GEP Health & Exercise Studies course list.*

**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities/Social Sciences/Visual and Performing Arts*

**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*

K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation.

# GEP FORMAT B – CURRICULUM REQUIREMENTS

| | |
|---|---|
| **Degree Title:** | **Bachelor of Science in Civil Engineering** |
| **Current Degree Key:** | **14CEBS** |
| **Effective Date of Revision:** | **1/2018** |

| **MAJOR FIELD OF STUDY REQUIREMENTS:** | | |
|---|---|---|
| ***Required Courses/Groups/ Electives:*** | ***Credit Hours*** | ***GEP category, if applicable*** |
| **Indicate if course or course groupings have a C-wall or MGPA requirement** | | **List GEP category and hours satisfied by a Major requirement** |
| **Math** | | |
| MA 141 (C-), MA 241 (C-), MA 242, MA 302 | 13 | Mathematics (6 hours) |
| **GRP 033** (MA 341 or MA 305) | 3 | |
| **Sciences** | | |
| CH 101(C-), CH 102(C-), | 4 | Natural Sciences (4 hours) |
| PY 205(C-), PY 208 | 8 | Natural Sciences (3 hours) |
| **GRP 039** – Basic Science Elective (BIO 181 or BIO 183, MEA 101, MEA 110) | 3 | |
| **CE Major** | | |
| **GRP 030** (CE 214 or MAE 206) (C-), | 3 | |
| **GRP 031** (CE 215 or MAE 208) | 3 | |
| **GRP 032** (CE 313 or MAE 314) | 3 | |
| CE 382 | 3 | |
| CE 390 | 1 | |
| **GRP 033** CE/Science/Math Elective | 3 | |
| **GRP 034** – CE Area Intro Electives I, II, III, IV, V<br>CE 305, CE 327, CE 332, CE 337, CE 339, CE 342, CE 373, CE 367, CE 383, CE 426, CE 463, CE 466,,CE 487 | 15 | |
| **GRP 035** - CE Electives I, II, III, IV, V, VI, VII<br>CE215, CE 261, CE 305, CE 324 CE 327, CE 367, CE 381, CE 383, CE 413, CE 426, CE 443, CE 466, CE 476, CE 477, CE 484, CE 488, CE 400, CE 402, CE403, CE 413, CE 420, CE 421, CE 440, CE 476, CE 477, CE 480 , CE 484, CE 488, CE 301, CE 325, CE 401, CE 425, CE 435, CE 479, CE 487, CE 504, CE 509, CE 537, CE 305, CE 327, CE 332, CE 337, CE 339, CE 342, CE 373, CE 367, CE 383, CE 426, CE 463, CE 466, CE 487 | 18 | |
| **GRP 036** – CE 400, CE 420, CE 421, CE 440, CE 480 | 3 | |
| **GRP 038** – CE 324, CE381, CE 332, CE 342 | 0 | Meets Lab requirements |
| **GRP 038** – ECE 331 or MAE 301 | 3 | |
| **Other Major** | | |
| CSC 112 | 3 | |
| MSE 200 | 3 | |
| ST 370 | 3 | |
| GC 120 | 3 | |
| ENG 331 or COM 110 | 3 | |

| | | |
|---|---|---|
| **Concentration Courses/Groups/Electives:** | | |
| **Free Electives:** | 0 | |
| **Total credit hours under Major Field of Study:** *Minimum 27 hours required in program area.* | 101 hours | |
| **COLLEGE REQUIREMENTS:** | | |
| **Orientation Course(s):** E 101, E 115 and E102 | 4 | E115 satisfies Technology Fluency Requirement |
| **Other:** (ex: Adv Communication courses) Economics Elective (EC 205, 201; ARE 201) | 3 | Social Science |
| **Total credit hours under College Requirements:** | 7 hours | |

| **NCSU GENERAL EDUCATION PROGRAM REQUIREMENTS**<br><br>*Courses in the Major and/or Minor may also fulfill a General Education requirement; however, a GEP category may not be subset to require a specific course from the category list. Required courses must be listed in the Major/College requirements.*<br><br>***Specific courses should not be listed in any of the fields below other than ENG 101.*** | | **At least one of the following must be listed:**<br>[1]Choose course(s) from the University Approved GEP course list for this category.<br>[2]Minimum requirements are satisfied by Major/College course requirements.<br>[3] Major/College course requirement satisfies X credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.<br>[4]Co-requisite is satisfied by a Major/College course requirement.<br>[5] Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences, or Visual & Performing Arts.<br>[6] Choose course(s) from the University Approved GEP course lists for the Natural and Mathematical Sciences. |
|---|---|---|
| **General Education Program Requirements:** *Minimum 39-40 hrs* | *Credit hours* | *How will the GEP requirement be met? (choose applicable statement from 1-6 listed above)* |
| **Mathematical Sciences** *(minimum of 6 credits)* (at least one with *MA or ST* prefix) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **Natural Sciences** *(minimum of 7 credits)* (at least *1 laboratory*) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **English 101** | 4 | ENG 101 |
| **Humanities** *(minimum of 6 credits)* (from two different disciplines) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 3 | *Required College course satisfies 3 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Social Sciences** *(minimum of 6 credits)* (from two different disciplines) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 3 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Additional Breadth** *(minimum of 3 credits)* (Choose AB course list that is different from the approach of the Major) ***Major/College requirements cannot satisfy this requirement and an AB course cannot be double-counted except in satisfying the Global Knowledge and Diversity co-requisites.*** | 3 | *Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences or Visual and Performing Arts* |
| **Interdisciplinary Perspective** *(minimum of 5-6 credits)* ***Only course(s) in the Major may double-count to satisfy this requirement.*** | 3 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Physical Education/Healthy Living** (including one Fitness and Wellness course) | 2 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Total credit hours needed to complete GEP that are not satisfied as part of the Major/College requirements.** | 18 hours | |

| | | |
|---|---|---|
| **GEP Co-Requisites:** | | ***Courses taken in the Major, GEP, or Minor may double-count to fulfill the co-requisites. Courses that satisfy the U.S. Diversity* or Global Knowledge** co-requisite are marked on course lists with asterisks as indicated.*** |
| **U.S. Diversity co-requisite*** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Global Knowledge co-requisite**** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Foreign Language Proficiency** | n/a | FL_102 |
| **The following requirements must be satisfied within the College/Program:** | | |
| **Advanced Communication** | X | Satisfied by College/Program Requirements |
| **Technology Fluency** | X | Satisfied by College/Program Requirements |

| | | |
|---|---|---|
| **Total credit hours required to complete Degree:**<br>**Total must be within 120-128 credit hours.** | **126 Total hours** | **Graduation requirements include: (1) 2.0 overall GPA or higher in all courses attempted at NCSU and (b) 2.0 GPA or higher in all CE designated courses, or a (C-) or higher in all CE designated courses.** |

NC STATE UNIVERSITY

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**DATE:** September 28, 2017

**TO:** Dr. Michael D. Mullen, Vice Provost and Dean of Academic and Student Affairs
**FROM:** Dr. Michael Escuiti, Departmental Curriculum Chair, Computer Engineering Department

**RE:** Curriculum Revision for 14CPEBS to specify the GEP (IP) Course, E102: Engineering In the 21st Century

By means of this memorandum and the attached documents, the Computer Engineering Department proposes to modify the 2nd semester of their engineering curriculum to add the GEP (Interdisciplinary) course E102: Engineering in the 21st Century.

This revision specifies a 2-hour, interdisciplinary perspective, general education elective in the second semester. The course, E102: Engineering in the 21st Century, is designed as an early exploration class intended to introduce students to the Engineering Grand Challenges. The course will be open to the campus. There is no change in the number of credit hours. Resources are being allocated from the college to accomplish this change. Attached is a semester-by-semester display with the revision shown in blue. The course was approved by UCCC and officially added to all of the Engineering First Year curricula (EFY) in 2017.

**SIGNATURES**

**RECOMMENDED BY:**

David D. Stanley — 11/17/17
HEAD, DEPARTMENT/PROGRAM — DATE

**ENDORSED BY:**

17 Nov 17
CHAIR, COLLEGE COURSES & CURRICULA COMMITTEE — DATE

Jerome P. Lavelle — 12/04/17
COLLEGE DEAN — DATE

**APPROVED BY:**

CHAIR, UNIVERSITY COURSES & CURRICULA COMMITTEE — DATE

DEAN OF UNDERGRADUATE ACADEMIC PROGRAMS — DATE

APPROVAL DATE _____

## Computer Engineering |14CPEBS Req Term ~~Spring 13~~|

### Freshman Year

| | *Fall Semester* | *Credits* | | *Spring Semester* | *Credits* |
|---|---|---|---|---|---|
| CH | 101 Chemistry, A Molecular Science[1] | 3 | ECE | 109 Intro to Computer Systems[2] | 3 |
| CH | 102 General Chemistry Lab[1] | 1 | MA | 241 Calculus II[1] | 4 |
| E | 101 Introduction to Engr & Prob Solv[1,2] | 1 | PY | 205 Physics for Engr & Sc I[1] | 3 |
| E | 115 Intro to Computing Environ[1,2] | 1 | PY | 206 Physics for Engr & Sc I[1] Lab | 1 |
| ENG | 101 Academic Writing and Research[1,2] | 4 | *** | *** Economics EC 201/205, ARE 201(GEP*) | 3 |
| MA | 141 Calculus I[1] | 4 | HESF | 10* Fitness & Wellness | 1 |
| *** | *** GEP Requirement* | 3 | | | |
| | **Semester Total** | **17** | | **Semester Total** | **15** |

### Sophomore Year

| | *Fall Semester* | *Credits* | | *Spring Semester* | *Credits* |
|---|---|---|---|---|---|
| ECE | 200 Intro. to ECE Laboratory[2] | 4 | COM | 110 Public Speaking | 3 |
| ECE | 209 Computer Systems Programming[2] | 3 | CSC | 226 Discrete Mathematics[2] | 3 |
| MA | 242 Calculus III | 4 | ECE | 211 Electric Circuits[2] | 4 |
| PY | 208 Physics for Engr & Sc II | 3 | ECE | 212 Fund of Logic Des[2] | 3 |
| PY | 209 Physics for Engr & Sc II[1] Lab | 1 | ECE | 220 Analytical Found. Of ECE[2] | 3 |
| | **Semester Total** | **15** | | **Semester Total** | **16** |

### Junior Year

| | *Fall Semester* | *Credits* | | *Spring Semester* | *Credits* |
|---|---|---|---|---|---|
| ECE | 301 Linear Systems | 3 | ECE | 309 Object-Oriented Programming | 3 |
| ECE | 302 Intro. to Microelectronics | 4 | ECE | 380 Engr Profession for ECE[3] | 1 |
| ECE | 306 Intro. to Embedded Systems | 3 | ECE | 310 Design of Complex Digital Sys | 3 |
| ST | 371 Intro to Prob and Dist Theory | 3 | *** | *** Open/Technical Elective[4] | 3 |
| *** | *** GEP Requirement* | 3 | ENG | 331 Comm for Engr & Tech | 3 |
| | | | HES | *** Health & Exercise Studies | 1 |
| | **Semester Total** | **16** | | **Semester Total** | **14** |

### Senior Year

| | *Fall Semester* | *Credits* | | *Spring Semester* | *Credits* |
|---|---|---|---|---|---|
| ECE | 484 ECE Senior Design Project I | 3 | ECE | 485 ECE Senior Design Project II | 3 |
| ECE | 4** CPE Elective[5] | 3 | ECE | 4** ECE Elective[6] | 3 |
| ECE | 4** CPE Elective[5] | 3 | ECE | 4** ECE Elective[6] | 3 |
| *** | *** GEP Requirement* | 3 | *** | *** GEP Requirement* | 3 |
| *** | *** GEP Requirement* | 3 | *** | *** GEP Requirement* | 2-3 |
| | **Semester Total** | **15** | | **Semester Total** | **14-15** |

**Minimum Total Credit Hours Required for Graduation 122**

**Major/Program requirements and footnotes:**

[1] Courses required for Change of Degree Audit (CODA) CH 101, 102, MA 141, 241, PY 205, 206 must be completed with C or higher
[2] Grade of C- or better required. E 115 requires satisfactory completion (S)
[3] Students in the entrepreneurs program should take ECE 383/ECE 482/ECE 483 instead of ECE 380/ECE 484/ECE 485
[4] Open/Technical electives E 304, ECE 305, ECE 308, any ECE 4** elective; CE 214 or MAE 206, ISE 311, MAE 208, MAE 301, MAE 302, MSE 200 or MSE 201
[5] ECE 4** electives (Choose 2 courses) (Comp Arch Sys) ECE 463, ECE 464; (Embed Sys) ECE 461, (Network Sys) ECE 407, ECE 470, (Software Sys) ECE 466
[6] ECE 4** electives (Choose 2) ECE 402, ECE 403, ECE 404, ECE 407, ECE 420, ECE 421, ECE 422, ECE 423, ECE 434, ECE 436, ECE 442, ECE 445, ECE 451, ECE 452, ECE 453, ECE 455, ECE 456, ECE 461, ECE 463, ECE 464, ECE 465, ECE 492 (Special Topics Classes) Students with major GPAs greater than 3.2 can also take ECE 5** courses

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at
http://ouce.ncsu.edu/gep-courses/

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list*

**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics*
*Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.*

**Health and Exercise Studies** (2 credit hours – must include one HESF 100-level course and one additional HES course)
*Choose from the University approved GEP Health and Exercise Studies course list.*

**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities Social Sciences Visual and Performing Arts*

**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list*

**The following Co-Requisites must be satisfied to complete the General Education Program requirements.**

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite*

K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation

# Computer Engineering [14CPEBS Req Term Spring 2018]

## Freshman Year

| Fall Semester | | | Credits | Spring Semester | | | Credits |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | ECE | 109 | Intro to Computer Systems[2] | 3 |
| CH | 102 | General Chemistry Lab[1] | 1 | MA | 241 | Calculus II[1] | 4 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | PY | 206 | Physics for Engr & Sc I[1] Lab | 1 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | E | 102 | Engineering in the 21st Century (IP - GEP) | 2 |
| MA | 141 | Calculus I[1] | 4 | HESF | 10* | Fitness & Wellness | 1 |
| *** | *** | Economics EC 201/205, ARE 201(GEP*) | 3 | | | | |
| | | **Semester Total** | **17** | | | **Semester Total** | **14** |

## Sophomore Year

| Fall Semester | | | Credits | Spring Semester | | | Credits |
|---|---|---|---|---|---|---|---|
| ECE | 200 | Intro. to ECE Laboratory[2] | 4 | COM | 110 | Public Speaking | 3 |
| ECE | 209 | Computer Systems Programming[2] | 3 | CSC | 226 | Discrete Mathematics[2] | 3 |
| MA | 242 | Calculus III | 4 | ECE | 211 | Electric Circuits[2] | 4 |
| PY | 208 | Physics for Engr & Sc II | 3 | ECE | 212 | Fund of Logic Des[2] | 3 |
| PY | 209 | Physics for Engr & Sc II[1] Lab | 1 | ECE | 220 | Analytical Found. Of ECE[2] | 3 |
| | | **Semester Total** | **15** | | | **Semester Total** | **16** |

## Junior Year

| Fall Semester | | | Credits | Spring Semester | | | Credits |
|---|---|---|---|---|---|---|---|
| ECE | 301 | Linear Systems | 3 | ECE | 309 | Object-Oriented Programming | 3 |
| ECE | 302 | Intro. to Microelectronics | 4 | ECE | 380 | Engr Profession for ECE[3] | 1 |
| ECE | 306 | Intro. to Embedded Systems | 3 | ECE | 310 | Design of Complex Digital Sys | 3 |
| ST | 371 | Intro to Prob and Dist Theory | 3 | *** | *** | Open/Technical Elective[4] | 3 |
| *** | *** | GEP Requirement* | 3 | ENG | 331 | Comm for Engr & Tech | 3 |
| | | | | HES | *** | Health & Exercise Studies | 1 |
| | | **Semester Total** | **16** | | | **Semester Total** | **14** |

## Senior Year

| Fall Semester | | | Credits | Spring Semester | | | Credits |
|---|---|---|---|---|---|---|---|
| ECE | 484 | ECE Senior Design Project I | 3 | ECE | 485 | ECE Senior Design Project II | 3 |
| ECE | 4** | CPE Elective[5] | 3 | ECE | 4** | ECE Elective[6] | 3 |
| ECE | 4** | CPE Elective[5] | 3 | ECE | 4** | ECE Elective[6] | 3 |
| *** | *** | GEP Requirement* | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | GEP Requirement* | 3 | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **15** | | | **Semester Total** | **15** |

**Minimum Total Credit Hours Required for Graduation 122**

**Major/Program requirements and footnotes:**

[1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.

[2]Grade of C- or better required, E 115 requires satisfactory completion (S).

[3]Students in the entrepreneurs program should take ECE 383/ECE 482/ECE 483 instead of ECE 380/ECE 484/ECE 485.

[4]Open/Technical electives: E 304; ECE 305; ECE 308; any ECE 4** elective; CE 214 or MAE 206; ISE 311; MAE 208, MAE 201, MAE 302, MSE 200 or MSE 201.

[5]ECE 4** electives (Choose 2 courses): (Comp Arch Sys) ECE 463, ECE 464; (Embed Sys) ECE 461; (Network Sys) ECE 407, ECE 470; (Software Sys) ECE 466.

[6]ECE 4** electives (Choose 2): ECE 402, ECE 403, ECE 404, ECE 407, ECE 420, ECE 421, ECE 422, ECE 423, ECE 434, ECE 436, ECE 442, ECE 445, ECE 451, ECE 452, ECE 453, ECE 455, ECE 456, ECE 461, ECE 463, ECE 464, ECE 465, ECE 492 (Special Topics Classes). Students with major GPAs greater than 3.2 can also take ECE 5** courses.

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://oucc.ncsu.edu/gep-courses

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list .*

**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics. Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.*

**Health and Exercise Studies** (2 credit hours – must include one HESF 100-level course and one additional HES course)
*Choose from the University approved GEP Health and Exercise Studies course list.*

**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities/Social Sciences/Visual and Performing Arts*

**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*

K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation.

# CURRICULUM REQUIREMENTS

**Degree Title:** Bachelor of Science in Computer Engineering

**Current Degree Key:** 14CPEBS

**Effective Date of Revision:** 1/2018

| **MAJOR FIELD OF STUDY REQUIREMENTS:** | | |
|---|---|---|
| ***Required Courses/Groups/ Electives:*** | ***Credit Hours*** | ***GEP category, if applicable*** |
| Indicate if course or course groupings have a C-wall or MGPA requirement | | List GEP category and hours satisfied by a Major requirement |
| **Math** | | |
| MA 141 (C)-wall, MA 241 (C)-wall, MA 242 | 12 | Mathematics (6 hours) |
| ST 371 | 3 | |
| **Sciences** | | |
| CH 101 (C)-wall, CH 102 (C)-wall | 4 | Natural Sciences (4 hours) |
| PY 205 (C)-wall, PY 208 | 8 | Natural Sciences (4 hours) |
| **CPE Major** | | |
| ECE 109 (C-)-wall | 3 | |
| ECE 200 (C-)-wall | 4 | |
| ECE 209 (C-)-wall | 3 | |
| ECE 211 (C-)-wall | 4 | |
| ECE 212 (C-)-wall | 3 | |
| ECE 220 (C-)-wall | 3 | |
| ECE 301 | 3 | |
| ECE 302 | 4 | |
| ECE 306 | 3 | |
| ECE 309 | 3 | |
| ECE 310 | 3 | |
| ECE 380 | 1 | |
| ECE 484 | 3 | |
| ECE 485 | 3 | |
| **GRP 030** CPE Elective (Pick any 2) | | |
| **GRP 031** ECE 461, **GRP 032** (ECE 463, ECE 464), **GRP 033** ECE 466, **GRP 034** (ECE 407, ECE 470) | 6 | |
| **GRP 040** ECE Elective (Pick 2) | | |
| ECE 402, ECE 403, ECE 404, ECE 407, ECE 420, ECE 421, ECE 422, ECE 423, ECE 434, ECE 436, ECE 442, ECE 445, ECE 451, ECE 452, ECE 453, ECE 455, ECE 456, ECE 461, ECE 463, ECE 464, ECE 466, ECE 470 | 6 | |
| **GRP 050** Open/Technical Elective (Pick 1) | | |
| **GRP 040**, E 304, ECE 305, ECE 308, **GRP051** (CE 214, MAE 206), MAE 208, MAE 301, MAE 302, ISE 311, **GRP 052**(MSE 201, MSE 200) | 3 | |
| **Other Major** | | |
| CSC 226 | 3 | |
| COM 110 | 3 | |
| ENG 331 | 3 | |
| **Concentration Courses/Groups/Electives:** | | |
| **Free Electives:** | | |
| **Total credit hours under Major Field of Study:** *Minimum 27 hours required in program area.* | 94 hours | |

| COLLEGE REQUIREMENTS: | | |
|---|---|---|
| **Orientation Course(s):**<br>**E 101** (C-)-wall **and E 115** (C-)-wall<br>and E102 | 4 | E115 satisfies Technology Fluency requirement |
| **Other:** (ex: Adv Communication courses)<br>Economics Elective (EC 205, 201; ARE 201) | 3 | Social Science |
| **Total credit hours under College Requirements:** | 7 hours | |

| **NCSU GENERAL EDUCATION PROGRAM REQUIREMENTS**<br><br>*Courses in the Major and/or Minor may also fulfill a General Education requirement; however, a GEP category may not be subset to require a specific course from the category list. Required courses must be listed in the Major/College requirements.*<br><br>***Specific courses should not be listed in any of the fields below other than ENG 101.*** | | **At least one of the following must be listed:**<br>[1]Choose course(s) from the University Approved GEP course list for this category.<br>[2]Minimum requirements are satisfied by Major/College course requirements.<br>[3] Major/College course requirement satisfies X credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.<br>[4]Co-requisite is satisfied by a Major/College course requirement.<br>[5] Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences, or Visual & Performing Arts.<br>[6]Choose course(s) from the University Approved GEP course lists for the Natural and Mathematical Sciences. |
|---|---|---|
| **General Education Program Requirements:**<br>*Minimum 39-40 hrs* | *Credit hours* | *How will the GEP requirement be met?*<br>***(choose applicable statement from 1-6 listed above)*** |
| **Mathematical Sciences** *(minimum of 6 credits)*<br>(at least one with *MA or ST* prefix)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **Natural Sciences** *(minimum of 7 credits)* (at least *1 laboratory*)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **English 101** | 4 | ENG 101 (C-)-wall |
| **Humanities** *(minimum of 6 credits)* (from two different disciplines)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 6 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Social Sciences** *(minimum of 6 credits)* (from two different disciplines)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 3 | *Required College course satisfies 3 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Additional Breadth** *(minimum of 3 credits)*<br>(Choose AB course list that is different from the approach of the Major)<br>***Major/College requirements cannot satisfy this requirement and an AB course cannot be double-counted except in satisfying the Global Knowledge and Diversity co-requisites.*** | 3 | *Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences or Visual and Performing Arts* |
| **Interdisciplinary Perspective** *(minimum of 5-6 credits)*<br>***Only course(s) in the Major may double-count to satisfy this requirement.*** | 5 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Health Exercise Studies**<br>(including one Fitness course) | 2 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Total credit hours needed to complete GEP that are not satisfied as part of the Major/College requirements.** | 23 hours | |
| **GEP Co-Requisites:** | | ***Courses taken in the Major, GEP, or Minor may double-count to fulfill the co-requisites. Courses that satisfy the U.S. Diversity* or Global Knowledge** co-requisite are marked on course lists with asterisks as indicated.*** |
| **U.S. Diversity co-requisite*** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Global Knowledge co-requisite**** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |

| | | |
|---|---|---|
| **Foreign Language Proficiency** | n/a | FL_102 |
| **The following requirements must be satisfied within the College/Program:** | | |
| **Advanced Communication** | X | Satisfied by College/Program Requirements |
| **Technology Fluency** | X | Satisfied by College/Program Requirements |

| | | |
|---|---|---|
| **Total credit hours required to complete Degree:** Total must be within 120-128 credit hours. | 122 | **As applicable, indicate here the overall GPA requirement for degree completion including course completion.** |

NC STATE UNIVERSITY

**College of Engineering**
Office of Academic Affairs

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**DATE:** September 28, 2017

**TO:** Dr. Michael D. Mullen, Vice Provost and Dean of Academic and Student Affairs
**FROM:** Dr. Rudi Seracino, Departmental Curriculum Chair, Environmental Engineering Department

**RE:** Curriculum Revision for 14ENEBS to specify the GEP (IP) Course, E102: Engineering In the 21st Century

By means of this memorandum and the attached documents, the Environmental Engineering Department proposes to modify the 2nd semester of their engineering curriculum to add the GEP (Interdisciplinary) course E102: Engineering in the 21st Century.

This revision specifies a 2-hour, interdisciplinary perspective, general education elective in the second semester. The course, E102: Engineering in the 21st Century, is designed as an early exploration class intended to introduce students to the Engineering Grand Challenges. The course will be open to the campus. There is no change in the number of credit hours. Resources are being allocated from the college to accomplish this change. Attached is a semester-by-semester display with the revision shown in blue. The course was approved by UCCC and officially added to all of the Engineering First Year curricula (EFY) in 2017.

**SIGNATURES**

**RECOMMENDED BY:**

Rudi Seracino — 11/17/17
HEAD, DEPARTMENT/PROGRAM — DATE

**ENDORSED BY:**

20 Nov 17
CHAIR, COLLEGE COURSES & CURRICULA COMMITTEE — DATE

Jerome P. Lavelle — 12/04/17
COLLEGE DEAN — DATE

**APPROVED BY:**

CHAIR, UNIVERSITY COURSES & CURRICULA COMMITTEE — DATE

DEAN OF UNDERGRADUATE ACADEMIC PROGRAMS — DATE

APPROVAL DATE _____

## Environmental Engineering [14ENEBS Req Term Spring 13]

### Freshman Year

| | | Fall Semester | Credits | | | Spring Semester | Credits |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | CH | 201 | Chemistry - A Quantitative Science | 3 |
| CH | 102 | General Chemistry Lab[1] | 1 | EC | 205 | Econ (ARE/EC 201; GEP Soc Sci Req'ment*) | 3 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | MA | 241 | Calculus II[1] | 4 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | PY | 206 | Physics for Engr & Sc I Lab[1] | 1 |
| MA | 141 | Calculus I[1] | 4 | HES | *** | Health & Exercise Studies | 1 |
| HESF | 10* | Fitness & Wellness Course* | 1 | | | | |
| | | **Semester Total** | **15** | | | **Semester Total** | **15** |

### Sophomore Year

| | | Fall Semester | Credits | | | Spring Semester | Credits |
|---|---|---|---|---|---|---|---|
| CE | 214 | Engr Mech – Statics | 3 | BIO | 183 | Intro. Biol: Cell & Mol Biol | 4 |
| CE | 373 | Fundamentals of Envr Engr | 3 | CE | 313 | Mechanics of Solids | 3 |
| CHE | 205 | Chem Proc Principles | 4 | CSC | 111 | Intro to Computing Python | 3 |
| MA | 242 | Calculus III | 4 | MEA | 323 | Earth System Chemistry | 3 |
| *** | *** | COM 110 (preferred) or GC 120 (GEP)[3] | 3 | MA | 341 | Appl Differential Equations I | 3 |
| | | **Semester Total** | **17** | | | **Semester Total** | **16** |

### Junior Year

| | | Fall Semester | Credits | | | Spring Semester | Credits |
|---|---|---|---|---|---|---|---|
| CE | 378 | Environ Chem & Microbiology | 4 | CE | 342 | Engr Behavior of Soils & Found | 4 |
| CE | 390 | Engineering Economics | 1 | CE | 381 | Hydraulics Sys Meas Lab | 1 |
| CE | 339 | Civil Engineering Systems | 3 | CE | 383 | Hydrology & Urban Water Sys | 3 |
| CE | 382 | Hydraulics | 3 | MAE | 301 | Engr Thermodynamics I | 3 |
| PY | 208 | Physics for Engr & Sc II | 3 | | | Graphics/Communication Elective[3] | 3 |
| PY | 209 | Physics for Engr & Sc II Lab | 1 | PS | 320 | US Environ Law and Politics ***or*** | |
| ST | 370 | Probability & Statistics for Engr | 3 | PS | 336 | Global Envir Pol (GEP Soc Sci Req*) | 3 |
| | | **Semester Total** | **18** | | | **Semester Total** | **17** |

### Senior Year

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CE | 476 | Air Pollution Control ***or*** | | CE | 477 | Solid Waste Engineering | 3 |
| CE | 479 | Air Quality | 3 | CE | 481 | Environmental Engineering Project | 3 |
| CE | 484 | Water Supply & Waste Water Sys | 3 | *** | *** | Environmental Engr Elect[4] | 3 |
| CE | 488 | Water Resources Engineering | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | GEP Requirement* | 3 | *** | *** | GEP Requirement (Interdisciplinary Persp)* | 2-3 |
| *** | *** | GEP Requirement* | 3 | | | | |
| | | **Semester Total** | **15** | | | **Semester Total** | **14-15** |

**Minimum Total Credit Hours Required for Graduation 127**

**Major/Program requirements and footnotes:**

[1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.
[2]Minimum grade of C-, E 115 requires satisfactory completion (S).
[3]Graphics/Communication Elective: If select COM 110, take GIS 410 or TDE 220; if select GC 120, take ENG 331 or COM 110.
[4]Select from CE(MEA) 435 (Spring only), CE 476 (Fall only), CE(MEA) 479 (Spring only) or CE 487 (Spring only).

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://oucc.ncsu.edu/gep-courses.

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list .*

**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Economics 205 (or EC 201 or ARE 201), taken as part of the Major requiremen; and PS 320 or PS 336 taken as part of the Major requirement satisfies 6 credit hours needed to fulfill the GEP Social Sciences requirement from two different disciplines.*

**Health and Exercise Studies** (2 credit hours – must include one HESF 100-level course and one additional HES course)
*Choose from the University approved GEP Health and Exercise Studies course list.*

**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities/Social Sciences/Visual and Performing Arts*

**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*

K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation.

# Environmental Engineering [14ENEBS Req Term Spring 2018]

## Freshman Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | CH | 201 | Chemistry - A Quantitative Science | 3 |
| CH | 102 | General Chemistry Lab[1] | 1 | EC | 205 | Econ (ARE/EC 201; GEP Soc Sci Req'ment*) | 3 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | MA | 241 | Calculus II[1] | 4 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | PY | 206 | Physics for Engr & Sc I Lab[1] | 1 |
| MA | 141 | Calculus I[1] | 4 | HES | *** | Health & Exercise Studies | 1 |
| HESF | 10* | Fitness & Wellness Course* | 1 | E | 102 | Engineering in the 21st Century (GEP-IP) | 2 |
| | | **Semester Total** | **15** | | | **Semester Total** | **17** |

## Sophomore Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CE | 214 | Engr Mech – Statics | 3 | BIO | 183 | Intro. Biol: Cell & Mol Biol | 4 |
| CE | 373 | Fundamentals of Envr Engr | 3 | CE | 313 | Mechanics of Solids | 3 |
| CHE | 205 | Chem Proc Principles | 4 | CSC | 111 | Intro to Computing Python | 3 |
| MA | 242 | Calculus III | 4 | MEA | 323 | Earth System Chemistry | 3 |
| *** | *** | COM 110 (preferred) or GC 120 (GEP)[3] | 3 | MA | 341 | Appl Differential Equations I | 3 |
| | | **Semester Total** | **17** | | | **Semester Total** | **16** |

## Junior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CE | 378 | Environ Chem & Microbiology | 4 | CE | 342 | Engr Behavior of Soils & Found | 4 |
| CE | 390 | Engineering Economics | 1 | CE | 381 | Hydraulics Sys Meas Lab | 1 |
| CE | 339 | Civil Engineering Systems | 3 | CE | 383 | Hydrology & Urban Water Sys | 3 |
| CE | 382 | Hydraulics | 3 | MAE | 201 | Engr Thermodynamics I | 3 |
| PY | 208 | Physics for Engr & Sc II | 3 | *** | *** | Graphics/Communication Elective[3] | 3 |
| PY | 209 | Physics for Engr & Sc II Lab | 1 | PS | 320 | US Environ Law and Politics ***or*** | |
| ST | 370 | Probability & Statistics for Engr | 3 | PS | 336 | Global Envir Pol (GEP Soc Sci Req*) | 3 |
| | | **Semester Total** | **18** | | | **Semester Total** | **17** |

## Senior Year

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CE | 476 | Air Pollution Control ***or*** | | CE | 477 | Solid Waste Engineering | 3 |
| CE | 479 | Air Quality | 3 | CE | 481 | Environmental Engineering Project | 3 |
| CE | 484 | Water Supply & Waste Water Sys | 3 | *** | *** | Environmental Engr Elect[4] | 3 |
| CE | 488 | Water Resources Engineering | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | GEP Requirement* | 3 | | | Removing IP GEP requirement | |
| *** | *** | GEP Requirement* | 3 | | | | |
| | | **Semester Total** | **15** | | | **Semester Total** | **12** |
| | | | | | | **Minimum Total Credit Hours Required for Graduation** | **127** |

**Major/Program requirements and footnotes:**

[1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.
[2]Minimum grade of C-, E 115 requires satisfactory completion (S).
[3]Graphics/Communication Elective: If select COM 110, take GIS 410 or TDE 220; if select GC 120, take ENG 331 or COM 110.
[4]Select from CE(MEA) 435 (Spring only), CE 476 (Fall only), CE(MEA) 479 (Spring only) or CE 487 (Spring only).

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://oucc.ncsu.edu/gep-courses.

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list .*

**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Economics 205 (or EC 201 or ARE 201), taken as part of the Major requiremen; and PS 320 or PS 336 taken as part of the Major requirement satisfies 6 credit hours needed to fulfill the GEP Social Sciences requirement from two different disciplines.*

**Health and Exercise Studies** (2 credit hours – must include one HESF 100-level course and one additional HES course)
*Choose from the University approved GEP Health and Exercise Studies course list.*

**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities/Social Sciences/Visual and Performing Arts*

**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*

K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation.

# GEP FORMAT B – CURRICULUM REQUIREMENTS

| |
|---|
| **Degree Title:** Bachelor of Science in Environmental Engineering |
| **Current Degree Key:** 14ENEBS |
| **Effective Date of Revision:** 1/2018 |

| **MAJOR FIELD OF STUDY REQUIREMENTS:** | | |
|---|---|---|
| ***Required Courses/Groups/ Electives:*** | ***Credit Hours*** | ***GEP category, if applicable*** |
| **Indicate if course or course groupings have a C-wall or MGPA requirement** | | **List GEP category and hours satisfied by a Major requirement** |
| **Math** | | |
| MA 141, MA 241, MA 242 | 12 | Mathematics (6 hours) |
| MA 341 | 3 | |
| ST 370 | 3 | |
| **Sciences** | | |
| CH 101, CH 102 | 4 | Natural Sciences (4 hours) |
| PY 205, PY 208 | 8 | Natural Sciences (3 hours) |
| CH 201 | 3 | |
| BIO 183 | 4 | |
| MEA 323 | 3 | |
| **ENE Major** | | |
| CE 214 | 3 | |
| CE 313 | 3 | |
| CE 342 | 4 | |
| CE 373 | 3 | |
| CE 374 | 2 | |
| CE 375 | 3 | |
| CE 381 | 1 | |
| CE 382 | 3 | |
| CE 383 | 3 | |
| CE 477 | 3 | |
| CE 481 | 3 | |
| CE 484 | 3 | |
| CE 488 | 3 | |
| **Other Major** | | |
| ENG 331 | 3 | [redacted], GEP Advanced Writing and Speaking co-requisite |
| **GRP 035** (CE 476 or 479) | 3 | |
| **GRP 037** (CE 435, 476, 479, or 487) | 3 | |
| CSC 116 | 3 | |
| CHE 205 | 4 | |
| [redacted] | [redacted] | |
| MAE 301 | 3 | |
| **GRP 320** (PS 320 or 336) | 3 | Social Science Requirement |
| PRT 462 | 3 | |
| **Concentration Courses/Groups/Electives:** | | |
| **Free Electives:** | | |
| **Total credit hours under Major Field of Study:** *Minimum 27 hours required in program area.* | 102 [redacted] hours | |
| **COLLEGE REQUIREMENTS:** | | |

| | | |
|---|---|---|
| **Orientation Course(s):**<br>E 101, E 115 and E102 | 4 | E115 satisfies Technology Fluency Requirement |
| **Other:** (ex: Adv Communication courses)<br>Economics Elective (EC 205, 201; ARE 201) | 3 | Satisfies Social Science Requirement |
| **Total credit hours under College Requirements:** | 7hours | |

| **NCSU GENERAL EDUCATION PROGRAM REQUIREMENTS**<br><br>*Courses in the Major and/or Minor may also fulfill a General Education requirement; however, a GEP category may not be subset to require a specific course from the category list. Required courses must be listed in the Major/College requirements.*<br><br>***Specific courses should not be listed in any of the fields below other than ENG 101.*** | | **At least one of the following must be listed:**<br>[1]Choose course(s) from the University Approved GEP course list for this category.<br>[2]Minimum requirements are satisfied by Major/College course requirements.<br>[3] Major/College course requirement satisfies X credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.<br>[4]Co-requisite is satisfied by a Major/College course requirement.<br>[5] Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences, or Visual & Performing Arts.<br>[6] Choose course(s) from the University Approved GEP course lists for the Natural and Mathematical Sciences. |
|---|---|---|
| **General Education Program Requirements:**<br>*Minimum 39-40 hrs* | *Credit hours* | *How will the GEP requirement be met?*<br>***(choose applicable statement from 1-6 listed above)*** |
| **Mathematical Sciences** *(minimum of 6 credits)*<br>(at least one with *MA or ST* prefix)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **Natural Sciences** *(minimum of 7 credits)* (at least *1 laboratory*)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **English 101** | 4 | ENG 101 |
| **Humanities** *(minimum of 6 credits)* (from two different disciplines)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 6 | *Required College course satisfies 3 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Social Sciences** *(minimum of 6 credits)* (from two different disciplines)<br>***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Required College course satisfies 6 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Additional Breadth** *(minimum of 3 credits)*<br>(Choose AB course list that is different from the approach of the Major)<br>***Major/College requirements cannot satisfy this requirement and an AB course cannot be double-counted except in satisfying the Global Knowledge and Diversity co-requisites.*** | 3 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Interdisciplinary Perspective** *(minimum of 5-6 credits)*<br>***Only course(s) in the Major may double-count to satisfy this requirement.*** | 3 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Physical Education/Healthy Living**<br>(including one Fitness and Wellness course) | 2 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Total credit hours needed to complete GEP that are not satisfied as part of the Major/College requirements.** | 18 hours | |
| **GEP Co-Requisites:** | | ***Courses taken in the Major, GEP, or Minor may double-count to fulfill the co-requisites. Courses that satisfy the U.S. Diversity* or Global Knowledge** co-requisite are marked on course lists with asterisks as indicated.*** |
| **U.S. Diversity co-requisite*** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Global Knowledge co-requisite**** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Foreign Language Proficiency** | n/a | FL_102 |

| The following requirements must be satisfied within the College/Program: | | |
|---|---|---|
| **Advanced Communication** | X | Satisfied by College/Program Requirements |
| **Technology Fluency** | X | Satisfied by College/Program Requirements |

| | | |
|---|---|---|
| **Total credit hours required to complete Degree:**<br>**Total must be within 120-128 credit hours.** | 127 Total hours | **Graduation requirements include: (1) 2.0 overall GPA or higher in all courses attempted at NCSU and (b) 2.0 GPA or higher in all CE designated courses, or a (C-) or higher in all CE designated courses.** |

NC STATE UNIVERSITY

**College of Engineering**
Office of Academic Affairs

www.engr.ncsu.edu

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Raleigh, NC 27695-7904
P: 919.515.3263

**DATE:** September 28, 2017

**TO:** Dr. Michael D. Mullen, Vice Provost and Dean of Academic and Student Affairs
**FROM:** Dr. Michael Escuiti, Departmental Curriculum Chair, Electrical Engineering Department

**RE:** Curriculum Revision for 14EEBS to specify the GEP (IP) Course, E102: Engineering In the 21st Century

By means of this memorandum and the attached documents, the Electrical Engineering Department proposes to modify the 2nd semester of their engineering curriculum to add the GEP (Interdisciplinary) course E102: Engineering in the 21st Century.

This revision specifies a 2-hour, interdisciplinary perspective, general education elective in the second semester. The course, E102: Engineering in the 21st Century, is designed as an early exploration class intended to introduce students to the Engineering Grand Challenges. The course will be open to the campus. There is no change in the number of credit hours. Resources are being allocated from the college to accomplish this change. Attached is a semester-by-semester display with the revision shown in blue. The course was approved by UCCC and officially added to all of the Engineering First Year curricula (EFY) in 2017.

**SIGNATURES**

**RECOMMENDED BY:**

HEAD, DEPARTMENT/PROGRAM — DATE 11/17/17

**ENDORSED BY:**

CHAIR, COLLEGE COURSES & CURRICULA COMMITTEE — DATE 17 Nov 17

COLLEGE DEAN — DATE 12/04/17

**APPROVED BY:**

CHAIR, UNIVERSITY COURSES & CURRICULA COMMITTEE — DATE

DEAN OF UNDERGRADUATE ACADEMIC PROGRAMS — DATE

APPROVAL DATE _____

## Electrical Engineering |14EEBS Req Term Spring 13|

### Freshman Year

| | | Fall Semester | Credits | | | Spring Semester | Credits |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | ECE | 109 | Intro to Computer Systems[2] | 3 |
| CH | 102 | General Chemistry Lab[1] | 1 | MA | 241 | Calculus II[1] | 4 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | PY | 206 | Physics for Engr & Sc I Lab[1] | 1 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | *** | *** | Economics EC 201/205, ARE 201(GEP*) | 3 |
| MA | 141 | Calculus I[1] | 4 | HESF | 10* | Fitness & Wellness | 1 |
| *** | *** | GEP Requirement* | 3 | | | | |
| | | **Semester Total** | **17** | | | **Semester Total** | **15** |

### Sophomore Year

| | | Fall Semester | Credits | | | Spring Semester | Credits |
|---|---|---|---|---|---|---|---|
| ECE | 200 | Intro. to ECE Laboratory[2] | 4 | COM | 110 | Public Speaking | 3 |
| ECE | 209 | Computer Systems Programming[2] | 3 | ECE | 211 | Electric Circuits[2] | 4 |
| MA | 242 | Calculus III | 4 | ECE | 212 | Fund of Logic Des[2] | 3 |
| PY | 208 | Physics for Engr & Sc II | 3 | ECE | 220 | Analytical Found. Of ECE[2] | 3 |
| PY | 209 | Physics for Engr & Sc II Lab | 1 | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **15** | | | **Semester Total** | **16** |

### Junior Year

| | | Fall Semester | Credits | | | Spring Semester | Credits |
|---|---|---|---|---|---|---|---|
| ECE | 301 | Linear Systems | 3 | ECE | 303 | Electromagnetic Fields | 3 |
| ECE | 302 | Intro. to Microelectronics | 4 | ECE | 380 | Engr Profession for EE[4] | 1 |
| ECE | 3** | ECE Foundation Elective[3] | 3 | ECE | 3** | ECE Foundation Elective[3] | 3 |
| ST | 371 | Intro to Prob and Dist Theory | 3 | *** | *** | Open/Technical Elective[5] | 3 |
| HES* | *** | Health & Exercise Studies | 1 | ENG | 331 | Comm for Engr & Tech | 3 |
| | | | | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **14** | | | **Semester Total** | **16** |

### Senior Year

| | | Fall Semester | Credits | | | Spring Semester | Credits |
|---|---|---|---|---|---|---|---|
| ECE | 484 | ECE Senior Design Project I | 3 | ECE | 485 | ECE Senior Design Project II | 3 |
| ECE | 4** | EE Elective[6] | 3 | ECE | 4** | ECE Elective[6] | 3 |
| ECE | 4** | EE Elective[6] | 3 | ECE | 4** | ECE Elective[6] | 3 |
| *** | *** | Open/Technical Elective[5] | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | GEP Requirement* | 3 | *** | *** | GEP Requirement* | 2-3 |
| | | **Semester Total** | **15** | | | **Semester Total** | **14-15** |

**Minimum Total Credit Hours Required for Graduation 122**

**Major/Program requirements and footnotes:**

[1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.

[2]Grade of C- or better required. E 115 requires satisfactory completion (S).

[3]ECE foundation electives: E 304; ECE 305; ECE 308; ECE 435 or either ECE 306 or ECE 310

[4] Students in the entrepreneurs program should take ECE 383/ECE 482/ECE 483 instead of ECE 380/ECE 484/ECE 485.

[5]Open/Technical electives (Choose 2): any ECE 3** or ECE 4**; CE 214 or MAE 206; ISE 311; MAE 208, MAE 301, MAE 302, MAE 308; MSE 200 or MSE 201.

[6]EE 4** electives (Choose 2 courses from within any one of the following lists): (Comm. Sig Proc Sys) ECE 402, ECE 420; ECE 421; (Control Sys) ECE 436, ECE 455, ECE 456; (Circ, E&M Sys) ECE 403, ECE 422; (Nano Sys) ECE 404, ECE 442, ECE 445; (Power Sys) ECE 434, ECE 451, ECE 452, ECE 453, ECE 552.

ECE 4** electives (Choose 2): ECE 402, ECE 403, ECE 404, ECE 407, ECE 420, ECE 421, ECE 422, ECE 423, ECE 434, ECE 436, ECE 442, ECE 445, ECE 451, ECE 452, ECE 453, ECE 455, ECE 456, ECE 461, ECE 463, ECE 464, ECE 465, ECE 492 (Special Topics Classes). Students with major GPAs greater than 3.2 can also take ECE 5** courses.

**General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://ouec.ncsu.edu/gep-courses

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list.*

**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics. Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.*

**Health and Exercise Studies** (2 credit hours – must include one HESF 100-level course and one additional HES course)
*Choose from the University approved GEP Health and Exercise Studies course list*

**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities/Social Sciences/Visual and Performing Arts*

**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*

K. **Foreign Language proficiency** - Proficiency at the FL 102 level

# Electrical Engineering [14EEBS Req Term Spring 2018]

## Freshman Year

| | | *Fall Semester* | *Credits* | | | *Spring Semester* | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | ECE | 109 | Intro to Computer Systems[2] | 3 |
| CH | 102 | General Chemistry Lab[1] | 1 | MA | 241 | Calculus II[1] | 4 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | PY | 206 | Physics for Engr & Sc I Lab[1] | 1 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | E | 102 | Engineering in the 21st Century (GEP-IP) | 2 |
| MA | 141 | Calculus I[1] | 4 | HESF | 10* | Fitness & Wellness | 1 |
| *** | *** | Economics EC 201/205, ARE 201(GEP*) | 3 | | | | |
| | | **Semester Total** | **17** | | | **Semester Total** | **14** |

## Sophomore Year

| | | *Fall Semester* | *Credits* | | | *Spring Semester* | *Credits* |
|---|---|---|---|---|---|---|---|
| ECE | 200 | Intro. to ECE Laboratory[2] | 4 | COM | 110 | Public Speaking | 3 |
| ECE | 209 | Computer Systems Programming[2] | 3 | ECE | 211 | Electric Circuits[2] | 4 |
| MA | 242 | Calculus III | 4 | ECE | 212 | Fund of Logic Des[2] | 3 |
| PY | 208 | Physics for Engr & Sc II | 3 | ECE | 220 | Analytical Found. Of ECE[2] | 3 |
| PY | 209 | Physics for Engr & Sc II Lab | 1 | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **15** | | | **Semester Total** | **16** |

## Junior Year

| | | *Fall Semester* | *Credits* | | | *Spring Semester* | *Credits* |
|---|---|---|---|---|---|---|---|
| ECE | 301 | Linear Systems | 3 | ECE | 303 | Electromagnetic Fields | 3 |
| ECE | 302 | Intro. to Microelectronics | 4 | ECE | 380 | Engr Profession for EE[4] | 1 |
| ECE | 3** | ECE Foundation Elective[3] | 3 | ECE | 3** | ECE Foundation Elective[3] | 3 |
| ST | 371 | Intro to Prob and Dist Theory | 3 | *** | *** | Open/Technical Elective[5] | 3 |
| HES* | *** | Health & Exercise Studies | 1 | ENG | 331 | Comm for Engr & Tech | 3 |
| | | | | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **14** | | | **Semester Total** | **16** |

## Senior Year

| | | *Fall Semester* | *Credits* | | | *Spring Semester* | *Credits* |
|---|---|---|---|---|---|---|---|
| ECE | 484 | ECE Senior Design Project I | 3 | ECE | 485 | ECE Senior Design Project II | 3 |
| ECE | 4** | EE Elective[6] | 3 | ECE | 4** | ECE Elective[7] | 3 |
| ECE | 4** | EE Elective[6] | 3 | ECE | 4** | ECE Elective[7] | 3 |
| *** | *** | Open/Technical Elective[5] | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | GEP Requirement* | 3 | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **15** | | | **Semester Total** | **15** |

**Minimum Total Credit Hours Required for Graduation 122**

**Major/Program requirements and footnotes:**

[1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.

[2]Grade of C- or better required. E 115 requires satisfactory completion (S).

[3]ECE foundation electives: E 304; ECE 305; ECE 308; ECE 435 or either ECE 306 or ECE 310.

[4] Students in the entrepreneurs program should take ECE 383/ECE 482/ECE 483 instead of ECE 380/ECE 484/ECE 485.

[5]Open/Technical electives (Choose 2): any ECE 3** or ECE 4**; CE 214 or MAE 206; ISE 311; MAE 208, MAE 201, MAE 302, MAE 308; MSE 200 or MSE 201.

[6]EE 4** electives (Choose 2 courses from within any one of the following lists): (Comm. Sig Proc Sys) ECE 402, ECE 420; ECE 421; (Control Sys) ECE 436, ECE 455, ECE 456; (Circ, E&M Sys) ECE 403, ECE 422; (Nano Sys) ECE 404, ECE 442, ECE 445; (Power Sys) ECE 434, ECE 451, ECE 452, ECE 453, ECE 552.

[7]ECE 4** electives (Choose 2): ECE 402, ECE 403, ECE 404, ECE 407, ECE 420, ECE 421, ECE 422, ECE 423, ECE 434, ECE 436, ECE 442, ECE 445, ECE 451, ECE 452, ECE 453, ECE 455, ECE 456, ECE 461, ECE 463, ECE 464, ECE 465, ECE 492 (Special Topics Classes). Students with major GPAs greater than 3.2 can also take ECE 5** courses.

**General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://oucc.ncsu.edu/gep-courses

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list.*

**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics. Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.*

**Health and Exercise Studies** (2 credit hours – must include one HESF 100-level course and one additional HES course)
*Choose from the University approved GEP Health and Exercise Studies course list.*

**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities/Social Sciences/Visual and Performing Arts*

**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*

K. **Foreign Language proficiency** - Proficiency at the FL_102 level

# CURRICULUM REQUIREMENTS

| |
|---|
| **Degree Title:** Bachelor of Science in Electrical Engineering |
| **Current Degree Key:** 14EEBS |
| **Effective Date of Revision:** 1/2018 |

| **MAJOR FIELD OF STUDY REQUIREMENTS:** | | |
|---|---|---|
| ***Required Courses/Groups/ Electives:*** | ***Credit Hours*** | ***GEP category, if applicable*** |
| Indicate if course or course groupings have a C-wall or MGPA requirement | | List GEP category and hours satisfied by a Major requirement |
| Math | | |
| MA 141 (C)-wall, MA 241 (C)-wall, MA 242 | 12 | Mathematics (6 hours) |
| ST 371 | 3 | |
| Sciences | | |
| CH 101 (C)-wall, CH 102 (C)-wall | 4 | Natural Sciences (4 hours) |
| PY 205 (C)-wall, PY 208 | 8 | Natural Sciences (4 hours) |
| EE Major | | |
| ECE 109 (C-)-wall | 3 | |
| ECE 200 (C-)-wall | 4 | |
| ECE 209 (C-)-wall | 3 | |
| ECE 211 (C-)-wall | 4 | |
| ECE 212 (C-)-wall | 3 | |
| ECE 220 (C-)-wall | 3 | |
| ECE 301 | 3 | |
| ECE 302 | 4 | |
| ECE 303 | 3 | |
| ECE 380 | 1 | |
| ECE 484 | 3 | |
| ECE 485 | 3 | |
| **GRP 020** ECE 3xx Elective (Pick 2)<br>E304, ECE305, ECE 308, **GRP 021**( ECE 306, ECE 310) | 6 | |
| **GRP 030** EE 4xx Elective (Pick 2 from any group)<br>**GRP 031** (ECE 402, ECE 420, ECE 421), **GRP 032** (ECE 403, ECE 422), **GRP 033** (ECE 404, ECE 423, ECE 442, ECE 445), **GRP 034** (ECE 436, ECE 455, ECE 456), **GRP 035** (ECE 434, ECE 451, ECE 452, ECE 453) | 6 | |
| **GRP 040** ECE Elective (Pick 2)<br>ECE 402, ECE 403, ECE 404, ECE 407, ECE 420, ECE 421, ECE 422, ECE 423, ECE 434, ECE 436, ECE 442, ECE 445, ECE 451, ECE 452, ECE 453, ECE 455, ECE 456, ECE 461, ECE 463, ECE 464, ECE 466, ECE 470 | 6 | |
| **GRP 050** Open/Technical Elective (Pick 2)<br>**GRP 040, GRP 020, GRP 051** (CE 214, MAE 206), **GRP052** (MSE200, MSE 201), ISE311, MAE 208, MAE 301, MAE 302 | 6 | |
| COM 110 | 3 | |
| ENG 331 | 3 | |
| **Concentration Courses/Groups/Electives:** | | |
| **Free Electives:** | | |

| | | |
|---|---|---|
| **Total credit hours under Major Field of Study:** *Minimum 27 hours required in program area.* | 94 hours | |
| **COLLEGE REQUIREMENTS:** | | |
| **Orientation Course(s):** **E 101** (C-)-wall, **E 115** (C-)-wall and E102 | 4 | E115 satisfies Technology Fluency requirement |
| **Other:** (ex: Adv Communication courses) Economics Elective (EC 205, 201; ARE 201) | 3 | Social Science |
| **Total credit hours under College Requirements:** | 7 hours | |

| **NCSU GENERAL EDUCATION PROGRAM REQUIREMENTS**<br><br>*Courses in the Major and/or Minor may also fulfill a General Education requirement; however, a GEP category may not be subset to require a specific course from the category list. Required courses must be listed in the Major/College requirements.*<br><br>***Specific courses should not be listed in any of the fields below other than ENG 101.*** | | **At least one of the following must be listed:**<br>[1]Choose course(s) from the University Approved GEP course list for this category.<br>[2]Minimum requirements are satisfied by Major/College course requirements.<br>[3] Major/College course requirement satisfies **X** credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.<br>[4]Co-requisite is satisfied by a Major/College course requirement.<br>[5] Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences, or Visual & Performing Arts.<br>[6] Choose course(s) from the University Approved GEP course lists for the Natural and Mathematical Sciences. |
|---|---|---|
| **General Education Program Requirements:** *Minimum 39-40 hrs* | *Credit hours* | *How will the GEP requirement be met?* ***(choose applicable statement from 1-6 listed above)*** |
| **Mathematical Sciences** *(minimum of 6 credits)* (at least one with *MA or ST* prefix) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **Natural Sciences** *(minimum of 7 credits)* (at least *1 laboratory*) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **English 101** | 4 | ENG 101 (C-)-wall |
| **Humanities** *(minimum of 6 credits)* (from two different disciplines) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 6 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Social Sciences** *(minimum of 6 credits)* (from two different disciplines) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 3 | *Required College course satisfies 3 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Additional Breadth** *(minimum of 3 credits)* (Choose AB course list that is different from the approach of the Major) ***Major/College requirements cannot satisfy this requirement and an AB course cannot be double-counted except in satisfying the Global Knowledge and Diversity co-requisites.*** | 3 | *Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences or Visual and Performing Arts* |
| **Interdisciplinary Perspective** *(minimum of 5-6 credits)* ***Only course(s) in the Major may double-count to satisfy this requirement.*** | 3 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Health Exercise Sciences** (including one Fitness course) | 2 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Total credit hours needed to complete GEP that are not satisfied as part of the Major/College requirements.** | 21 hours | |
| **GEP Co-Requisites:** | | ***Courses taken in the Major, GEP, or Minor may double-count to fulfill the co-requisites. Courses that satisfy the U.S. Diversity* or Global Knowledge** co-requisite are marked on course lists with asterisks as indicated.*** |
| **U.S. Diversity co-requisite*** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |

| | | |
|---|---|---|
| **Global Knowledge co-requisite**** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Foreign Language Proficiency** | n/a | FL_102 |
| **The following requirements must be satisfied within the College/Program:** | | |
| **Advanced Communication** | X | Satisfied by College/Program Requirements |
| **Technology Fluency** | X | Satisfied by College/Program Requirements |

| | | |
|---|---|---|
| **Total credit hours required to complete Degree:**<br>Total must be within 120-128 credit hours. | 122 | **As applicable, indicate here the overall GPA requirement for degree completion including course completion.** |

NC STATE UNIVERSITY

College of Engineering
Office of Academic Affairs

www.engr.ncsu.edu

Campus Box 7904
21 Current Drive, Page Hall
Raleigh, NC 27695-7904
P: 919.515.3263

**DATE:** September 28, 2017

**TO:** Dr. Michael D. Mullen, Vice Provost and Dean of Academic and Student Affairs
**FROM:** Dr. Kanton Reynolds, Departmental Curriculum Chair, Industrial Engineering Department

**RE:** Curriculum Revision for 14IEBSto specify the GEP (IP) Course, E102: Engineering In the 21st Century

By means of this memorandum and the attached documents, the Industrial Engineering Department proposes to modify the 2nd semester of their engineering curriculum to add the GEP (Interdisciplinary) course E102: Engineering in the 21st Century.

This revision specifies a 2-hour, interdisciplinary perspective, general education elective in the second semester. The course, E102: Engineering in the 21st Century, is designed as an early exploration class intended to introduce students to the Engineering Grand Challenges. The course will be open to the campus. There is no change in the number of credit hours. Resources are being allocated from the college to accomplish this change. Attached is a semester-by-semester display with the revision shown in blue. The course was approved by UCCC and officially added to all of the Engineering First Year curricula (EFY) in 2017.

**SIGNATURES**

**RECOMMENDED BY:**

HEAD, DEPARTMENT/PROGRAM — DATE 11/15/17

**ENDORSED BY:**

CHAIR, COLLEGE COURSES & CURRICULA COMMITTEE — DATE 15 Nov 17

COLLEGE DEAN — DATE 12/04/17

**APPROVED BY:**

CHAIR, UNIVERSITY COURSES & CURRICULA COMMITTEE — DATE

DEAN OF UNDERGRADUATE ACADEMIC PROGRAMS — DATE

APPROVAL DATE _____

## Industrial Engineering [14IEBS Req Term Spring 14]

### Freshman Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | | | | |
| CH | 102 | General Chemistry Lab[1] | 1 | EC | 205 | Economics (or EC 201 or ARE 201*) | 3 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | MA | 241 | Calculus II[1] | 4 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | PY | 206 | Physics for Engr & Sc I Lab[1] | 1 |
| MA | 141 | Calculus I[1] | 4 | HES | *** | Health & Exercise Studies | 1 |
| HESF | 10* | Fitness & Wellness | 1 | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **15** | | | **Semester Total** | **15** |

### Sophomore Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| MSE | 200 | Mech Prop Struc Mat | 3 | ECE | 331 | Prin of Elect Engr | 3 |
| ISE | 110 | Comp Model for Engrs[3] | 3 | ISE | 215 | Found of Design & 3D Model for Engr | 1 |
| MA | 242 | Calculus III | 4 | ISE | 216 | Mfg Engr Practicum | 3 |
| PY | 208 | Physics for Engr & Sc II | 3 | MA | 303 | Linear Analysis | 3 |
| PY | 209 | Physics for Engr & Sc II Lab | 1 | ST | 372 | Intro Stat Infer & Regres | 3 |
| ST | 371 | Intro Prob & Dist Theory[2] | 3 | *** | *** | Engr Science Elect[4] | 3 |
| | | **Semester Total** | **17** | | | **Semester Total** | **16** |

### Junior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| ENG | 331 | Tech Writing | 3 | ISE | 352 | Work Anal & Design | 3 |
| ISE | 315 | Intro to Computer-Aided Manufacturing | 1 | ISE | 362 | Stochastic Models in IE | 3 |
| ISE | 316 | Mfg Engr I - Processes | 3 | ISE | 443 | Quality Control | 3 |
| ISE | 361 | Deter Models in IE | 3 | *** | *** | Technical Elect[6] | 3 |
| ISE | 441 | Intro to Simulation | 3 | CE | 214 | Engr Mech - Statics | 3 |
| *** | *** | Ethics (GEP Req*)[5] | 3 | | | | |
| | | **Semester Total** | **16** | | | **Semester Total** | **15** |

### Senior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| ISE | 311 | Engr Economic Analysis | 3 | ISE | 498 | Sr Design Proj | 3 |
| ISE | 408 | Cont of Prod & Ser Sys | 3 | *** | *** | Technical Elect[6] | 3 |
| ISE | 453 | Design of Prod, Logistics & Serv Syst | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | Technical Elect[6] | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | GEP Requirement* | 3 | *** | *** | GEP Requirement* | 2-3 |
| | | **Semester Total** | **15** | | | **Semester Total** | **14-15** |

**Minimum Total Credit Hours Required for Graduation** **124**

**Major/Program requirements and footnotes:**
[1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.
[2]Grade of C- or better required, E 115 requires satisfactory completion (S).
[3]ISE 110 must be completed with a grade of C or higher.

[4]Engineering science electives: CE 313, MAE 208, MAE 301, MAE 308, or MAE 314
[5] Ethics elective: IDS 201, IDS(NR) 303, STS 214, STS 302, STS 304, STS 322, or STS(PHI) 325
[6] Technical elective: ISE 416, 417, 452, 462, 495; MSE 445, 465, 485; ST 430, 431

***General Education Program (GEP) requirements and GEP Footnotes:**
To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://oucc.ncsu.edu/gep-courses

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list .* [1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205 must be completed with C or higher.
[2]Grade of C- or better required, E 115 requires satisfactory completion (S).
**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics. Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.*
**Health and Exercise Studies** (2 credit hours – must include one HESF 100-level course and one additional HES course)
*Choose from the University approved GEP Health and Exercise Studies course list.*
**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities/Social Sciences/Visual and Performing Arts*
**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*
The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*
J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*
K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation.

# Industrial Engineering [14IEBS Req Term Spring 2018]

## Freshman Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | EC | 205 | Economics (or EC 201 or ARE 201*) | 3 |
| CH | 102 | General Chemistry Lab[1] | 1 | MA | 241 | Calculus II[1] | 4 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | PY | 206 | Physics for Engr & Sc I Lab[1] | 1 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | HES | *** | Health & Exercise Studies | 1 |
| MA | 141 | Calculus I[1] | 4 | E | 102 | Engineering in the 21st Century (GEP-IP) | 2 |
| HESF | 10* | Fitness & Wellness | 1 | | | Removing GEP | |
| | | **Semester Total** | **15** | | | **Semester Total** | **14** |

## Sophomore Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| MSE | 200 | Mech Prop Struc Mat | 3 | ECE | 331 | Prin of Elect Engr | 3 |
| ISE | 110 | Comp Model for Engrs[3] | 3 | ISE | 215 | Found of Design & 3D Model for Engr | 1 |
| MA | 242 | Calculus III | 4 | ISE | 216 | Mfg Engr Practicum | 3 |
| PY | 208 | Physics for Engr & Sc II | 3 | MA | 303 | Linear Analysis | 3 |
| PY | 209 | Physics for Engr & Sc II Lab | 1 | ST | 372 | Intro Stat Infer & Regres | 3 |
| ST | 371 | Intro Prob & Dist Theory[2] | 3 | *** | *** | Engr Science Elect[4] | 3 |
| | | **Semester Total** | **17** | | | **Semester Total** | **16** |

## Junior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| ENG | 331 | Tech Writing | 3 | ISE | 352 | Work Anal & Design | 3 |
| ISE | 315 | Intro to Computer-Aided Manufacturing | 1 | ISE | 362 | Stochastic Models in IE | 3 |
| ISE | 316 | Mfg Engr I - Processes | 3 | ISE | 443 | Quality Control | 3 |
| ISE | 361 | Deter Models in IE | 3 | *** | *** | Technical Elect[6] | 3 |
| ISE | 441 | Intro to Simulation | 3 | CE | 214 | Engr Mech - Statics | 3 |
| *** | *** | Ethics (GEP Req*)[5] | 3 | | | | |
| | | **Semester Total** | **16** | | | **Semester Total** | **15** |

## Senior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| ISE | 311 | Engr Economic Analysis | 3 | ISE | 498 | Sr Design Proj | 3 |
| ISE | 408 | Cont of Prod & Ser Sys | 3 | *** | *** | Technical Elect[6] | 3 |
| ISE | 453 | Design of Prod, Logistics & Serv Syst | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | Technical Elect[6] | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | GEP Requirement* | 3 | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **15** | | | **Semester Total** | **15** |

**Minimum Total Credit Hours Required for Graduation** **123**

**Major/Program requirements and footnotes:**

[1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.
[2]Grade of C- or better required, E 115 requires satisfactory completion (S).
[3]ISE 110 must be completed with a grade of C or higher.

[4]Engineering science electives: CE 313, MAE 208, MAE 201, MAE 308, or MAE 214
[5]Ethics elective: IDS 201, IDS(NR) 303, STS 214, STS 302, STS 304, STS 322, or STS(PHI) 325
[6]Technical elective: ISE 416, 417, 452, 462, 495; MSE 445, 465, 485; ST 430, 431

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***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://oucc.ncsu.edu/gep-courses

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list .* [1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205 must be completed with C or higher.
[2]Grade of C- or better required, E 115 requires satisfactory completion (S).
**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics. Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.*
**Health and Exercise Studies** (2 credit hours – must include one HESF 100-level course and one additional HES course)
*Choose from the University approved GEP Health and Exercise Studies course list.*
**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities/Social Sciences/Visual and Performing Arts*
**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*
The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*
J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*
K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation.

# GEP FORMAT B – CURRICULUM REQUIREMENTS

| |
|---|
| **Degree Title:** Bachelor of Science in Industrial Engineering |
| **Current Degree Key:** 14IEBS |
| **Effective Date of Revision:** 1/2018 |

| MAJOR FIELD OF STUDY REQUIREMENTS: | | |
|---|---|---|
| *Required Courses/Groups/ Electives:* | *Credit Hours* | *GEP category, if applicable* |
| Indicate if course or course groupings have a C-wall or MGPA requirement | | List GEP category and hours satisfied by a Major requirement |
| **Math** | | |
| MA 141(C), MA 241(C), MA 242 | 12 | Mathematics (6 hours) |
| MA 303 | 3 | |
| ST 371(C-), ST 372 | 6 | |
| **Sciences** | | |
| CH 101(C), CH 102(C) | 4 | Natural Sciences (3 hours) |
| PY 205(C), PY 208 | 8 | Natural Sciences (4 hours) |
| **ISE Major** | | |
| ISE 110(C) | 3 | |
| ISE 215 | 1 | |
| ISE 216 | 3 | |
| ISE 315 | 1 | |
| ISE 316 | 3 | |
| ISE 311 | 3 | |
| ISE 352 | 4 | |
| ISE 361 | 3 | |
| ISE 362 | 3 | |
| ISE 408 | 3 | |
| ISE 443 | 3 | |
| ISE 498 | 3 | |
| **Other Major** | | |
| GRP 035 (ISE 441 or CSC 441) | 3 | |
| GRP 030 (CE 214 or MAE 206) | 3 | |
| ECE331 | 3 | |
| MSE 200 | 3 | |
| ENG 331 | 3 | |
| GRP 033 (CE 215, CE 313, MAE 208, MAE 301, MAE 308, MAE 314) | 3 | Humanities (3 hours); GEP co-requisite for Advanced Communications |
| GRP206 (IDS 201, IDS 303, STS 214, STS 302, STS 304, STS 320, STS 322, STS 325) | 3 | |
| | 3 | Interdisciplinary Perspective (3 hours) |
| **Concentration Courses/Groups/Electives:** Technical Electives: ISE 416, ISE 417, ISE 452, ISE 462, ISE 495, MA 405, ST 430, ST 431, MSE 465, MSE 485 | 9 | |
| **Free Electives:** | 3 | |
| **Total credit hours under Major Field of Study:** *Minimum 27 hours required in program area.* | 102 hours | |
| **COLLEGE REQUIREMENTS:** | | |

| | | |
|---|---|---|
| **Orientation Course(s):** E 101 (C-)<br>E 115 and E102 | 4 | Technology Fluency requirement and IP |
| **Other:** (ex: Adv Communication courses)<br>Economics Elective (EC 205, 201; ARE 201) | 3 | Social Science (3 hours) |
| **Total credit hours under College Requirements:** | 7 hours | |

## NCSU GENERAL EDUCATION PROGRAM REQUIREMENTS

*Courses in the Major and/or Minor may also fulfill a General Education requirement; however, a GEP category may not be subset to require a specific course from the category list. Required courses must be listed in the Major/College requirements.*

*Specific courses should not be listed in any of the fields below other than ENG 101.*

**At least one of the following must be listed:**
[1]Choose course(s) from the University Approved GEP course list for this category.
[2]Minimum requirements are satisfied by Major/College course requirements
[3] Major/College course requirement satisfies X credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.
[4]Co-requisite is satisfied by a Major/College course requirement.
[5] Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences, or Visual & Performing Arts.
[6]Choose course(s) from the University Approved GEP course lists for the Natural and Mathematical Sciences.

| **General Education Program Requirements:**<br>*Minimum 39-40 hrs* | *Credit hours* | *How will the GEP requirement be met?*<br>*(choose applicable statement from 1-6 listed above)* |
|---|---|---|
| **Mathematical Sciences** *(minimum of 6 credits)*<br>(at least one with *MA or ST* prefix)<br>*Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.* | X | *Minimum requirements are satisfied by Major course requirements* |
| **Natural Sciences** *(minimum of 7 credits)* (at least *1 laboratory*)<br>*Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.* | X | *Minimum requirements are satisfied by Major course requirements* |
| **English 101(C-)** | 4 | ENG 101 |
| **Humanities** *(minimum of 6 credits)* (from two different disciplines)<br>*Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.* | 3 | *Major requirement (ENG 331) satisfies 3 credit hours of this requirement. Remaining hours must be chosen from the University Approved GEP course list for this category* |
| **Social Sciences** *(minimum of 6 credits)* (from two different disciplines)<br>*Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.* | 3 | *College requirement (EC 205 or EC 201 or ARE 201) satisfies 3 credit hours of this requirement. Remaining hours must be chosen from the University Approved GEP course list for this category* |
| **Additional Breadth** *(minimum of 3 credits)*<br>(Choose AB course list that is different from the approach of the Major)<br>*Major/College requirements cannot satisfy this requirement and an AB course cannot be double-counted except in satisfying the Global Knowledge and Diversity co-requisites.* | 3 | *Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences or Visual and Performing Arts* |
| **Interdisciplinary Perspective** *(minimum of 5-6 credits)*<br>*Only course(s) in the Major may double-count to satisfy this requirement.* | 0 | *Major requirement (Ethics-GRP 203) satisfies 3 credit hours of this requirement. E102 satisfies 2 Credit Hours* |
| **Physical Education/Healthy Living**<br>(including one Fitness and Wellness course) | 2 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Total credit hours needed to complete GEP that are not satisfied as part of the Major/College requirements.** | 18 hours | . |
| **GEP Co-Requisites:** | | *Courses taken in the Major, GEP, or Minor may double-count to fulfill the co-requisites. Courses that satisfy the U.S. Diversity* or Global Knowledge** co-requisite are marked on course lists with asterisks as indicated.* |
| **U.S. Diversity co-requisite*** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Global Knowledge co-requisite**** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Foreign Language Proficiency** | n/a | FL_102 |

| The following requirements must be satisfied within the College/Program: | | |
|---|---|---|
| Advanced Communication | X | Satisfied by College/Program Requirements |
| Computer Literacy | X | Satisfied by College/Program Requirements |

| Total credit hours required to complete Degree:<br>Total must be within 120-128 credit hours. | 123 Total hours | Graduation requirements include: (a) 2.0 overall GPA or higher on all courses attempted at NCSU and (b) 2.0 GPA or higher in all ISE designated courses, or a C- or higher in all ISE designated courses. |
|---|---|---|

NC STATE UNIVERSITY

College of Engineering
Office of Academic Affairs

www.engr.ncsu.edu

Campus Box 7904
21 Current Drive, Page Hall
Raleigh, NC 27695-7904
P: 919.515.3263

**DATE:** September 28, 2017

**TO:** Dr. Michael D. Mullen, Vice Provost and Dean of Academic and Student Affairs
**FROM:** Dr. Cheryl Cass, Departmental Curriculum Chair, Materials Science Engineering Department

**RE:** Curriculum Revision for 14MSEBS to specify the GEP (IP) Course, E102: Engineering In the 21st Century

By means of this memorandum and the attached documents, the Materials Science Engineering Department proposes to modify the 2nd semester of their engineering curriculum to add the GEP (Interdisciplinary) course E10: Engineering in the 21st Century.

This revision specifies a 2-hour, interdisciplinary perspective, general education elective in the second semester. The course, E102: Engineering in the 21st Century, is designed as an early exploration class intended to introduce students to the Engineering Grand Challenges. The course will be open to the campus. There is no change in the number of credit hours. Resources are being allocated from the college to accomplish this change. Attached is a semester-by-semester display with the revision shown in blue. The course was approved by UCCC and officially added to all of the Engineering First Year curricula (EFY) in 2017.

**SIGNATURES**

**RECOMMENDED BY:**

HEAD, DEPARTMENT/PROGRAM — DATE 11/17/17

**ENDORSED BY:**

CHAIR, COLLEGE COURSES & CURRICULA COMMITTEE — DATE 17 Nov 17

COLLEGE DEAN — DATE 12/04/17

**APPROVED BY:**

CHAIR, UNIVERSITY COURSES & CURRICULA COMMITTEE — DATE

DEAN OF UNDERGRADUATE ACADEMIC PROGRAMS — DATE

APPROVAL DATE _____

**Materials Science & Engineering [14MSEBS Req Term Summer 1 13]**

**Freshman Year**

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | CH | 201 | Chemistry, A Quant Science | 3 |
| CH | 102 | General Chemistry Lab[1] | 1 | CH | 202 | Quantitative Chemistry Lab | 1 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | MA | 241 | Calculus II[1] | 4 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | PY | 206 | Physics for Engr & Sc I Lab[1] | 1 |
| MA | 141 | Calculus I[1] | 4 | HESF | 10* | Fitness & Wellness Course* | 1 |
| EC | 205 | Economics (or EC 201 or ARE 201)* | 3 | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **17** | | | **Semester Total** | **16** |

**Sophomore Year**

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CSC | 112 | Intro Comp: Fortran (or CSC 116: Java) | 3 | CH | 220 | Intro to Organic Chemistry | 4 |
| MA | 242 | Calculus III | 4 | MA | 341 | Applied Diff Equations I | 3 |
| MSE | 201 | Struct & Prop Engr Materials[2] | 3 | MSE | 255 | Exp Meth Struct Analysis of Matls | 2 |
| PY | 208 | Physics for Engr & Sc II | 3 | MSE | 260 | Math Methods for Material Engineers | 3 |
| PY | 209 | Physics for Engr & Sc II Lab | 1 | MSE | 270 | MSE Seminar | 1 |
| HES* | *** | Health & Exercise Studies | 1 | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **15** | | | **Semester Total** | **16** |

**Junior Year**

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| MSE | 300 | Structure of Matls at Nanoscale | 3 | MSE | 355 | Elect, Mag & Opt Prop of Matls | 3 |
| MSE | 301 | Intro Thermodynamics of Matls | 3 | MSE | 360 | Kinetic Process in Matls | 3 |
| MSE | 320 | Intro Defects in Solids | 3 | MSE | 370 | Microstructure of Inorganic Matls | 3 |
| MSE | 335 | Exp Meth Analysis of Matls Properties | 2 | MSE | 380 | Microstructure of Organic Matls | 3 |
| *** | *** | GEP Requirement* | 3 | *** | *** | Engineering Elective[3] | 3 |
| *** | *** | GEP Requirement* | 3 | | | | |
| | | **Semester Total** | **17** | | | **Semester Total** | **15** |

**Senior Year**

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| MSE | 420 | Mechanical Prop of Matls | 3 | MSE | 470 | Matl Sci & Engr Design Project | 3 |
| MSE | 423 | Intro to Matls Engr Design | 1 | MSE | 480 | Materials Forensics and Degradation | 3 |
| MSE | *** | MSE Processing Elective[3] | 3 | MSE | *** | Tech Elect[4] | 3 |
| MSE | *** | Tech Elect[4] | 3 | MSE | *** | Tech Elect[4] | 3 |
| ENG | 331 | Technical Writing (or ENG 333) | 3 | *** | *** | Ethics Elective (GEP Requirement*)[5] | 2-3 |
| *** | *** | GEP Requirement* | 3 | | | | |
| | | **Semester Total** | **16** | | | **Semester Total** | **14-15** |

**Minimum Total Credit Hours Required for Graduation** **126**

**Major/Program requirements and footnotes:**

[1]Courses required for Change of Degree Audit (CODA): CH 101, 102, MA 141, 241, PY 205, 206 must be completed with C or higher

[2]Minimum grade of C-, E 115 requires satisfactory completion (S)

[3]Choose any course from the following list: CE 214 or MAE 206, CE 215 or MAE 208, CE 313 or MAE 314, CSC 200, ECE 331, ISE 311, MSE 350, MSE(NE) 409, NE 202, TE 205, CHE 455, MSE 440, MSE 445, MSE 455, MSE 456, MSE 460

[4]Choose any course from the following list: BCH 451,CH 221, CH 223, CH 315,CH 401, CH 437, MA 305, MA 351, MA 401, MA 402, MA 405, MEA 463, PY 328, PY 407, PY 411, PY 412, PY 414, PY 415, PY 463, ST 370, CE 214or MAE 206, CE 215 or MAE 208, CE 313 or MAE 314, CSC 200, ECE 331, ISE 311, MSE 350, MSE(NE) 409, NE 202, TE 205, CHE 455, MSE 440, MSE 445, MSE 455, MSE 456, MSE 460

[5]Choose any course from the following list: CHE 455, MSE 440, 445, 455, 460, 456

[5]Ethics course must be chosen from the following list: IDS 201, STS 302, 304, 325 (PHI 325); PHI 214, 221 or 375

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied University approved GEP course lists for each of the following categories can be found at

http://ugcc.nesu.edu/gep-courses

**Humanities** (6 credit hours selected from two different disciplines course prefixes)
*Choose from the University approved GEP Humanities course list*

**Social Sciences** (6 credit hours selected from two different disciplines course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics*
*Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement*

**Health and Exercise Studies** (2 credit hours – must include one HESF 100-level course and one additional HES course)
*Choose from the University approved GEP Health and Exercise Studies course list*

**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities Social Sciences Visual and Performing Arts*

**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list*

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite*

K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation

# Materials Science & Engineering [14MSEBS Req Term Spring 2018]

## Freshman Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | CH | 201 | Chemistry, A Quant Science | 3 |
| CH | 102 | General Chemistry Lab[1] | 1 | CH | 202 | Quantitative Chemistry Lab | 1 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | MA | 241 | Calculus II[1] | 4 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | PY | 206 | Physics for Engr & Sc I Lab[1] | 1 |
| MA | 141 | Calculus I[1] | 4 | HESF | 10* | Fitness & Wellness Course* | 1 |
| EC | 205 | Economics (or EC 201 or ARE 201)* | 3 | E | 102 | Engineering in the 21st Century (GEP - IP) | 2 |
| | | **Semester Total** | **17** | | | | **15** |

## Sophomore Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| MSE | 201 | Struct & Prop Engr Materials[2] | 3 | CH | 220 | Introductory Organic Chemistry | 3 |
| MA | 242 | Calculus III | 4 | CH | 222 | Organic Chemistry I Lab | 1 |
| ST | 370 | Prob & Statistics for Engineers | 3 | MA | 341 | Applied Diff Equations I | 3 |
| PY | 208 | Physics for Engr & Sc II | 3 | MSE | 255 | Exp Meth Struct Analysis of Matls | 2 |
| PY | 209 | Physics for Engr & Sc II Lab | 1 | MSE | 260 | Math Methods for Material Engineers | 3 |
| HES* | *** | Health & Exercise Studies | 1 | MSE | 270 | MSE Seminar | 1 |
| | | **Semester Total** | **15** | *** | *** | GEP Requirement* | 3 |
| | | | | | | **Semester Total** | **16** |

## Junior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| MSE | 300 | Structure of Matls at Nanoscale | 3 | MSE | 355 | Elect, Mag & Opt Prop of Matls | 3 |
| MSE | 301 | Intro Thermodynamics of Matls | 3 | MSE | 360 | Kinetic Process in Matls | 3 |
| MSE | 320 | Intro Defects in Solids | 3 | MSE | 370 | Microstructure of Inorganic Matls | 3 |
| MSE | 335 | Exp Meth Analysis of Matls Properties | 2 | MSE | 380 | Microstructure of Organic Matls | 3 |
| *** | *** | Tech Elect[3,4,5] | 3 | *** | *** | Engineering Elective[3,5] | 3 |
| *** | *** | GEP Requirement* | 3 | | | | |
| | | **Semester Total** | **17** | | | **Semester Total** | **15** |

## Senior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| MSE | 420 | Mechanical Prop of Matls | 3 | MSE | 470 | Matl Sci & Engr Design Project | 3 |
| MSE | 423 | Intro to Matls Engr Design | 1 | MSE | 480 | Materials Forensics and Degradation | 3 |
| MSE | *** | MSE Processing Elective[5] | 3 | MSE | *** | Tech Elect[3,4,5] | 3 |
| MSE | *** | Tech Elect[3,4,5] | 3 | *** | *** | GEP Requirement*[6] | 3 |
| ENG | 331 | Technical Writing (or ENG 333) | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | GEP Requirement* | 3 | | | | |
| | | **Semester Total** | **16** | | | **Semester Total** | **15** |
| | | | | | | **Minimum Total Credit Hours Required for Graduation** | **126** |

**Major/Program requirements and footnotes:**

[1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.

[2]Minimum grade of C-, E 115 requires satisfactory completion (S).

[3]Choose any course from the following list: CE 214 or MAE 206, MAE 208, CE 313 or MAE 214, CSC 200, ECE 331, ISE 311, MSE 350, MSE(NE) 409, NE 202, TE 205, CHE 455, MSE 440, MSE 445, MSE 455, MSE 456, MSE 460

[4]Choose any course from the following list: BCH 451,CH 221, CH 223, CH 315,CH 401, CH 437, MA 305, MA 351, MA 401, MA 402, MA 405, MEA 463, PY 328, PY 407, PY 411, PY 412, PY 414, PY 415, PY 463, ST 370, CE 214or MAE 206, MAE 208, CE 313 or MAE 214, CSC 200, ECE 331, ISE 311, MSE 350, MSE(NE) 409, NE 202, TE 205, CHE 455, MSE 440, MSE 445, MSE 455, MSE 456, MSE 460

[5]Choose any course from the following list: CHE 455, MSE 440, 445, 455, 456, 460.

[6]Ethics course must be chosen from the following list: IDS 201; STS 302, 304, 325 (PHI 325); PHI 214, 221 or 375.

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://oucc.ncsu.edu/gep-courses.

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list .*

**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics. Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.*

**Health and Exercise Studies** (2 credit hours – must include one HESF 100-level course and one additional HES course)
*Choose from the University approved GEP Health and Exercise Studies course list.*

**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities/Social Sciences/Visual and Performing Arts*

**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*

K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation.

## 3. List of requirements (Format B)

# CURRICULUM REQUIREMENTS

**Format B** **BS IN MATERIALS SCIENCE AND ENGINEERING**

| | |
|---|---|
| Degree/Plan Title: **Bachelor of Science in Materials Science and Engineering** | Plan SIS Code: **14MSEBS** |
| Concentration/Subplan Title: | Subplan SIS Code: |
| Indicate requirements status: Current: | Proposed Effective Semester: Spring **2018** |
| New Degree Audit required? (Y or N) **Yes** | |
| Critical Path Courses - Identify using the code (CP) which courses are considered critical path courses which represent specific major requirements that are predictive of student success in a given program/plan. Place the (CP) next to the credit hours for the course. | |

| **MAJOR FIELD OF STUDY REQUIREMENTS:** | | |
|---|---|---|
| ***Required Courses/Groups/ Electives:*** | ***Credit Hours*** | GEP category, if applicable |
| **Indicate if course or course groupings have a C-wall or MGPA requirement and which are considered Critical Path courses – indicate with (CP) next to applic. course.** | | **List GEP category and hours satisfied by a Major requirement** |
| **Math**<br>MA 141 (CP), MA 241 (CP), MA 242 (CP), MA 341, ST 370 | 18 | Mathematics (6 hours) |
| **Sciences**<br>CH 101 (CP), CH 102 (CP), CH 201, CH 202, CH 220<br>PY 205 (CP), PY 208 (CP)<br>EC 205 | 12<br>8<br>3 | Natural Sciences (8 hours)<br><br>Social Sciences (3 hours) |
| **Required courses**<br>MSE 201 (CP), MSE 255, MSE 260,<br>MSE 270, MSE 300, MSE 301, MSE 320, MSE 335, MSE 355,<br>MSE 360, MSE 370, MSE 380, MSE 420, MSE 423, MSE 470,<br>MSE 480 | 42 | |
| **Concentration Courses/Groups/Electives:**<br><br>**GRP 080 – MSE Processing Elective (choose 1 course)**<br>MSE 440, MSE 445, MSE 455, MSE 456, MSE 460<br><br>**GRP 061 Engineering Elective (choose 1 course)**<br>Any MSE processing elective, MSE 350, MSE/NE 409,<br>MSE 490B, CE 214, CE 251, CE 313, MAE 206, MAE 208,<br>MAE 314, ECE 331, ISE/GC 210, ISE 311, NE 202,<br>TE 205<br><br>**GRP 071 – Technical Electives (choose 3 courses)**<br>Any MSE processing elective, any engineering elective,<br>BCH 451, CH 221, CH 223, CH 315, CH 401, CH 437, MA 305,<br>MA 351, MA 401, MA 402, MA 405, PY 328, PY 407, PY 411,<br>PY 412, PY 414, PY 415, MEA/PY 463 | 15 | |

| | | |
|---|---|---|
| **Free Electives:** | | |
| **Total credit hours under Major Field of Study:** *Minimum 27 hours required in program area.* | 98 | |
| **COLLEGE REQUIREMENTS:** | | |
| **Orientation Course(s):** E 101, E 115 and E102 | 4 | |
| **Other:** ENG 331 | 3 | Satisfies Communication in the Major GEP co-requisite |
| **Total credit hours under College Requirements:** | 7 | |

## *NCSU GENERAL EDUCATION PROGRAM REQUIREMENTS*

*Courses in the Major and/or Minor may also fulfill a General Education requirement; however, a GEP category may not be subset to require a specific course from the category list. Required courses must be listed in the Major/College requirements.*

***Specific courses should not be listed in any of the fields below other than ENG 101.***

***At least one of the following must be listed:***

1. Choose course(s) from the University Approved GEP course list for this category
2. Minimum requirements are satisfied by Major/College course requirements.
3. Major/College course requirement satisfies X credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.
4. Co-requisite is satisfied by a Major/College course requirement.
5. Choose course(s) from the University Approved GEP course lists for the Humanities/ Social Sciences/ Visual & Performing Arts.
6. Choose course(s) from the University Approved GEP course lists for Natural Sciences/Mathematical Sciences.

| **General Education Program Requirements:** *Minimum 39-40 hrs* | *Credit hours* | *How will the GEP requirement be met?* ***(Choose applicable statement from 1-6 listed above)*** |
|---|---|---|
| **Mathematical Sciences** *(6 credits)* (At least 1 course with *MA or ST* prefix) *Course(s) in the Major may double-count to satisfy this requirement and also satisfy either the Global Knowledge or U.S. Diversity co-requisites.* | X | *(Choose statement 1, 2 or 3)* *2. Minimum requirements are satisfied by Major/College course requirements.* |
| **Natural Sciences** *(7 credits)* (At least 1 *lab* course or course with a *lab*) *Course(s) in the Major may double-count to satisfy this requirement and also satisfy either the Global Knowledge or U.S. Diversity co-requisites.* | X | *(Choose statement 1, 2 or 3)* *2. Minimum requirements are satisfied by Major/College course requirements.* |
| **English 101** (C- or better required) *(4 credits)* | 4 | ENG 101 |
| **Humanities** *(6 credits)* (Courses from *two different* disciplines) *Course(s) in the Major may double-count to satisfy this requirement and also satisfy either the Global Knowledge or U.S. Diversity co-requisites.* | 6 | *(Choose statement 1, 2 or 3)* *1. Choose course(s) from the University Approved GEP course list for this category.* |
| **Social Sciences** *(6 credits)* (Courses from *two different* disciplines) *Course(s) in the Major may double-count to satisfy this requirement and also satisfy either the Global Knowledge or U.S. Diversity co-requisites.* | 3 | *(Choose statement 1, 2 or 3)* *3. Course in the Major (EC 205) satisfies 3 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Additional Breadth** *(3 credits)* (Choose approach that is *different* from the approach of the Major) *Major/College requirements cannot satisfy this requirement and an AB course cannot be double-counted except in satisfying the Global Knowledge or U.S. Diversity co-requisites.* | 3 | *(Choose statement 5 or 6)* *5. Choose course(s) from the University Approved GEP course lists for the Humanities/Social Sciences/Visual and Performing Arts* |
| **Interdisciplinary Perspectives** *(5 credits)* *Course(s) in the Major may double-count to satisfy this requirement and also satisfy either the Global Knowledge or U.S. Diversity co-requisites.* | 3 | *(Choose statement 1, 2 or 3)* *1. Choose course(s) from the University Approved GEP course list for this category.* |
| **Physical Education/Healthy Living** *(2 credits)* (Including one *Fitness and Wellness* course) | 2 | *Choose course(s) from the University Approved GEP course list for this category.* |
| **Total credit hours needed to complete GEP that are not satisfied as part of the Major/College requirements.** | 21 | |

| | | |
|---|---|---|
| **GEP Co-Requisites:** | | ***Courses taken in the Major, GEP, or Minor may double-count to fulfill the co-requisites. Courses that satisfy the U.S. Diversity or Global Knowledge co-requisite are marked on course lists with a "USD" or "GK" indicator.*** |
| **U.S. Diversity co-requisite** (USD) | n/a | *(Choose statement 1 or 4)* |
| **Global Knowledge co-requisite** (GK) | n/a | *(Choose statement 1 or 4)* |
| **Foreign Language Proficiency** | n/a | Proficiency at the FL_102 level required. |
| **The following requirements must be satisfied within the College/Program:** | | Place an **X** in the credit hour box to indicate below that the requirement is **"Satisfied by College/Program Requirements"** |
| **Communication in the Major (Advanced Communication)** | X | Satisfied by College/Program Requirements |
| **Technology Fluency** | X | Satisfied by College/Program Requirements |
| **Total credit hours required to complete Degree:** **Total must be within 120-128 credit hours.** | 126 | **As applicable, indicate here the overall GPA requirement for degree completion including course completion.** |

## 4. Catalog description of proposed curriculum

The Department of Materials Science and Engineering (MSE) offers programs to qualify graduates for positions in industry, R & D laboratories, educational institutions and governmental agencies. This basic education involves design, development, selection and processing of engineered materials. Industries served by graduates in materials science and engineering are aerospace, automotive, chemical and chemical processing, communications, electronics, energy production, manufacturing, nuclear and transportation. This program has been accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, 111 Market Place, Suite 1050, Baltimore, MD 21202; phone: (410) 347-7700.

The MSE program at NCSU prepares their B.S. graduates to achieve the following career and professional goals:

- To apply their knowledge of materials science and engineering to problems and challenges encountered in their professional careers.
- To use modern analytical equipment and methods as needed for materials testing, design, processing, development and research.
- To communicate well orally and in writing, interact professionally and work effectively on multi-disciplinary teams to achieve design and project objectives.
- To engage in lifelong learning in their profession and practice professional and ethical responsibility.

### Opportunities

The continuing industrial and technological growth of the United States, the southeast region, and the state of North Carolina has been marked by a particularly strong and increasing demand for materials engineers and scientists. Modern technological advances require new materials and novel processing and/or fabrication methods. At the national level, materials research is prominently mentioned in most lists of critical or enabling technologies. As our understanding of materials science advances, common features and elements tend to unite many different industries. As an example, consider that our current knowledge of silicon is necessary in the electronics, photovoltaics, optical fiber technology, lasers, pollution control, and biomedical industries. Advanced understanding of polymers also crosses and unites several different industries such as plastics, textiles, electronics, biomaterials and recycling.

Education in materials science and engineering provides career opportunities in a wide range of industries from those that produce and/or use metals, glass, polymers, or ceramics, to those which use such materials in an integrated fashion such as the microelectronics industry. These opportunities include careers in research and development of new materials, new processes for producing them, failure analysis, product design, testing and reliability, and technical management at all levels of business. The importance and growth potential of the materials science and engineering discipline is reflected by a recent U.S. Department of Labor study which predicts that over the next decade the demand for materials engineers and scientists will exceed that of any other engineering discipline.

**Curriculum**

The materials scientist and engineer must understand the wide range of phenomena that occur in all classes of materials: metals, ceramics, polymers, composites and electronic materials. The MSE undergraduate curriculum achieves this by integrating concepts common to all classes of materials into each course as much as possible. This approach differs from the traditional MSE curriculum in which separate courses are devoted to each class of material. The integrated approach provides students with a better understanding of the differences between the various classes of materials by comparing them in each course. Students are then better prepared to design and select the right material for various applications.

The MSE curriculum includes fundamental courses in thermodynamics, kinetics and structure, followed by more applied courses that cover mechanical, thermal, electrical, magnetic and optical properties of materials. Two intensive laboratory courses introduce students to analytical methods used to characterize the structure of materials at all length scales and to measure properties of all classes of materials. Cutting-edge technologies in materials science and engineering such as nanotechnology, biomaterials, computer modeling and forensics (materials degradation and failure analysis) are covered. Five technical electives are included which allow students to select from a broad range of courses in materials processing, engineering, chemistry, physics, mathematics and other disciplines. The flexibility afforded by these technical electives allows students to customize their education to prepare them for careers in industry or for graduate school.

The required 2-semester capstone senior design sequence provides a bridge between concepts learned in the classroom and practical application of these concepts in an industrial setting. The fall semester course covers open-ended classroom exercises, design methodologies, critical thinking skills, group dynamics, team formation and preparation of team project proposals. In the spring semester course, teams of students work on real-world materials problems submitted by industrial sponsors. The remaining required courses in the MSE curriculum are distributed among mathematics, physical sciences, and the humanities and social sciences.

*Biomaterials Concentration*

The Biomaterials Concentration in the MSE department provides undergraduate students with a comprehensive materials science and engineering background, while introducing elements of biology that will afford students an understanding of how materials interact with the body and how they can enhance quality of life. Students who graduate with a biomaterials concentration in MSE will be well-suited for a career in medical device and medical technology industries that require sufficient understanding of materials selection, processing, and characterization.

*Nanomaterials Concentration*

The Nanomaterials Concentration in MSE provides undergraduate students with a comprehensive materials science and engineering background, while emphasizing concepts for understanding materials

at length scales approaching the size of a few individual atoms or molecules of a material in the form of ultra-thin films, nanowires and nanoparticles. Properties from materials at these scales can differ from those observed in bulk specimens, while material structure engineering at the nanoscale can influence bulk structural and functional properties. Students who graduate with a Nanomaterials Concentration in MSE will be well prepared for a career working with materials that support nanotechnology industries including electronics, structural materials, and pharmaceuticals.

The materials science and engineering program, which is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET), leads to the degree Bachelor of Science in Materials Science and Engineering. An accelerated 5-year BS/MS program is available for advanced study and further specialization. Graduate degrees are also offered; consult the online Graduate Catalog: **http://www.fis.ncsu.edu/grad_catalog/catalog.htm.**

Specific curriculum requirements are available online: **www.ncsu.edu/registrar/curricula.**

**Minor in Materials Science and Engineering**

The Materials Science and Engineering minor is designed to provide undergraduate engineering and science majors in curricula other than MSE with the fundamentals of modern materials science and engineering. Students may select between two tracks in the MSE minor. One track focuses on inorganic materials and requires 17 hours of MSE courses The second track focuses on organic (soft) materials and requires one semester of organic chemistry plus 14 hours of MSE courses. A cumulative GPA of 2.0 or higher is required in the minor courses. Further information regarding a Minor in Materials Science and Engineering is available from the MSE Director of Undergraduate Programs.

**5. Enrollment history in Materials Science and Engineering for the past five years**

The table below contains undergraduate enrollment information for the MSE-BS degree during the last five years. Note that MSE-U and EFY-MSEI students are not included in these numbers.

| Year | Total 14MSE-BS Enrollment |
|---|---|
| 2014 | 139 |
| 2013 | 118 |
| 2012 | 78 |
| 2011 | 57 |
| 2010 | 54 |

**6. Projected enrollment in Materials Science and Engineering**

Our total projected enrollment per year over the next 4 years will approach 150 students. The MSE department has an enrollment cap of 50 students per year for engineering first year students and internal and external transfer students.

| Year | Total 14MSE-BS Enrollment |
|---|---|
| 2015 | 140 |
| 2016 | 150 |
| 2017 | 150 |
| 2018 | 150 |

NC STATE UNIVERSITY

College of Engineering
Office of Academic Affairs

www.engr.ncsu.edu

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**DATE:** September 28, 2017

**TO:** Dr. Michael D. Mullen, Vice Provost and Dean of Academic and Student Affairs
**FROM:** Dr. Jack Edwards, Departmental Curriculum Chair, Mechanical Engineering Department

**RE:** Curriculum Revision for 14MEBS to specify the GEP (IP) Course, E102: Engineering In the 21st Century

By means of this memorandum and the attached documents, the Mechanical Engineering Department proposes to modify the 2nd semester of their engineering curriculum to add the GEP (Interdisciplinary) course E102: Engineering in the 21st Century.

This revision specifies a 2-hour, interdisciplinary perspective, general education elective in the second semester. The course, E102: Engineering in the 21st Century, is designed as an early exploration class intended to introduce students to the Engineering Grand Challenges. The course will be open to the campus. There is no change in the number of credit hours. Resources are being allocated from the college to accomplish this change. Attached is a semester-by-semester display with the revision shown in blue. The course was approved by UCCC and officially added to all of the Engineering First Year curricula (EFY) in 2017.

**SIGNATURES**

**RECOMMENDED BY:**

HEAD, DEPARTMENT/PROGRAM — DATE: 11/15/17

**ENDORSED BY:**

CHAIR, COLLEGE COURSES & CURRICULA COMMITTEE — DATE: 15 Nov 17

COLLEGE DEAN — Jerome P. Lavelle — DATE: 12/04/17

**APPROVED BY:**

CHAIR, UNIVERSITY COURSES & CURRICULA COMMITTEE — DATE

DEAN OF UNDERGRADUATE ACADEMIC PROGRAMS — DATE

APPROVAL DATE _____

**Mechanical Engineering |14MEBS Req Term Summer 2 2015|**

**Freshman Year**

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | CSC | 113 | Intro Comp MATLAB | 3 |
| CH | 102 | General Chemistry Lab[1] | 1 | MA | 241 | Calculus II[1] | 4 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | PY | 206 | Physics for Engr & Sc I[1] Lab | 1 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | GC | 120 | Foundations of Graphics | 3 |
| MA | 141 | Calculus I[1] | 4 | HESF | 10* | Fitness & Wellness Course* | 1 |
| EC | 205 | Economics (or EC 201 or ARE 201)* | 3 | | | | |
| HES | *** | Health & Exercise Studies | 1 | | | | |
| | | **Semester Total 18** | | | | **Semester Total 15** | |

**Sophomore Year**

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| MA | 242 | Calculus III | 4 | MA | 341 | Appl Differential Eq | 3 |
| MAE | 200 | Introduction to ME Design | 1 | MAE | 201 | Engr Thermodynamics I[2] | 3 |
| MAE | 206 | Engineering Statics[2,3] | 3 | MAE | 205 | ME Lab I | 1 |
| PY | 208 | Physics for Engr & Sc II | 3 | MAE | 208 | Engineering Dynamics[2,3] | 3 |
| PY | 209 | Physics for Engr & Sc II[1] Lab | 1 | MAE | 214 | Solid Mechanics[2,3] | 3 |
| ST | 370 | Prob & Stat for Engineers ( or ST 371) | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | GEP Requirement* | 3 | | | | |
| | | **Semester Total 18** | | | | **Semester Total 16** | |

**Junior Year**

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| ENG | 331 | Comm Engr & Tech | 3 | ECE | 331 | Principles of Elec. Engr. I | 3 |
| MAE | 302 | Engr Thermodynamics II | 3 | MAE | 310 | Heat Transfer Fundamentals | 3 |
| MAE | 306 | ME Lab II | 1 | MAE | 316 | Strength of Mech Comp | 3 |
| MAE | 308 | Fluid Mechanics | 3 | MSE | 200 | Mech. Prop. Engr. Materials | 3 |
| MAE | 315 | Dynamics of Machines | 3 | **E | *** | Tech Elective[4] | 3 |
| *** | *** | GEP Requirement* | 3 | *** | *** | GEP Requirement* (Inter Persp) | 2-3 |
| | | **Semester Total 16** | | | | **Semester Total 16-17** | |

**Senior Year**

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| MAE | 405 | Controls Lab | 1 | **E | *** | Tech Elective[4] | 3 |
| MAE | 435 | Prin of Auto Control | 3 | MAE | 416 | ME Senior Design | 4 |
| MAE | 4** | Mech Engr Design Elective[5] | 3 | *** | *** | GEP Requirement* | 3 |
| **E | *** | Tech Elective[4] | 3 | *** | *** | Ethics (GEP Req*)[6] | 3 |
| ISE | 311 | Engr Econ Analysis | 3 | | | | |
| | | **Semester Total 13** | | | | **Semester Total 13** | |

**Minimum Total Credit Hours Required for Graduation 126**

**Major/Program requirements and footnotes:**

[1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.

[2]Minimum grade of C-, E 115 requires satisfactory completion (S).

[3]Students must have a 2.5 GPA to enroll in this course

[4]Technical electives must be selected from the following list (when offered): MAE 320, MAE 403, MAE 406, MAE407, MAE 408, MAE 410, MAE 42 MAE 426, MAE 430, MAE 442, MAE 472, MAE 495, MAE 496 (with permission of the instructor, limited to 3 credit hours), MAE 5** (with permissio the instructor, 3.5 GPA), up to 3 hours outside of MAE with permission of MAE advisor.

[5]Choose one: MAE 412, 415, 485

[6]Select from IDS 201, STS 302, STS 304, STS(PHI) 325, PHI 214 or PHI 375.

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied.

University approved GEP course lists for each of the following categories can be found at http://oucc.ncsu.edu/gep-courses.

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list .*

**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics.*
*Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.*

**Health and Exercise Studies** (2 credit hours – must include one HESF 100-level course and one additional HES course)
*Choose from the University approved GEP Health and Exercise Studies course list.*

**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities/Social Sciences/Visual and Performing Arts*

**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*

K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation.

# Mechanical Engineering |14MEBS Req Term Spring 2018|

## Freshman Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | CSC | 113 | Intro Comp MATLAB | 3 |
| CH | 102 | General Chemistry Lab[1] | 1 | MA | 241 | Calculus II[1] | 4 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | PY | 206 | Physics for Engr & Sc I[1] Lab | 1 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | E | 102 | Engineering in the 21st Century | 2 |
| MA | 141 | Calculus I[1] | 4 | GC | 120 | Foundations of Graphics | 3 |
| EC | 205 | Economics (or EC 201 or ARE 201)* | 3 | HESF | 10* | Fitness & Wellness Course* | 1 |
| HES | *** | Health & Exercise Studies | 1 | | | | |
| | | **Semester Total 18** | | | | **Semester Total 17** | |

## Sophomore Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| MA | 242 | Calculus III | 4 | MA | 341 | Appl Differential Eq | 3 |
| MAE | 200 | Introduction to ME Design | 1 | MAE | 201 | Engr Thermodynamics I[2] | 3 |
| MAE | 206 | Engineering Statics[2,3] | 3 | MAE | 205 | ME Lab I | 1 |
| PY | 208 | Physics for Engr & Sc II | 3 | MAE | 208 | Engineering Dynamics[2,3] | 3 |
| PY | 209 | Physics for Engr & Sc II[1] Lab | 1 | MAE | 214 | Solid Mechanics[2,3] | 3 |
| ST | 370 | Prob & Stat for Engineers ( or ST 371) | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | GEP Requirement* | 3 | | | | |
| | | **Semester Total 18** | | | | **Semester Total 16** | |

## Junior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| ENG | 331 | Comm Engr & Tech | 3 | ECE | 331 | Principles of Elec. Engr. I | 3 |
| MAE | 302 | Engr Thermodynamics II | 3 | MAE | 310 | Heat Transfer Fundamentals | 3 |
| MAE | 306 | ME Lab II | 1 | MAE | 316 | Strength of Mech Comp | 3 |
| MAE | 308 | Fluid Mechanics | 3 | MSE | 200 | Mech. Prop. Engr. Materials | 3 |
| MAE | 315 | Dynamics of Machines | 3 | **E | *** | Tech Elective[4] | 3 |
| *** | *** | GEP Requirement* | 3 | | | Removing IP GEP requirement | |
| | | **Semester Total 16** | | | | **Semester Total 15** | |

## Senior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| MAE | 405 | Controls Lab | 1 | **E | *** | Tech Elective[4] | 3 |
| MAE | 435 | Prin of Auto Control | 3 | MAE | 416 | ME Senior Design | 4 |
| MAE | 4** | Mech Engr Design Elective[5] | 3 | *** | *** | GEP Requirement* | 3 |
| **E | *** | Tech Elective[4] | 3 | *** | *** | Ethics (GEP Req*)[6] | 3 |
| ISE | 311 | Engr Econ Analysis | 3 | | | | |
| | | **Semester Total 13** | | | | **Semester Total 13** | |

**Minimum Total Credit Hours Required for Graduation 126**

**Major/Program requirements and footnotes:**

[1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.

[2]Minimum grade of C-, E 115 requires satisfactory completion (S).

[3]Students must have a 2.5 GPA to enroll in this course

[4]Technical electives must be selected from the following list (when offered): MAE 320, MAE 403, MAE 406, MAE407, MAE 408, MAE 410, MAE 42 MAE 426, MAE 430, MAE 442, MAE 472, MAE 495, MAE 496 (with permission of the instructor, limited to 3 credit hours), MAE 5** (with permissio the instructor, 3.5 GPA), up to 3 hours outside of MAE with permission of MAE advisor.

[5]Choose one: MAE 412, 415, 485

[6]Select from IDS 201, STS 302, STS 304, STS(PHI) 325, PHI 214 or PHI 375.

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied.

University approved GEP course lists for each of the following categories can be found at http://oucc.ncsu.edu/gep-courses.

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list .*

**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics.*
*Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.*

**Health and Exercise Studies** (2 credit hours – must include one HESF 100-level course and one additional HES course)
*Choose from the University approved GEP Health and Exercise Studies course list.*

**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities/Social Sciences/Visual and Performing Arts*

**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*

K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation.

# GEP FORMAT B – CURRICULUM REQUIREMENTS

| | |
|---|---|
| **Degree Title:** | **Bachelor of Science in Mechanical Engineering** |
| **Current Degree Key:** | **14MEBS** |
| **Effective Date of Revision:** | **1/2018** |

| **MAJOR FIELD OF STUDY REQUIREMENTS:** | | |
|---|---|---|
| ***Required Courses/Groups/ Electives:*** | ***Credit Hours*** | ***GEP category, if applicable*** |
| | | **List GEP category and hours satisfied by a Major requirement** |
| **Math** | | |
| MA 141(C-), MA 241(C-), MA 242 | 12 | Mathematics (6 hours) |
| **GRP 020** Differential Equations (MA 341 or MA 301) | 3 | |
| **Sciences** | | |
| CH 101 (C-), CH 102(C-) | 4 | Natural Sciences (3 hours) |
| PY 205 (C-), PY 208 | 8 | Natural Sciences (4 hours) |
| **ME Major** | | |
| **GRP 030** (MAE 206 (C-) or CE 214 (C-)) | 3 | |
| **GRP 031** (MAE 208 (C-) or CE 215 (C-)) | 3 | |
| **GRP 032** (MAE 314 (C-) or CE 313 (C-)) | 3 | |
| MAE 301(C-) | 3 | |
| MAE 302 | 3 | |
| MAE 305 | 1 | |
| MAE 306 | 1 | |
| MAE 308 | 3 | |
| MAE 310 | 3 | |
| MAE 315 | 3 | |
| MAE 316 | 3 | |
| MAE 412 | 3 | |
| MAE 415 | 3 | |
| MAE 416 | 4 | |
| MAE 43S | 3 | |
| MAE 469 | 1 | |
| **GRP 033** (~~ISE 311~~, MAE 403, MAE 406, MAE 408, MAE 421, MAE 407, MAE 442, MAE 495, MAE 496, MAE 5**) | 6 | |
| **Other Major** | | |
| CSC 112 | 3 | |
| MSE 200 | 3 | |
| ST 370 | 3 | |
| GC 120 | 3 | |
| ECE 331 | 3 | |
| ISE 311 | 3 | |
| **GRP 040** Engineering Ethics (STS 302, STS 304, STS 320, PHI 214, or PHI 375) | 3 | Humanities or Interdisciplinary Perspectives (3 hours). |
| ENG 331 | 3 | Advanced Communication co-requisite. |
| **Concentration Courses/Groups/Electives:** | | |
| **Free Electives:** | | |

| | | |
|---|---|---|
| PY 212) | | |
| **Total credit hours under Major Field of Study:** *Minimum 27 hours required in program area.* | 108 hours | |
| **COLLEGE REQUIREMENTS:** | | |
| **Orientation Course(s):** E101 (C-) ,E 115 & E102 | 4 | E 115 satisfies Technology Fluency Requirement |
| **Other:** (ex: Adv Communication courses) Economics Elective (EC 205, 201; ARE 201) | 3 | Social Science |
| **Total credit hours under College Requirements:** | 5 hours | |

| **NCSU GENERAL EDUCATION PROGRAM REQUIREMENTS** *Courses in the Major and/or Minor may also fulfill a General Education requirement; however, a GEP category may not be subset to require a specific course from the category list. Required courses must be listed in the Major/College requirements.* *Specific courses should not be listed in any of the fields below other than ENG 101.* | | **At least one of the following must be listed:** [1]Choose course(s) from the University Approved GEP course list for this category. [2]Minimum requirements are satisfied by Major/College course requirements. [3] Major/College course requirement satisfies X credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category. [4]Co-requisite is satisfied by a Major/College course requirement. [5] Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences, or Visual & Performing Arts. [6] Choose course(s) from the University Approved GEP course lists for the Natural and Mathematical Sciences. |
|---|---|---|
| **General Education Program Requirements:** *Minimum 39-40 hrs* | *Credit hours* | *How will the GEP requirement be met? (choose applicable statement from 1-6 listed above)* |
| **Mathematical Sciences** *(minimum of 6 credits)* (at least one with *MA or ST* prefix) *Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.* | X | *Minimum requirements ore satisfied by Major course requirements* |
| **Natural Sciences** *(minimum of 7 credits)* (at least *1 laboratory*) *Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.* | X | *Minimum requirements ore satisfied by Major course requirements* |
| **English 101** (C-) | 4 | ENG 101 |
| **Humanities** *(minimum of 6 credits)* (from two different disciplines) *Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.* | 6[4] | |
| **Social Sciences** *(minimum of 6 credits)* (from two different disciplines) *Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.* | 3 | *Required College course (EC 205) satisfies 3 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Additional Breadth** *(minimum of 3 credits)* (Choose AB course list that is different from the approach of the Major) *Major/College requirements cannot satisfy this requirement and an AB course cannot be double-counted except in satisfying the Global Knowledge and Diversity co-requisites.* | 3 | *Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences or Visual and Performing Arts* |
| **Interdisciplinary Perspective** *(minimum of 5-6 credits)* *Only course(s) in the Major may double-count to satisfy this requirement.* | 3 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Physical Education/Healthy Living** (including one Fitness and Wellness course) | 2 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Total credit hours needed to complete GEP that are not satisfied as part of the Major/College requirements.** | 18 hours | *Required Departmental course in engineering ethics will satisfy 3 hours of Humanities or Interdisciplinary Perspectives category.* |
| **GEP Co-Requisites:** | | *Courses taken in the Major, GEP, or Minor may double-count to fulfill the co-requisites. Courses that satisfy the U.S. Diversity* or Global Knowledge** co-requisite are marked on course lists* |

| | | |
|---|---|---|
| | | *with asterisks as indicated.* |
| **U.S. Diversity co-requisite*** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Global Knowledge co-requisite**** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Foreign Language Proficiency** | n/a | FL_102 |
| **The following requirements must be satisfied within the College/Program:** | | |
| **Advanced Communication** | X | Satisfied by College/Program Requirements (ENG 331) |
| **Technology Fluency** | X | Satisfied by College/Program Requirements |

| | | |
|---|---|---|
| **Total credit hours required to complete Degree:** **Total must be within 120-128 credit hours.** | 125 Total hours | **Graduation requirements include: (1) 2.0 overall GPA or higher in all courses attempted at NCSU and (b) 2.0 GPA or higher in all MAE designated courses, or a (C-) or higher in all MAE designated courses.** |

NC STATE UNIVERSITY

College of Engineering
Office of Academic Affairs

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Campus Box 7904
21 Current Drive, Page Hall
Raleigh, NC 27695-7904
P: 919.515.3263

**DATE:** September 28, 2017

**TO:** Dr. Michael D. Mullen, Vice Provost and Dean of Academic and Student Affairs
**FROM:** Dr. Lisa Marshall, Departmental Curriculum Chair, Nuclear Engineering Department

**RE:** Curriculum Revision for 14NEBS to specify the GEP (IP) Course, E102: Engineering In the 21st Century

By means of this memorandum and the attached documents, the Nuclear Engineering Department proposes to modify the 2nd semester of their engineering curriculum to add the GEP (Interdisciplinary) course E102: Engineering in the 21st Century.

This revision specifies a 2-hour, interdisciplinary perspective, general education elective in the second semester. The course, E102: Engineering in the 21st Century, is designed as an early exploration class intended to introduce students to the Engineering Grand Challenges. The course will be open to the campus. There is no change in the number of credit hours. Resources are being allocated from the college to accomplish this change. Attached is a semester-by-semester display with the revision shown in blue. The course was approved by UCCC and officially added to all of the Engineering First Year curricula (EFY) in 2017.

**SIGNATURES**

**RECOMMENDED BY:**

HEAD, DEPARTMENT/PROGRAM — DATE 11/15/17

**ENDORSED BY:**

CHAIR, COLLEGE COURSES & CURRICULA COMMITTEE — DATE 17 Nov 17

COLLEGE DEAN — DATE 12/04/17

**APPROVED BY:**

CHAIR, UNIVERSITY COURSES & CURRICULA COMMITTEE — DATE

DEAN OF UNDERGRADUATE ACADEMIC PROGRAMS — DATE

APPROVAL DATE _____

## Nuclear Engineering [14NEBS Req Term Spring 13]

### Freshman Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | CSC | 112 | Intro to Computing - FORTRAN | 3 |
| CH | 102 | General Chemistry Lab[1] | 1 | MA | 241 | Calculus II[1] | 4 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | PY | 206 | Physics for Engr & Sc I Lab[1] | 1 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | EC | 205 | Economics (or EC 201 or ARE201)* | 3 |
| MA | 141 | Calculus I[1] | 4 | *** | *** | GEP Requirement* | 3 |
| HESF | 10* | Fitness & Wellness Course* | 1 | | | | |
| | | **Semester Total** | **15** | | | **Semester Total** | **17** |

### Sophomore Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| MAE | 206 | Engineering Statics | 3 | MAE | 208 | Engineering Dynamics | 3 |
| MA | 242 | Calculus III | 4 | MA | 341 | Appl Differential Eq | 3 |
| NE | 201 | Intro to Nuclear Engr | 2 | NE | 202 | Rad. Sources, Interact & Detect[2] | 4 |
| PY | 208 | Physics for Engr & Sc II | 3 | *** | *** | GEP Requirement* | 3 |
| PY | 209 | Physics for Engr & Sc II Lab | 1 | *** | *** | GEP Requirement* | 3 |
| *** | *** | Advanced Communication Elect[3] | 3 | | | | |
| | | **Semester Total** | **16** | | | **Semester Total** | **16** |

### Junior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| MAE | 301 | Engr Thermo I | 3 | MAE | 308 | Fluid Mechanics | 3 |
| MA | 401 | Appl Diff Equations II | 3 | MSE | 201 | Struct Prop of Engr Mat | 3 |
| NE | 301 | Fund of Nuclear Engr[2] | 4 | NE | 400 | Nuclear React Ener Conver | 4 |
| ISE | 311 | Engr Ec Analysis | 3 | NE | 401 | React Analysis & Des | 4 |
| *** | *** | GEP Requirement* | 3 | HES* | *** | Health & Exercise Studies | 1 |
| | | **Semester Total** | **16** | | | **Semester Total** | **15** |

### Senior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| NE | 402 | Reactor Engr | 4 | NE | 405 | Reactor Systems | 3 |
| NE | 404 | Rad Safety & Shielding | 3 | NE | 408 | Nucl Engr Des Proj | 3 |
| NE | 406 | Nuclear Engr Senior Design Prep | 1 | *** | *** | Engr Tech Elective[6] | 3 |
| NE | *** | NE Elective[4] | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | Tech Elective[5] | 3 | *** | *** | GEP Requirement* | 2-3 |
| | | **Semester Total** | **14** | | | **Semester Total** | **14-15** |
| | | | | **Minimum Total Credit Hours Required for Graduation** | | | **123** |

**Major/Program requirements and footnotes:**

[1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.

[2]Grade of C- or better required. E 115 requires satisfactory completion (S).

[3]Advanced Communication Elective: COM 110, COM 112, COM 211, ENG 288, ENG 289, ENG 316, ENG 331, ENG 332, ENG 333, FLA 201, FLA 202, FLF 201, FLF 202, FLJ 201, FLJ 202, FLJ 203, FLJ 204, FLR 201, FLR 202, FLS 201, FLS 202, GRK 201, GRK 202, LAT 201, LAT 202. If any of the listed courses are taken to satisfy this requirement, must take another course for any of the GEP requirements.

[4]Nuclear Engineering Electives: NE 409, NE 412, NE 418, NE 509, NE 512, NE 528.

[5]Technical Electives: BUS 370, 420; CSC 302; CH 315, 331; ECE 331, 421; MA 405, 427; MAE 301, 310, 316, 410, 421; MSE 301; PY 341, 411, 414, 415, 525, 528; ST 361, 371.

[6]Engineering Technical Electives: Any course from (2) or any College of Engineering course at the 300-level or above.

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://ouce.ncsu.edu/gep-courses.

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list.*

**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics. Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.*

**Health and Exercise Studies** (2 credit hours – must include one HESF 100-level course and one additional HES course)
*Choose from the University approved GEP Health and Exercise Studies course list.*

**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities, Social Sciences, Visual and Performing Arts.*

**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements.

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*

K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation.

# Nuclear Engineering [14NEBS Req Term Spring 2018]

## Freshman Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| CH | 101 | Chemistry, A Molecular Science[1] | 3 | CSC | 113 | Intro to Computing - MATLAB | 3 |
| CH | 102 | General Chemistry Lab[1] | 1 | MA | 241 | Calculus II[1] | 4 |
| E | 101 | Introduction to Engr & Prob Solv[1,2] | 1 | PY | 205 | Physics for Engr & Sc I[1] | 3 |
| E | 115 | Intro to Computing Environ[1,2] | 1 | PY | 206 | Physics for Engr & Sc I Lab[1] | 1 |
| ENG | 101 | Academic Writing and Research[1,2] | 4 | EC | 205 | Economics (or EC 201 or ARE201)* | 3 |
| MA | 141 | Calculus I[1] | 4 | E | 102 | Engineering in the 21st Century (GEP IP) | 2 |
| HESF | 10* | Fitness & Wellness Course* | 1 | | | | |
| | | **Semester Total** | **15** | | | **Semester Total** | **16** |

## Sophomore Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| MAE | 206 | Engineering Statics | 3 | MAE | 208 | Engineering Dynamics | 3 |
| MA | 242 | Calculus III | 4 | MA | 341 | Appl Differential Eq | 3 |
| NE | 201 | Intro to Nuclear Engr | 2 | NE | 202 | Rad. Sources, Interact & Detect[2] | 4 |
| PY | 208 | Physics for Engr & Sc II | 3 | *** | *** | GEP Requirement* | 3 |
| PY | 209 | Physics for Engr & Sc II Lab | 1 | *** | *** | GEP Requirement* | 3 |
| *** | *** | Advanced Communication Elect[3] | 3 | | | | |
| | | **Semester Total** | **16** | | | **Semester Total** | **16** |

## Junior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| MAE | 201 | Engr Thermo I | 3 | MAE | 308 | Fluid Mechanics | 3 |
| MA | 401 | Appl Diff Equations II | 3 | MSE | 201 | Struct Prop of Engr Mat | 3 |
| NE | 301 | Fund of Nuclear Engr[2] | 4 | NE | 400 | Nuclear React Ener Conver | 4 |
| ISE | 311 | Engr Ec Analysis | 3 | NE | 401 | React Analysis & Des | 4 |
| *** | *** | GEP Requirement* | 3 | HES* | *** | Health & Exercise Studies | 1 |
| | | **Semester Total** | **16** | | | **Semester Total** | **15** |

## Senior Year

| *Fall Semester* | | | *Credits* | *Spring Semester* | | | *Credits* |
|---|---|---|---|---|---|---|---|
| NE | 402 | Reactor Engr | 4 | NE | 405 | Reactor Systems | 3 |
| NE | 404 | Rad Safety & Shielding | 3 | NE | 408 | Nucl Engr Des Proj | 3 |
| NE | 406 | Nuclear Engr Senior Design Prep | 1 | *** | *** | Engr Tech Elective[6] | 3 |
| NE | *** | NE Elective[4] | 3 | *** | *** | GEP Requirement* | 3 |
| *** | *** | Tech Elective[5] | 3 | *** | *** | GEP Requirement* | 3 |
| | | **Semester Total** | **14** | | | **Semester Total** | **15** |
| | | | | | | **Minimum Total Credit Hours Required for Graduation** | **123** |

**Major/Program requirements and footnotes:**

[1]Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.

[2]Grade of C- or better required, E 115 requires satisfactory completion (S).

[3]Advanced Communication Elective: COM 110, COM 112, COM 211, ENG 288, ENG 289, ENG 316, ENG 331, ENG 332, ENG 333, FLA 201, FLA 202, FLF 201, FLF 202, FLJ 201, FLJ 202, FLJ 203, FLJ 204, FLR 201, FLR 202, FLS 201, FLS 202, GRK 201, GRK 202, LAT 201, LAT 202. If any of the listed courses are taken to satisfy this requirement, must take another course for any of the GEP requirements.

[4]Nuclear Engineering Electives: NE 409, NE 412, NE 418, NE 509, NE 512, NE 528.

[5]Technical Electives: CSC 302; CH 315, 331; MA 405, 427; PY 341, 411, 414, 415, 525, 528; ST 361, 370, 371.

[6]Engineering Technical Electives: Any course from (4) or any College of Engineering course at the 300-level or above, except CSC classes.

***General Education Program (GEP) requirements and GEP Footnotes:**

To complete the requirements for graduation and the General Education Program, the following category credit hours and co-requisites must be satisfied. University approved GEP course lists for each of the following categories can be found at http://oucc.ncsu.edu/gep-courses.

**Humanities** (6 credit hours selected from two different disciplines/course prefixes)
*Choose from the University approved GEP Humanities course list .*

**Social Sciences** (6 credit hours selected from two different disciplines/course prefixes)
*Choose 3 credits from the University approved GEP Social Sciences course list in a discipline other than Economics. Economics 205 (or EC 201 or ARE 201), taken as part of the Major requirements, satisfies 3 credit hours needed to fulfill the GEP Social Sciences requirement.*

**Health and Exercise Studies** (2 credit hours – must include one HESF 100-level course and one additional HES course)
*Choose from the University approved GEP Health and Exercise Studies course list.*

**Additional Breadth** - (3 credit hours to be selected from the following University approved GEP course lists)
*Choose from the Humanities/Social Sciences/Visual and Performing Arts*

**Interdisciplinary Perspectives** (5-6 credit hours)
*Choose from the University approved GEP Interdisciplinary Perspectives course list.*

The following **Co-Requisites** must be satisfied to complete the General Education Program requirements:

I. **U.S. Diversity** (USD)
*Choose from the University approved GEP U.S. Diversity course list or choose a course identified on the approved GEP course lists as meeting the U.S. Diversity (USD) co-requisite.*

J. **Global Knowledge** (GK)
*Choose from the University approved GEP Global Knowledge course list or choose a course identified on the approved GEP course lists as meeting the Global Knowledge (GK) co-requisite.*

K. **Foreign Language proficiency** - Proficiency at the FL_102 level is required for graduation.

# GEP FORMAT B – CURRICULUM REQUIREMENTS

| | |
|---|---|
| **Degree Title:** | **Bachelor of Science in Nuclear Engineering** |
| **Current Degree Key:** | **14NEBS** |
| **Effective Date of Revision:** | **1/2018** |

| **MAJOR FIELD OF STUDY REQUIREMENTS:** | | |
|---|---|---|
| ***Required Courses/Groups/ Electives:*** | ***Credit Hours*** | ***GEP category, if applicable*** |
| **Indicate if course or course groupings have a C-wall or MGPA requirement** | | **List GEP category and hours satisfied by a Major requirement** |
| **Math** | | |
| MA 141, MA 241, MA 242 | 12 | Mathematics (6 hours) |
| MA 341 | 3 | |
| MA 401 | 3 | |
| **Sciences** | | |
| CH 101, CH 102 | 4 | Natural Sciences (4 hours) |
| PY 205, PY 208 | 8 | Natural Sciences (3 hours) |
| **NE Major** | | |
| NE 201 | 2 | |
| NE 202 – C-wall | 4 | |
| NE 301 – C-wall | 4 | |
| NE 400 | 4 | |
| NE 401 | 4 | |
| NE 402 | 4 | |
| NE 404 | 3 | |
| NE 406 | 1 | |
| NE 405 | 3 | |
| NE 408 | 3 | |
| **Other Major** | | |
| MAE 206 | 3 | |
| MAE 208 | 3 | |
| MAE 301 | 3 | |
| MAE 308 | 3 | |
| **GRP 011** Writing/Com/FL Elective(COM 110, COM 112, COM 146, COM 211, ENG 215, ENG 288, ENG 289, ENG 322, ENG 331, ENG 332, ENG 333, FLF 201, FLF 202, FLF 208, FLJ 201, FLJ 202, FLJ 203, FLJ 203, FLJ 204, FLJ 205, FLK 201, FLK 202, FLR 201, FLR 202, FLS 201, FLS 202, FLS 208, GRK 201, GRK 202, LAT 201, LAT 202) | 3 | Advanced Communications |
| IE 311 | 3 | |
| CSC 112 | 3 | |
| MSE 201 | 3 | |
| **GRP 036** (NE 409, NE 412, NE 418, NE 509, NE 512, or NE 528) | 3 | |
| **GRP 037 Technical Elective** (BUS 370, BUS 420, CH 315, CH 331, CSC 302, ECE 331, ECE 421, MA 405, MA 427, MAE 302, MAE 310, MAE 316, MAE 410, MAE 421, MSE 301, PY 341, PY 341, PY 411, PY 414, PY 415, PY 525, PY 528, ST 361, ST 371) | 3 | |
| **GRP 038 Engineering Technical Elective** (BME 3**, CE 3**, CHE 3**, [redacted], ECE 3**, EH 3**, IE 3**, MAE 3**, MAT 3**, OR 3**, or GRP 036) | 3 | |
| **Concentration Courses/Groups/Electives:** | | |
| **Free Electives:** | | |

| | | |
|---|---|---|
| **Total credit hours under Major Field of Study:** *Minimum 27 hours required in program area.* | 45 hours | |
| **COLLEGE REQUIREMENTS:** | | |
| **Orientation Course(s):** E 101 , 115 and E102 | 4 | E115 satisfies Technology Fluency requirement |
| **Other:** (ex: Adv Communication courses) Economics Elective (EC 205, 201; ARE 201) | 3 | Social Science |
| **Total credit hours under College Requirements:** | 7 hours | |

| **NCSU GENERAL EDUCATION PROGRAM REQUIREMENTS**<br><br>*Courses in the Major and/or Minor may also fulfill a General Education requirement; however, a GEP category may not be subset to require a specific course from the category list. Required courses must be listed in the Major/College requirements.*<br><br>***Specific courses should not be listed in any of the fields below other than ENG 101.*** | | **At least one of the following must be listed:**<br>1 Choose course(s) from the University Approved GEP course list for this category.<br>2 Minimum requirements are satisfied by Major/College course requirements.<br>3 Major/College course requirement satisfies X credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.<br>4 Co-requisite is satisfied by a Major/College course requirement.<br>5 Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences, or Visual & Performing Arts.<br>6 Choose course(s) from the University Approved GEP course lists for the Natural and Mathematical Sciences. |
|---|---|---|
| **General Education Program Requirements:** *Minimum 39-40 hrs* | *Credit hours* | ***How will the GEP requirement be met? (choose applicable statement from 1-6 listed above)*** |
| **Mathematical Sciences** *(minimum of 6 credits)* (at least one with *MA or ST* prefix) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements ore satisfied by Major course requirements* |
| **Natural Sciences** *(minimum of 7 credits)* (at least *1 laboratory*) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | X | *Minimum requirements are satisfied by Major course requirements* |
| **English 101** | 4 | ENG 101 |
| **Humanities** *(minimum of 6 credits)* (from two different disciplines) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 6 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Social Sciences** *(minimum of 6 credits)* (from two different disciplines) ***Course(s) in the Major may double-count to satisfy this requirement and also satisfy both the Global Knowledge and Diversity co-requisites.*** | 3 | *Required College course satisfies 3 credit hrs of this requirement. Remaining hours required must be chosen from the University Approved GEP course list for the category.* |
| **Additional Breadth** *(minimum of 3 credits)* (Choose AB course list that is different from the approach of the Major) ***Major/College requirements cannot satisfy this requirement and an AB course cannot be double-counted except in satisfying the Global Knowledge and Diversity co-requisites.*** | 3 | *Choose course(s) from the University Approved GEP course lists for the Humanities, Social Sciences or Visual and Performing Arts* |
| **Interdisciplinary Perspective** *(minimum of 5-6 credits)* ***Only course(s) in the Major may double-count to satisfy this requirement.*** | 3 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Physical Education/Healthy Living** (including one Fitness and Wellness course) | 2 | *Choose course(s) from the University Approved GEP course list for this category* |
| **Total credit hours needed to complete GEP that are not satisfied as part of the Major/College requirements.** | 21 hours | |
| **GEP Co-Requisites:** | | ***Courses taken in the Major, GEP, or Minor may double-count to fulfill the co-requisites. Courses that satisfy the U.S. Diversity* or Global Knowledge** co-requisite are marked on course lists with asterisks as indicated.*** |
| **U.S. Diversity co-requisite*** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |
| **Global Knowledge co-requisite**** | n/a | *Choose course(s) from the University Approved GEP course list for this category* |

| | | |
|---|---|---|
| **Foreign Language Proficiency** | n/a | FL_102 |
| **The following requirements must be satisfied within the College/Program:** | | |
| **Advanced Communication** | X | Satisfied by College/Program Requirements |
| **Technology Fluency** | X | Satisfied by College/Program Requirements |

| | | |
|---|---|---|
| **Total credit hours required to complete Degree:**<br>**Total must be within 120-128 credit hours.** | 123<br>~~126~~ Total hours | **Graduation requirements include: (1) 2.0 overall GPA or higher in all courses attempted at NCSU and (b) 2.0 GPA or higher in all NE designated courses, or a (C-) or higher in all NE designated courses.** |